CHAPTER 10: POLICY, TARGET AND MACRO-MEASURES FOR URBAN ENVIRONMENTAL IMPROVEMENT

10.1 Planning Issues, Targets and Macro Measures

(1) Planning Issues

Deterioration of "Bangkok environment" has been reaching a critical level, which means that further worsening of the quality of environment will jeopardize the people's lives as well as a sustainable socioeconomic growth. The majority of the Bangkok residents has been already aware of that substantial solutions on environmental problems should be prioritized even though they pay some cost for the economic growth as discussed in Section 8.1.

A fragmented remedial approach will no longer be effective to resolve problems of environmental deterioration, but an integrated approach is essential. New social rules are needed for using resources of the Metropolis, which are unique, intrinsic and compatible to the Thai socio-culture.

Planning issues, based on the above recognition together with findings through the assessment of the present states, are identified to be the following six (6):

1) Creation of social rules for "Sustainable Resource Utilization of the Vulnerable Environment";
2) Challenge for "Flood-free Urbanization"
3) Formulation of "Environment-initiative Transport System"
4) Pursuance of "Fresh-and-Clean Air Policy";
5) Creation of "Water-friendly Eco-city"; and
6) Up-grading if "Quality of Living Environment"

These issues are mutually related in the structure of urban metabolism, as illustrated on Fig. 10.1. Therefore, one solution is influential to another solution, at the same time, one problem is worsen another.

(2) Planning Target 2011

Planning targets for urban environmental improvement are set forth in accordance with the identified planning issues, aiming at the year 2011, as summarized in Table 10.1. The proposed targets are both descriptive and numerical, based on the visions derived from the following three:

Analyses of the most-likely future perspective, based on assessment of present environmental attributes, potentials and constraints;

Attainability, taking into account the performance of past and on-going projects and polices directed by the central government and BMA; and

A vision of planners on what Bangkok should or could be developed and improved to be like.

(3) Macro Measures to Achieve the Targets

Macro measures to achieve the targets are recommended as summarized in Table 10.1. These are derived from the results of simulation analyses and planning considerations based on the assessment of the present situation. The measures, including both soft and hard ones, should be pursued by the national level as well as BMA. And, some of them call for business sector's participation or people's strong involvement.

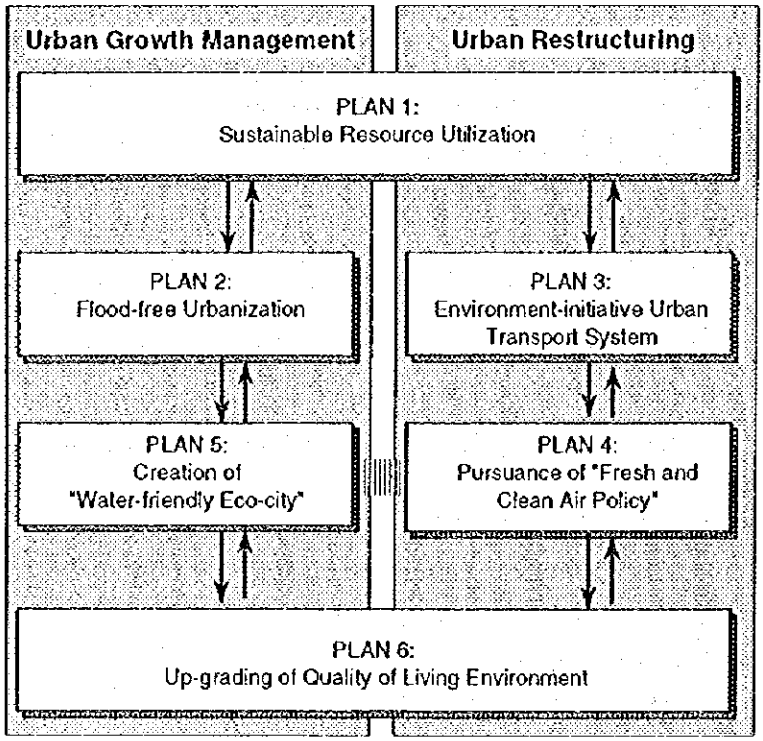

Fig. 10.1 Structure of Planning Issues

Table 10.1 (1/3) Planning Targets and Macro Measures for Bangkok Environmental Improvement

PLANNING ISSUE	TARGET 2011	NUMERICAL TARGET	PROPOSED MACRO-MEASURES TO ACHIEVE THE TARGET
PLAN 1: Sustainable Resource Utilization in Vulnerable Environment	Creation of the robust urban environment against the natural disasters.	None	• Pursue Energy-saving and Resources-recycling policy; • Undertake the measures for stopping land subsidence based on recommendations by the JICA Study (1992-95); • Develop "Green and Water Network" (in association with road improvement, public parks and Khlong beautification projects/program).
PLAN 2: Flood-free Urbanization	Creation of the man-made environment for people to be free from fears and apprehensions of floods	Keeping the drainage capacity to cope with 5 year rainfall probability	• Formulate a Long-term Master Plan and Action Plans for flood protection systems in a view of Lower Chao Phraya area in coordination among relevant agencies; • Formulate a Flood Mitigation Action Plan for the West Bank Area (Thonburi Side); • Institutionalize a Flood Plain Management System for the entire urban areas, including provision of retention ponds and control of land use in preserved areas as retention areas; • Facilitate coordinating work among the central and local authorities to functionalize District Storm-water Drain System in the entire system of Bangkok.
PLAN 3: Environment-initiative Urban Transport System	Re-structuring of the Bangkok Urban Transport System with a more environment-oriented system, or shifting to a public transport-based system; and Mitigation of road traffic congestion, providing with alternative urban public transport modes by which people may select means suitable for their purposes and time constraint.	Anyone can reach his/her work place or school within 45-60 minutes; and The modal share of public transportation shall be more than 50 %(as of all modes including walking trips), compared to 42% at present.	**Transport Demand Control:** • Straighten Urban Growth Management measures for traffic demands control; • Designate a policy zone of "Public Transit Advantage Zone" in part of CBD, where public transport services are intensively improved and in-flow of the private vehicles is controlled with institutional schemes; • Introduction of "Traffic Assessment Study" for permission of large-scale projects **Public Transport System Development:** • Facilitation of on-going Mass Transit Systems Projects based on the OCMRT Master Plan • Reroute bus service network/routes in the total public transport system; • Improve waterway transport systems on major khlongs; • Develop intermodal facilities/stations to transfer between "MRT-bus", "bus-waterway" and "MRT-waterway", in association with taxi and other para-transit systems; • Improvement of pedestrian facilities; **Road Transport Development:** • Made further efforts to construct more arterial and collector roads, reviewing the priority scheme under well-coordination among relevant organizations of DOH, BMA and ETA; • Develop tertiary/local road network in association with urban renewal and new urban development projects; • Accelerate the construction of the Ring Expressway System given the highest priority; • Improve the traffic control system, based on technical and analytical implications, including functionalization of the vested ATCS.

Table 10.1 (2/3) Planning Targets and Macro Measures for Bangkok Environmental Improvement

PLANNING ISSUE	TARGET 2011	NUMERICAL TARGET	PROPOSED MACRO-MEASURES TO ACHIEVE THE TARGET
PLAN 4: Pursuance of "Fresh and Clean Air Policy"	Mitigation of air pollution up to a level that people may feel no damage on health	Ambient air pollution levels in most of Bangkok urban areas shall satisfy the presently regulated "Thai Environmental Standard": CO: 9 ppm (8 hrs. avg) NO_2: 0.17 ppm (1 hr. avg.) SO_2: 0.3 ppm (1 hr. avg.) TSP: 0.1 mg/m³ (1 year avg.) PM10: 0.12 mg/m³ (24 hs. avg.) O_3: 0.1 ppm (1 hr. avg.)	**Environmental Administration:** • Enhance monitoring and analytical technique of environmental administrators; • Review the current environmental standards and formulate policies and strategies to achieve the standards; • Promote "public awareness" of air pollution to enlighten driving manners and promote environmental concerns to constructors for mitigating pollutant emission from construction sites; • Strengthen voluntary environmental management in the business sector through introduction of "ISO 14000". **Measures for Mobile Sources:** All measures for mitigation of traffic congestion is simultaneously effective to mitigation of air pollution. On this background, the sectoral measures are to: • Enhance control measures for "vehicle emission" with introduction of new vehicle regulation and inspection/maintenance systems; • Promote replacement to Low-pollution Buses and Trucks by both public and private operators with provision of institutional incentives; • Introduction of Quality Fuel: diesel oil with less sulfur contents and lower particulate matter (PM) emission (to be refined with lower distillation temperature); • Promote R & D of less pollution vehicles; • Improve the road structure with buffer greens, particularly for arterial heavy traffic roads; • Explore effective traffic management to increase the average vehicle travel speed; **Measures for Stationary Sources:** • Monitor regularly emissions of potential stationary sources; • Guide and introduce technologies for appropriate combustion management as well as installation of environmental protection equipment so as to save energy as well as mitigate air pollution; • Promote fuel conversion to less pollution fuel like LPG and/or LNG; • Provide an incentive scheme for factories to undertaken these measures against air pollution.

Table 10.1 (3/3) Planning Targets and Macro Measures for Bangkok Environmental Improvement

PLANNING ISSUE	TARGET 2011	NUMERICAL TARGET	PROPOSED MACRO-MEASURES TO ACHIEVE THE TARGET
PLAN 5: Creation of "Water-friendly Eco-city"	Restoration of the Thai water culture in association with improvement of water quality in khlongs	BOD: less than 15 mg/litter in major Khlongs in the special policy zone (Khlong Water Quality Improvement Promotion Zone)	• Designate a policy zone for "Khlong Water Quality Improvement Promotion Zone" in the central areas where special efforts should be intensively made with the highest priority; • Review the existing Sewage Master Plan, based on recommendations by the BEIP Study; • Facilitate the implementation on-going sewage projects under well- coordination among BMA, PCD and the newly established Waste Water Management Authority (WMA); • Further encourage the implementation of the on-going "Khlong Water Quality Improvement Project" in East Bank, and expand the project in West Bank (Thonburi area) as proposed by the BEIP Study; • Create "Green-cum-Water Network System" along major khlongs, implementing the expanded "Beautification Programs"; • Promote Public Campaigns for "Clean, Green, Khlong"
PLAN 6: Up-grading of Quality of Living Environment	Materialization of Healthy, Safe, Comfortable and Convenient Environment for all people, with social cares for the urban poor, elderly and handicappers	**Solid Waste Management:** Reduction of Per Capita Generation Rate of Solid Waste: by 10% **Water Supply:** Supply to all residents in urban areas, in association with reduction of the leakage ratio up to less than 20%	**Solid Waste Management:** • Formulate a Long-term Master Plan for Solid Waste Management for BMA; • Facilitate on-going Solid Waste Treatment Projects as urgent projects; • Acquire and prepare the land for final disposal on the long-term perspective within the BMA jurisdiction; • Promote community organization activities for people to participate in reducing, recycling and separation collection; **Water Supply:** • Review the existing Master Plan of Water Supply, taking into account the current and future urbanization process, and formulate "Rehabilitation Action Plans" of existing distribution systems; • Facilitate water supply and rehabilitation projects based on the reviewed Master Plan and Action Plans; • Strengthen the operation, maintenance and management system for distribution facilities and subscribers (GIS technique etc.) **Housing and Community Development:** • Facilitate provision of low and middle income housing by both HNA and the private sector; • Make further efforts for tackling slum problems with a comprehensive approach, including finical support institutions; • Creation of pedestrian-advantageous environment

10.2 Plan 1: Sustainable Resource Utilization of the Vulnerable Environment

It is an absolute fact that the capital city of Bangkok locates with environmentally vulnerable conditions. No one can change it unless the city moves somewhere else. Planning should start with recognizing the fact.

(1) Recognition of Environmental Vulnerability of Bangkok

Tropical Climate Severe for Human Environment:

It has too much precipitation in monsoon season (more than 300 mm per month) and too little in dry season (less than 10 mm per month). This naturally causes floods in monsoon season and droughts in dry season. In addition, a strongly stable condition of the air usually happens particularly in dry season, which tends to accumulate air pollutants on the surface due to less air circulation, thereby easily resulting in more serious air pollution.

Low Alluvium Plain Susceptible to Natural Disasters:

It has a geographical and geological constraint that the Bangkok metropolis locates in the low alluvium flat plain of the Chao Phraya River Delta (1 to 2 meter MSL). Because of this, once it suffers from a flood, water is difficult to be drained out and retain for a long time, thereby being likely to cause more serious damages on people's lives and the economy. In addition, land subsidence easily takes place in areas where voluminous underground water is being drawn up.

Moreover, it is predicted that along with proceeding of "Global Warming", the sea level will rise by 50 cm in coming 100 years on the average. If we believe in this statement, it can be said that after 300 years, most of Bangkok will sink under the sea, unless any measure will be undertaken.

Energy-consuming Modernization:

Compared to other countries, Thai is rapidly shifting to an energy-consuming country in terms of volume of oil consumption per unit GDP. Urban concrete jungle covered with buildings and paved roads, as a result of modernization, is energy-consuming, and the city is heating as much as the inside of buildings is cooling. This is weakening the restoration power of the natural environment. The modernization cannot be stopped, but an energy-saving and energy-recycling systems need to be introduced to the process of modernization and urbanization.

Water and Greens Vulnerable to Environmental Changes:

The tropical climate is capable of growing affluent greens. Bangkok used to be covered with a plenty of water and greens. Water and greens are the natural gifts to moderate the serious climatic conditions, and the most effective tools to mitigate the environmental pollution [1].

Water is necessary to improve the quality of water, and greens are necessary to clean the air. The Thai culture is based on such an exquisite and delicate natural system with water and greens. However, trees growing in the tropical climate are inherently

[1] "An Investigation on the Distribution of Air Temperature and the Effect of Open Space on Mitigating Server Climate in Bangkok, Thailand" (Nath Pichakum and Yorikazu Maruta, 1995) presents the result of simulation analysis using isotherm maps of Bangkok. Two interesting discussions are: 1) the difference of air temperature between built-up area and open space areas is identified to be 3.0 ∞C at 3:00 PM; and 2) when green coverage increases by 10%, air temperature reduces by 0.43-0.55 ∞ C.

vulnerable to an environmental change and weak in survival power. Because of this, intensive efforts should be made to preserve water and green.

(2) Directions of Macro-measures

The Thai culture is based on an exquisite and delicate natural system with water and greens. Planning, therefore, should focus on:

- Restoration and rehabilitation of "Green and Water Network System";
- Establishment of social rules and guidelines for stopping the land subsidence and protecting the living environment from floods;
- Pursuance of Resource-recycling system and guiding to Energy-saving urban economic development.

10.3 Plan 2: Flood-free Urbanization

Taking into account the environmental vulnerability of Bangkok as mentioned above, the most important urban planning issue must be first on how to manage water wisely and how to realize flood-free urbanization. This issue is fundamental for sustainable socioeconomic development. Bangkok should be free from any fear of flood, otherwise people's safe and comfortable living as well as continuous investments on the economy could not materialize. Bangkok should be restructured to be the most "Comfortable City of Asia". In this regard, the following are proposed:

(1) Long-term Master Plan

Substantial flood protection systems and the action programs should be formulated on long-term perspectives. This may include some large-scale projects (century projects) to release Bangkok from the chronic problem.

(2) Formation of A Hierarchical Drainage Network System

The drainage system, same as the road network, should be functionally networked with a hierarchical system, i.e.,

1) the primary may be Chao Phraya River;
2) the secondary system comprised of major water by-paths, diversion canals and major khlongs, connecting directly the primary; and
3) the tertiary system constituted with khlongs and local drainage canals, linking with the secondary system. Such a functionally systematic integration of existing khlongs and drainage system is a vital planning issue.

A conceptual scheme of this hierarchical drainage network system is proposed as illustrated on Fig. 10.2.

(3) Establishment of Well-functioning Water Management System:

Rehabilitation and improvement of existing drainage facilities should be further strengthened with establishment of the well-organized maintenance and management system under coordination between relevant agencies.

(4) Control of Environmentally Preserved Land

It is rational that urbanization should be encouraged in suitable land areas where a well-functioning drainage system has been developed in the entire system, while it should be restricted in the others areas where no drainage systems have been

developed. Priority for urbanization, therefore, needs to be coherent with development of such a system.

In this regard, areas where are assessed to be preserved from the environmental standpoints need to be strictly controlled. Two types of land areas exist for this purpose:

- the area between the so-called King's Dike (flood wall) and the middle flood wall in the eastern part of BMA, and
- the coastal transition area facing the Gulf of Thailand.

(5) Guidelines for Water Retaining Capacity;

Land development and construction activities in urbanization control areas should institutionally be guided to the direction that water retaining capacity of land after projects must not be lessen than the status quo.

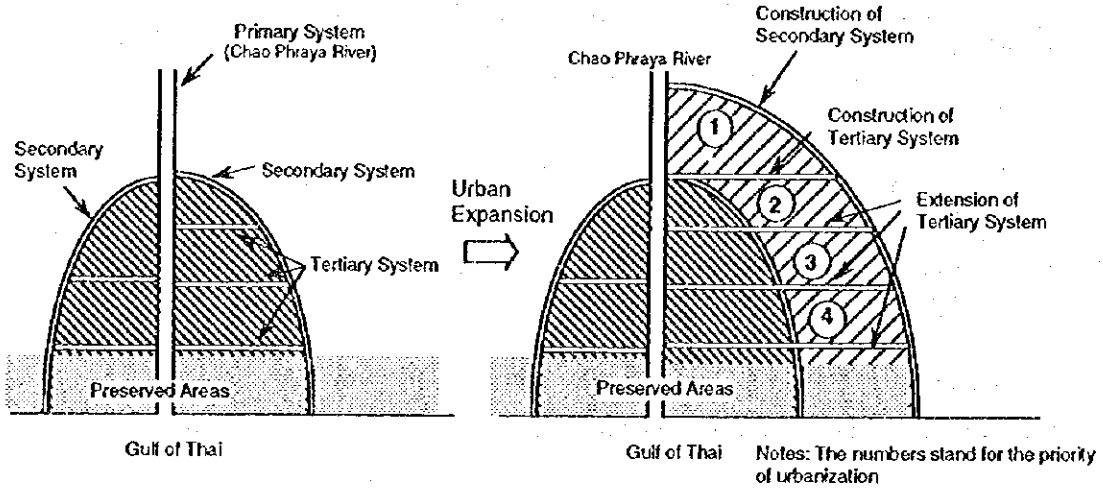

Fig. 10.2 A Hierarchical Drainage System for the Bangkok Metropolis

10.4 Plan 3: Environment-initiative Transport System

Environmental problems of Bangkok are attributed mainly to excessive concentration of economic activities and centric urban functions into the Bangkok Metropolis. This observation must have been broadly accepted. However, "concentration" does not necessarily stand for "congestion". Concentration is thought to be a result of pursuing some rationales of the economy to be more competitive and more efficient under the economy of scale. On the other hand, "congestion" takes place when adequate and sufficient provision of infrastructure and public services cannot meet demands for economic activities. Thus, congestion is stemmed from a failure in urban management or mal-structure of the urban spatial system.

It will be a central issue of the Study how to release the traffic congestion in the Bangkok Metropolis. This cannot be resolved with a sector approach, but needs an integrated approach to urban re-structuring of Bangkok.

(1) A Planning Concept of "Traffic Calmed City"

It needs to be recognized that we will be no longer able to enjoy Bangkok urban economic growth and urban life based on "Car-oriented Society" having been created for last two decades. In this society, mobility of cars is given the highest priority rather than mobility of people. This will eventually lead to a more serious environmental problem as well as fatal losses by further economic growth. Thus, there exist a vicious cycle in the "Car-oriented Society".

A challenge is now to redirect such a unorganized energy-consuming system with a vicious circle towards a new transport vision presented here, where people and transport urban infrastructure development can coexist for betterment of the whole community. The urban structure and transport infrastructure need to be developed together to achieve an environmental / ecological balance. This vision is also consistent with city development philosophies that are currently being pursued in other major cities, represented by "Eco-city" Development.

This implies that planning of transport infrastructure should be aimed at improving the mobility and transport access of people rather than those of motor vehicles, which is termed "Traffic Calming". To this end, it is necessary to change from a motorized private vehicle-advantageous society to a public transport-orientated society. Public transport systems which have less impact on urban ecology should be given the highest priority under the limited resources available to spend on transport infrastructure.

(2) A Shift from Road Transport-based Urban System to a Mass Transit-driven Urban System

There is no room to discuss further the necessity of a shift from the road transport-based to a mass transit-driven urban system in the Bangkok Metropolis. In this regard, the Study is standing on the same ground that several relevant agencies and a number of studies have long discussed for more than one decade. The Study Team also strongly endorses the following strategies some of which have been raised in previous studies:

- to guide intensive urbanization onto selected Metropolitan Subcenters where will be structured with MRT systems;
- to develop inter-modal transfer terminals/facilities with pedestrians, buses, waterways and MRTs;
- to develop "park-and-ride" facilities to encourage a modal shift from individual cars to MRTs;

- to improve the "pedestrian environment" especially in the Public Transport Advantageous Zone" and "Public Transport Corridors".

(2) Public Transport Corridor Development

Special policy emphasis should be placed on development of "Public Transport Corridors", combined with MRTs and buses, using radial arterial/secondary roads. Seven (7) corridors with traffic advantages to MRT and bus are proposed as discussed in Chapter 16.

(3) Formation of An Integrated Urban Transport Systems

A mega city with 10 million population needs a highly functional comprehensive urban transport systems. The system should be structured with the following planning criteria:

Public Transport Systems:

- MRTs or rail-systems provide with services to meet oriented mass traffic demands;
- The inner city needs to be all covered with public transport systems combined with several forms of transportation modes such as MRT, bus and waterway;
- Urbanized areas are all served with any public transportation;

Hierarchical Road Transport System:

A hierarchical road network system should be developed with special emphasis on the following:

- Middle Ring Expressways given a higher priority rather than radial expressways;
- Inter-regional arterial road network linked with Outer Ring Road and Middle Ring Expressways (Ring-and-Radar Pattern);
- Further development of "Secondary and Tertiary" roads in both built-up areas in association with Urban Renewal and Land Readjustment Projects;
- Infrastructure-led suburbanization, guided by institutional tools like guidelines for the private sector's development activities;
- Coordination in planning among relevant organizations to avoid duplicated efforts and funds;
- Area Traffic Control Systems should be explored, based on analytical bases; and
- The vested Area Traffic Control System (ATCS) should be made more functional with necessary institutional arrangement and human resource development to operate the system.

Intermodal System:

- Intermodal facilities should be developed to ease transfer activities and to encourage people to use public transportation; and
- Pedestrians-advantageous environment is created.

(4) Interrelations between Urban Development and Environment-initiative Transport System Development

Regeneration of the Inner City, or Old Bangkok

Relocation of out-of-date facilities in the inner areas should be facilitated. Especially, cargo traffic generators such as factories, warehouses and transport-related service

facilities which are no longer necessarily located in the inner areas should be encouraged to move to some selected suburban places where are more efficient in transport activities. To this end, the government sector needs to assume several responsibilities to:

- designate the relocation promotion areas and, at the same time, the areas to intensively and deliberately accommodate the relocated facilities;
- prepare well-developed land areas (in a form of industrial estates or truck terminals) for would-be-relocated facilities; and
- prepare an incentive scheme including tax incentives, provision of low-interest finance and technical advising services.

Based on the preliminary observation by the Study Team, Ratburana, Bang Kho Laem, Yanawa and Khlong Toey Districts are deemed to be focal areas for relocation.

The government sector also needs to intervene in usage of even private land available after the relocation. More public space for especially roads and open space is absolutely necessary in the inner city areas to improve the urban environment.

For this purpose, a new institution for land use and land transaction is needed to be enacted in order to justify such government interventions. The institution should stipulate an effective incentive scheme on the private-to-public land transaction.

Facilitation of Secondary and Tertiary Roads Development in Built-up Areas

Land acquisition for development of secondary and tertiary roads needs to be eased by empowerment of institutional tools of the Urban Planing Act to be linked with the Building Code.

The Urban Planing Act needs to definitely stipulate the legal designation system of "urban planning roads" including rules of landlords' contribution and land purchase by the public sector when existing buildings are demolished and re-built. More concretely, this system is as follows: when the landlord intends to change the land use or rebuild the building, if a part of the land has been legally designated as a Urban Planning Road, the landowner must contribute the part of land for the road construction or may claim the responsible authority to purchase the part of land at rational prices. The landowner may receive some tax incentives in compensation for doing so.

This system is not of acute treatment for public land acquisition, but workable in the long-term, since more or less 15% of the land use is likely to be changed in Bangkok for one decade, as discussed in Section 2.4.

This system is popular, not special, in developed countries to acquire public land for roads and infrastructures.

Infrastructure-led Suburbanization

To release the pressure of urban congestion, the deliberate suburbanization must be a key. In this regard, three (3) main issues should be tackled from the urban planning points of view:

- Sub-division Development;
- Ribbon Development; and
- Supper-block Problem.

Sub-division development is actively going on with less considerations of environmental impacts by sewage and drainage. It is surprisingly observed that those projects are taking place rather intensively in the zone designated to be environmentally preserved by the 1992 Bangkok General Plan, particularly in the eastern part of the Bangkok Metropolis. In many cases, there exist some drainage and sewerage systems but within the sub-division project areas, and no-treated sewage is being discharge directly to

khlongs or open ditches along roads. And, no adequate road network systems linking with public roads outside the subdivision area are observed.

Secondly, typical **ribbon development** apparently seen in suburban areas should be controlled as much as possible, because of the following three reasons:

- Benefits from the public investment on roads are distributed to only a limited number of residents along the road side;
- Road traffic capacity is likely to be reduced by allowing random access traffic;
- It makes more difficult to build an area-wise network system due to occupation of roadside space.

The problem would be worsen in the structure that many low level-roads (soi) are connected directly with an arterial road without a hierarchical road network structure.

In order to avoid such ribbon development, a hierarchical road network system related to land development needs to be applied as a basic urbanization model which could facilitate more effective area-wise urbanization system, involving the private sector's participation, as conceptually illustrated on Fig. 10.4. The land readjustment scheme is one of them.

Thirdly, supper-block problems which are typically observed in areas with a strong suburbanization pressure, are characterized by the same attributes as the problems on sub-division development. This issue has also been discussed in-depth in the Bangkok Plan (MIT/EC Teams).

The focal planning arguments on this matter are how to provide more secondary and tertiary roads and how to structure an adequate road network in total. Thus, the problem is mostly of the supply side.

Since the private sector's activities are inherently myopic and profit-oriented, it is the government sector's responsibility to provide clear-cut guidelines with enforcement power as an ordinance to direct the private sector's development toward a public benefits-oriented way. District governments have its chief responsibility.

Based on the above considerations, the BEIP Study proposed a Bangkok transport structure which can meet the future urbanization in 2011 and beyond 2011. The detailed discussions are made in Chapter 2 of Volume 3.

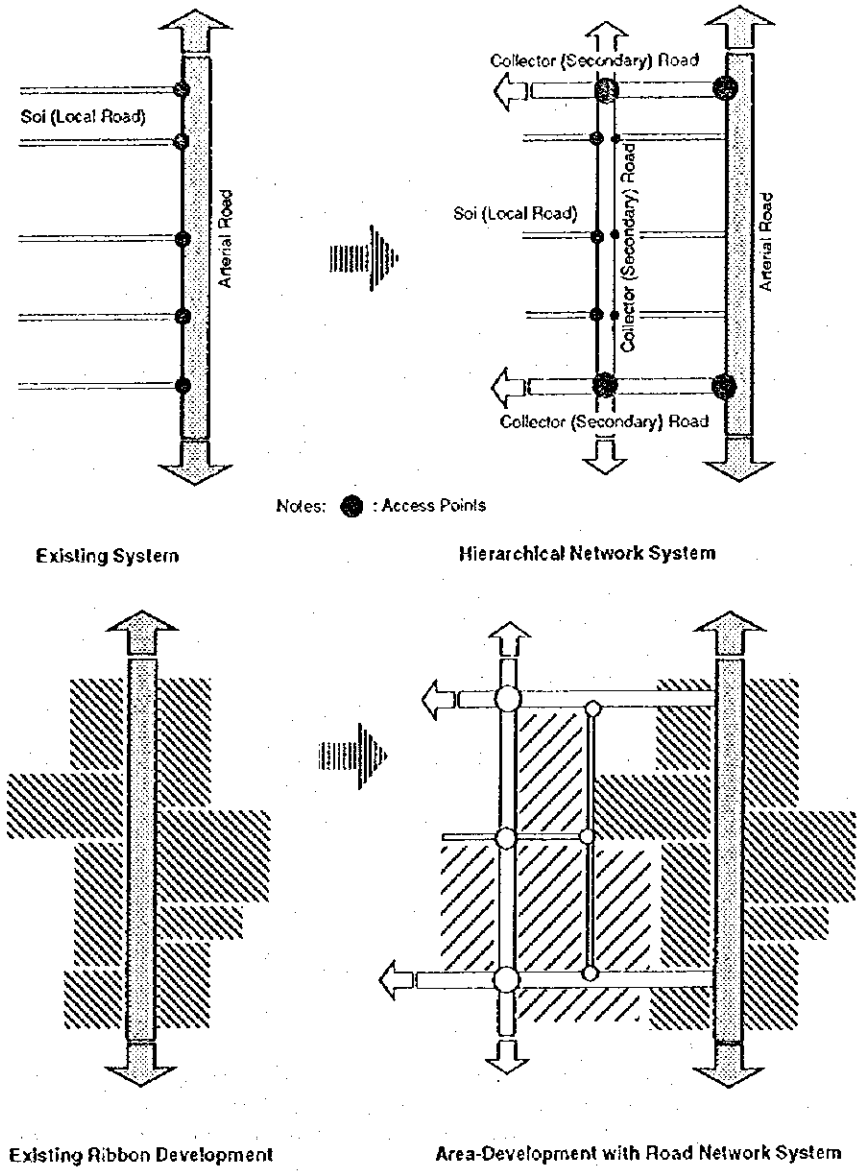

Fig. 10.3 A Conceptual Scheme for Area-wide Urban Development

10.5 Plan 4: Fresh-and-Clean Air Policy

(1) Measures for Air Pollutant Sources

"Healthy Bangkok" with no air pollution should be created so that people can take deep breath and absorb fresh air into their bodies.

Mitigation of air pollution depends greatly on policies and/or political will, as proved by the dramatic success in reduction of "lead" in Thailand. Important environmental measures are:

- strengthening of regulations and monitoring emission of potential pollutant sources with both institutional installment and technical approach;
- employing a policy of the total pollutant load control in the long-term;
- promotion of R & D to develop environmental technologies of less pollution vehicles as Thai National Car, with strong supports by the government and the private sector.

(2) Mobil Sources Related to Urban Transport System

PM-10 (or SPM) and NO_2 are the most serious pollutants in Bangkok, which are caused by road traffic. The air pollution simulation analysis reveals that most of the built-up areas are covered with the air with significantly higher concentration of PM-10 and NO_2 than the Thai environmental standard, as discussed in Chapter 18 in detail.

It has been proved that the air pollutant load caused by auto-vehicles in terms of CO_2, NO_2 and SPM, significantly reduce in accordance with improvement of the average speed, and that the marginal rate of reduction is very high in a range of low speed, say, 0 to 20 km/h. The current average speed in the central Bangkok is estimated at more or less 5 km/h. This means that Bangkok traffic is running in the worst state that emitted pollutants are maximized.

In general, the level of air pollutant loads are determined by three factors: 1) average travel speed; 2) traffic volume, especially heavy vehicles; and 3) emission factors. The optimal policy-mix needs to address proper measures to each element.

The simulation analysis also provides a planning implication that without a considerably sever policy mix, the air pollution cannot be mitigated to be under the designated standard level in terms of PM-10 and NO_2. The effective policy-mix calls for:

- Travel speed up on road traffic in the inner city;
- Significant shift of passengers from road transport to MRTs; and
- Strong vehicle emission regulation policy (as the European standard).

The state of air quality depends greatly on the urban structure and the transport system. The simulation analysis, again, reveals that given the urban re-structuring policy strengthened by a shift to the public transport-oriented system as well as subcenter development as proposed in the BEIP Study, the air pollutant diffusion pattern in 2011 would be significantly changed, as analyzed in Chapters 6 and 18. Despite that in the central area there will still exist a number of areas with higher concentration of PM-10 and NO_2 than the standard, the air condition of Bangkok will be improved as a whole.

(3) Stationary Sources Managed on Voluntary Basis

Stationary pollutant sources should be properly monitored and instructed for technical improvement by the authorities. More important is the voluntary activities for

environmental protection by the private sector itself, such as ISO14000, management of combustion and emission.

10.6 Plan 5: Water-friendly Eco-city

(1) Appreciation of the Thai Water Culture

The planning concept of "Water-friendly Eco-city" is derived from appreciation of the historical water system which the Thai socio-culture has been deeply rooted in. Thai people are traditionally well-knowledgeable of how to get along with water, and their living culture was based on such a respect on "water". Let us remind it again and restore the water-culture.

(2) Restoration of Khlongs

Currently, water quality of Khlongs are getting worse and the problem areas are expanding along with urbanization, as discussed in Section 3.2. In order to improve the water quality, sewage treatment systems need to be facilitated together with technical measures such as flash-water management and aeration.

Functions of khlongs should be restored again in a view of creating "**urban ecology**" in which people's living systems are integrated with the natural environment.

- **Drainage System**: The most important function of khlongs is for drainage canals for flood protection. This function should be maintained properly and strengthened.
- **Waterways for Public Transportation**: Some of major khlongs are being used as an alternative public transportation meeting commuting and daily traffic demands [2].
- **Open Space, Greens and Community Amenities**: Water is functioning as community links assorted with greens and open space. Thai people have already developed an outstanding urban design to form a comfortable combination with streets, khlongs and greens.

(3) Beautification of Khlongs and River Front Areas

Water is an effective element of urban amenity and brings out a "Taste of Bangkok", thereby attracting international tourists. Thai landscape design concept should be applied for the beautification program along selected khlongs and Chao Phraya River.

The beautification program needs to be concomitant with sewerage system and housing development.

[2] For crossing the east-west corridor, it takes 55 minutes by boat from the pier near Wat Saket to the Bangkapi Pier in Khlong Saen Saep (17 Km). The average speed is 20 km/h, even in peak hours. By car, it takes more than 2 hours in peak hours.

10.7 Plan 6: Quality of Living Environment

(1) Hygienic Living Environment

Solid waste management is the most vital issue for BMA, including the following measures:

- Promote social awareness for correct recognition of current problems on solid waste;
- Facilitate people's participation in the improvement with an community approach;
- Establish a sustainable system for solid waste management with the coherent system, including collection, transportation, intermediate treatment, and final disposal; and
- Explore a recycling system, encouraging participation of communities and the business sector, and support recycling industries.

(2) One-more-step Solution of Slum Problems:

Housing issues are broad and various, and call for a wide variety of social development approach. The "slum problems", reviewing the previous and on-going NHA's attempts and projects/programs, should be further tackled. The financial institutions to support their "self-help solution" should be explored.

(3) Pedestrian-advantageous Society

In the urban transportation network system, "walking" is the most important transport mode, which shares 29% of the total person-trips. In order to encourage people to utilize public transportation such bus and mass transit system, "walking" should be also encouraged. More pedestrian-advantageous urban environment should be formed in Bangkok.

(4) Environment for the Weak

More attention should be paid to the weak such children, handicappers, women and elders in urban design and uses of public service facilities. This is regard as an indicator for the social maturity. Bangkok should never stand behind the maturity, rather go ahead in the world in environment for the weak.

CHAPTER 11: PROGRAMMING OF PROJECTS/PROGRAMS

11.1 Concepts on Project Formation

In order to materialize the above-mentioned 6 plans, the BEIP team propose a number of projects and programs. The following area the basic considerations for the project formation process.

(1) Three types of Projects/Programs

Projects/programs are, in general, classified into three categories representing policies in terms of objectives, target beneficiaries, natures of investment and required approach to implement, as shown in Table 11.1.

Minimum: Projects/programs to provide an "environmental minimum" condition for all people equally and equitably, particular emphasis on the poor and the weak with a bottom-up approach;

Basic: Projects/programs to meet present and future demands to fulfill the gap between supplies and demands, thereby moving environmental diseconomies in the society with an economically and financially feasible approach; and

Strategic: Projects/programs to change the urban structure and/or the socioeconomic balance between demands and supplies toward a future vision of development/growth for people of the next generation with a top-down approach based on future visions.

The BEIP proposed all the three types of projects/programs on the long-term perspectives. Although the time horizons that they are aiming at are deferent, preparatory actions should be initiated urgently.

(2) A Conceptual Frame for Programming

Characteristics of projects/programs are considered in a conceptual frame with two axes: the axis of implementing bodies and the axis of policy approach, as illustrated on Fig. 11.1. In this coordinates, projects/programs are situated as one of four categories characterized as follows:

I: Public investment for local and sector solution;

II: Involvement of voluntary private activities;

III: Institutional system with guidelines, standards and regulations for urban environmental and growth management; and

IV: Strategic public investment for urban restructure.

All the four (4) types of projects/programs are substantially needed to implement in an integrated manner. However, in the short-term, intensive efforts should be made to

enhance the categories of I and III; and in the medium- to long-term, emphasis should be placed on the categories of II and IV.

Table 11.1 Three Types of Projects/Programs

	Minimum	Basic	Strategic
1. Objective	To provide with the Environmentally Minimum Conditions	To meet present and future demands	To change the urban structure and the balance between demands and supplies
2. Target Beneficiaries	All people with special focus on the poor and the weak	Users as direct beneficiaries	People of the next generation
3. Natures of Investment	Equitable, equal or balanced allocation	Prioritized sector allocation	Enhanced strategic allocation
4. Required Approach	Bottom-up social approach with strong participation of communities	Economically and financially feasible approach	Top-down approach based on future visions
5. Action	Actions should be initiated urgently, and continuously undertaken for the long-term	Feasibility and engineering studies should be undertaken urgently, aiming at the medium-term completion.	Master plan studies should be undertaken urgently, aiming at the medium-and long-term completion.

Source: The BEIP Study Team

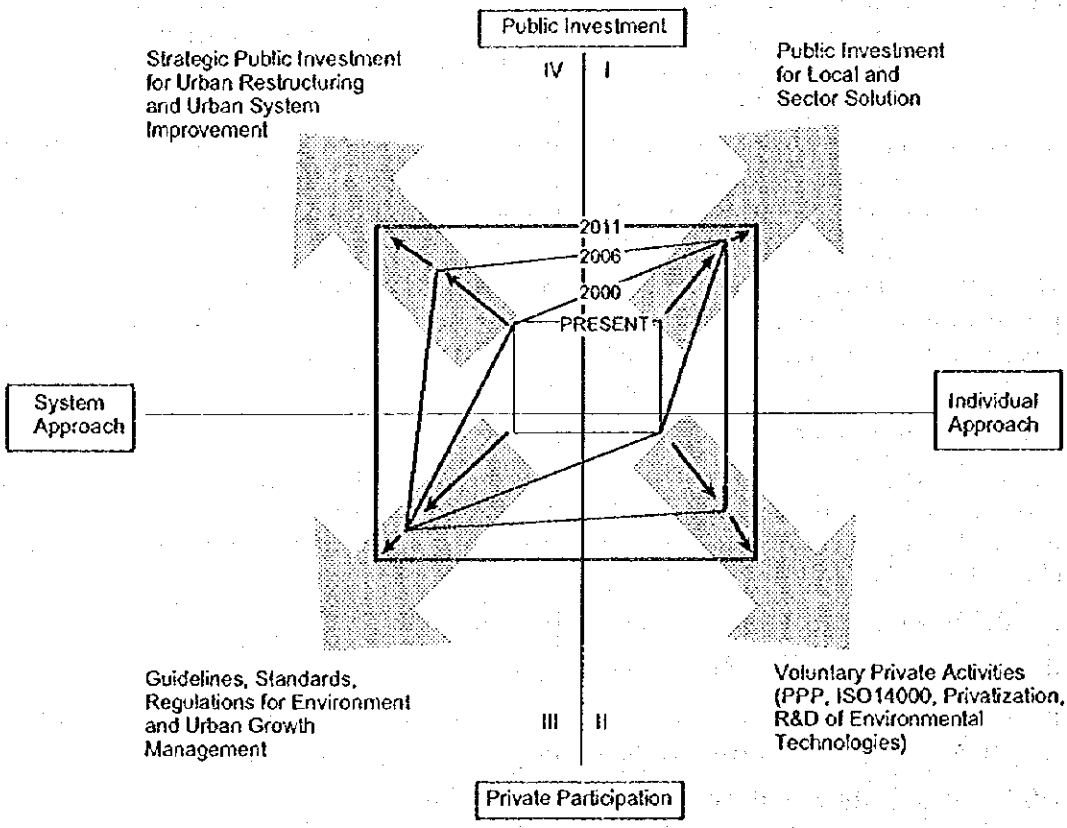

Fig. 11.1 A Conceptual Framework for Projects/Programs Identification and Priority

11.2 Proposed Projects/Programs

In the line with the 6 plans, a number of projects/programs were proposed as listed in Table 11.2. The implementing body who has chief responsibility, the relevant authorities with whom well-coordination is required, the degree of private sector's participation for successful completion; and the estimated cost and its allocation. The costs described here are preliminary estimates (at 1996 prices), and subject to changes after reviewing the detailed scheme. Beneficiaries of all the projects are Bangkok people or Thai people.

11.3 Prioritization Criteria

In addition to the above-mentioned basic concepts in Section 11.1, projects/programs with the following attributes are given the highest priority, or classified as "Urgent Actions" which should be undertaken during the period between 1996 and 2001:

1) Effective/supportive to facilitate on-going and planned environmental projects/programs which were assessed to be crucial;
2) Necessary or indispensable to achieve **Environmental Minimum**, referring to the attainable level of socioeconomic development in Bangkok;
3) Preparatory for massive investment for social capital formation to be implemented in the medium- and long-term;
4) Solvable and implementable with additional less investment or institutional improvement;
5) Effective to strengthen the governmental capabilities in environmental administration as well as planning and financing.

Table 11.2 Proposed Projects/Prograsm for Bangkok Environmental Improvement (1/9)

Title of Projects/Programs	Type of Project A: Development Study B: Institutional Building C: Infrastructure Dev. D: Others	Prioritization Criteria M: Minimum B: Basic S: Strategic	Implementing Body	Related Agencies	Private Participation I: Major II: Supporting	Cost and Allocation (million baht) Total Cost	BMA	Central Government	State Enterprise	Private
Plan 1: Sustainable Resource Utilization										
Urgent Actions										
RU11: Formulation of Institutional Program for Land Subsidence Protection Projects (based on the JICA Study, 1992-95)	B	M	BMA	MOSTE						
RU12: Establishment of Guidelines for Land Development and Environmental Preservation (related to UR12)	B	M	BMA	MOSTE /MOI						
RU13: Public Campaign for Promotion of People's Awareness of Energy-saving	D	M	MOSTE	MOI	II	90		90		
Medium-term Projects/programs										
RU21: Development of "Solid Waste Recycling Center" plus Encouragement of Recycling Industries" (related to SW21)	B, C	B	BMA	MOSTE	I					
RU22: Development of "Green and Water Network" along Major Khlongs (related to WE24)	B, C	B	BMA		II	4,390	4,390			
RU23: R & D Support Program for Environmental and Energy-saving Technologies (related to AR24)	D	S	MOSTE		I					
Long-term Projects/Programs										
RU31: Implementation of Projects/Programs for "Energy-saving" and "Environmental Preservation" (based on RU23)	B, D	B	MOSTE	MOI	I					
Plan 2: Flood-free Urbanization										
Urgent Actions										
FL11: Long-term Master Plan Study for Flood Control in Lower Chao Phraya River Basin (scheduled to be supported by JICA)	A	M	BMA	RID						
FL12: Improvement, Rehabilitation and Enhancement of Existing Flood Protection Facilities (Dike, Water Gates, Pumping Stations and Drainage Systems)	C	M	BMA	MOI/RID		310	310			
FL13: Flood Plain Management Project for the Eastern Bank Area (Thonburi Side)	C	M	BMA	MOI		880	880			
FL14: Implementation of Projects for BMA 5th Five-year Plan	C	B	BMA			23,630	23,630			
Medium-term Projects/programs										
FL21: Implementation of Phase I Projects for Flood Protection System/Facilities Development (based on FL11)	C	B	BMA	RID/MOI		310	310			

Table 11.2 Proposed Projects/Prograsm for Bangkok Environmental Improvement (2/9)

Title of Projects/Programs	Type of Project A: Development Study B: Institutional Building C: Infrastructure Dev. D: Others	Prioritization Criteria M: Minimum B: Basic S: Strategic	Implementing Body	Related Agencies	Private Participation I: Major II: Supporting	Cost and Allocation (million baht) Total Cost	BMA	Central Government	State Enterprise	Private
FL22: Implementation of the Extended Flood Plain Management Project for the Eastern Bank Area (following-up FL13)	C	B	BMA	MOI		880	880			
Long-term Projects/Programs										
FL31: Implementation of Phase II Projects for Flood Protection System/Facilities Development (based on FL11)	C	B	BMA	RID/MOI		880	880			
Plan 3: Environment-initiative Urban Transport (Eco-transport) System										
Urgent Actions										
ET11 Pedestrian Environment Improvement Plan	A	M	BMA			60	60			
ET12 Eco-Street Development Plan	A	B	BMA	MOTC		40	40			
ET13 Water Transport Revitalization Program	A	B	MOTC /BMA			40		40		
ET14 Public Transport Integration Plan	A	M	OCMRT /BMA	BMTA		60		60		
ET15 Master Plan and Feasibility Study on Public Transport Terminals and Inter-Modal Facilities	A	B	OCMRT /BMA	MOTC /BMTA		60		60		
ET16 Feasibility study and Engineering Study on Major Secondary Road	A	B	BMA			140	140			
ET17 Area Road Pricing plan	A	B	OCMRT	BMA /MOTC		60		60		
ET18 Review of Primary Road System	A	B	OCMRT	MOTC /ETA		20		20		
ET19 Implementation of Projects for BMA 5th Five-year Plan	C	B	BMA			54,400	54,400			
Medium-term Projects/programs										
ET24 Pedestrian Environment Improvement Phase 1 (based on ET11)	C	M	BMA		II	3,910	3,910			
ET25 Eco-Street Development Phase 1 (based on ET12)	C	B	BMA	MOTC	II	680	680			
ET26 Water Transport Revitalization Phase 1 (based on ET13)	C	M	MOTC /BMA		II	840		840		
ET27 Public Transport Integration Phase 1 (based on ET14)	C	M	BMTA	MOTC		100			100	
ET28 Public Transport Terminals and Inter-Modal Facilities Development (based on ET15)	C	B	MOTC /BMTA /BMA	OCMRT	II	7,480	2,490	2,490	2,500	
ET29 Implementation of Major Secondary Road Projects (based on ET16)	C	B	BMA			2,450	2,450			

Table 11.2 Proposed Projects/Prograsm for Bangkok Environmental Improvement (3/9)

	Title of Projects/Programs	Type of Project A: Development Study B: Institutional Building C: Infrastructure Dev. D: Others	Prioritization Criteria M: Minimum B: Basic S: Strategic	Implementing Body	Related Agencies	Private Participation I: Major II: Supporting	Cost and Allocation (million baht) Total Cost	BMA	Central Government	State Enterprise	Private
ET30	Implementation of Area Road Pricing Project (based on ET17)	C	B	BMA	MOTC /OCMRT		300	300			
ET31	Formulation of Transport Master Plan for 9th National Development Plan	A	M	OCMRT	NESDB		60		60		
ET32	Proceed Impiementation of Extended Mass Transit System Projects (71.4km)	C	S	MRTA	MOTC /BMA	I	42,080			29,290	12,790
Long-term Projects/Programs											
ET33	Pedestrian Environment Improvement Phase 2 (based on ET11)	C	M	BMA		II	1,360	1,360			
ET34	Eco-Street Development Phase 2 (based on ET12)	C	B	BMA	MOTC	II	1,560	1,560			
ET35	Water Transport Revitalization Phase 2 (based on ET13)	C	M	MOTC	BMA	II	1,550		1,550		
ET36	Public Transport Integration Phase 2 (based on ET14)	C	M	OCMRT	BMTA		100			100	
ET37	Public Transport Terminals and Inter-Modal Facilities Development (based on ET15)	C	B	MOTC /BMTA /BMA	OCMRT		640	210	210	220	
ET38	Implementation of Major Secondary Road Projects (based on ET16)	C	B	BMA			32,390	32,390			
ET39	Formulation of Transport Master Plan for 10th National Development Plan	A	M	OCMRT	NESDB		100		100		
ET40	Proceed Implementation of Mass Transit System Projects (63.6km)	C	S	MRTA	MOTC /BMA	I	37,400			26,520	10,880
Plan 4: Pursuance of "Fresh and Clean Air Policy"											
Urgent Actions											
AR11:	Environmental Administration Enhancement Program, including: • Extension of Monitoring Stations and Equipment for Meteorology and Ambient Air Quality; • Establishment of Epidemiological Surveillance System; and • Training and Technology Transfer of Analytical Technique.	B, D	M	MOSTE	BMA		130		130		
AR12:	Establishment of Air Pollutants Protection Guidelines for Private Activities, including: • Construction Site Management and Truck Cleaning; and • Combustion Management and Emission Control for Factories.	B	M	MOSTE	BMA	I					

Table 11.2 Proposed Projects/Prograsm for Bangkok Environmental Improvement (4/9)

Title of Projects/Programs	Type of Project A: Development Study B: Institutional Building C: Infrastructure Dev. D: Others	Prioritization Criteria M: Minimum B: Basic S: Strategic	Implementing Body	Related Agencies	Private Participation I: Major II: Supporting	Cost and Allocation (million baht)				
						Total Cost	BMA	Central Government	State Enterprise	Private
AR13: Improvement of Vehicle Inspection and Maintenance System Program, including • Standardization and Technical Guidelines of Emission Inspection; • Training and Qualification System for Inspectors /Mechanics; • Public Relation of the System, and Institution Building, and so on.	B, D	M	MOTC	MOSTE /BMA	I	600		600		
AR14: Implementation of "Fresh and Clean Air Program for Public Bus", including: • Checking System of Maintenance and Exhaust Gas; and • Low-Pollution Bus Replacement (Introduction of CNG Bus, ect.) Program.	B, D	B	BMTA	MOTC /BMA	II	9,350		940	8,410	
AR15: Public Campaign for Promotion of People's Awareness of Vehicle Maintenance and Dust Reduction by Construction	D	M	MOSTE /BMA	MOTC	II	60		60		
AR16: Establishment of Transportation Research Center (in coordination with ERTC), including • Study for environmentally sound transportation policies; • Research for low-emission-vehicles and transportation technology suitable for South East Asia	B, D	S	MOTC	MOSTE /MOI		90		90		
AR17: Study of Action Plans for "Comprehensive Urban Traffic Pollution Management"	A	M	MOSTE /MOTC	BMA	II	40		40		
AR18: Implementation of Projects for BMA 5th Five-year Plan	C	M	BMA	MOSTE	II	240	240			
Medium-term Projects/programs										
AR21: Implementation of the Extended Environmental Administration Enhancement Program (following-up AR11)	C, D	M	MOSTE		II	70		70		
AR22: Enhancement of Voluntary Activities by the Private Sector, including: • Introduction of Voluntary Environment Management System; • Promotion of Private Laboratory and Monitoring Activities; • Establishment of Public Qualification System for Environmental Engineers/Managers; and • Introduction of ISO14000 System.	B	B	MOSTE	NESDB /MOID	I	60		60		

Table 11.2 Proposed Projects/Prograsm for Bangkok Environmental Improvement (5/9)

Title of Projects/Programs	Type of Project A: Development Study B: Institutional Building C: Infrastructure Dev. D: Others	Prioritization Criteria M: Minimum B: Basic S: Strategic	Implementing Body	Related Agencies	Private Participation I: Major II: Supporting	Cost and Allocation (million baht) Total Cost	BMA	Central Government	State Enterprise	Private
AR23: Implementation of the Extended Vehicle Inspection and Maintenance System Improvement Program (following-up AR13)	C	M	MOTC	MOSTE	I	170		90		80
AR24: Implementation of "Energy-saving Policy", including: • Incentive Provision for Shifting to Cleaner Energy/Fuel; and • Institutional Support for Fuel Efficiency Improvement.	B	S	MOSTE	NESDB /MOF /MOID	I	60		60		
AR25: R & D Support Program for Less Pollutant Vehicle Production (Hybrid Electric Vehicle etc.)	A	S	MOSTE		I	5,100		1,020		4,080
Plan 5: Creation of Water-friendly Eco-city										
Sewerage System Development										
Urgent Actions										
SS11: Review of the Existing Sewage Master Plan in Priority, Facility Sites, Systems, Engineering Design and Implementation Scheme	A	M	BMA	WMA/ MOSTE		20	20			
SS12: Feasibility Study on Priority Sewerage System Projects, Committed in the BMA 5th Five Year Strategic Plan (based on SS11)	A	M	BMA	WMA/ MOSTE		40	40			
SS13: Procurement of Sewage Treatment Facility Construction Sites for the Priority Project (related to SS12)	C	B	BMA	WMA/ MOSTE	II	22,870	22,870			
SS14: Promotion of Public Campaign for Saving Water and Reducing Water Pollutants	D	M	BMA	WMA/ MOSTE		90	90			
SS15: Implementation Project for BMA 5th Five-year Plan	C	B	BMA	WMA/ MOSTE		18,300	18,300			
Medium-term Projects/programs										
SS21: Implementation of the Priority Projects (based on SS11-13)	C	B	BMA	WMA/ MOSTE	II	50,020	50,020			
SS22: Feasibility Study on Second Priority (Phase II) Sewerage System Projects (based on SS11)	A	B	BMA	WMA/ MOSTE		40	40			
SS23: System Management and Maintenance Capability Enhancement Project (related to UR22)	B	B	BMA	WMA/ MOSTE	II	590	590			
Long-term Projects/Programs										
SS31: Implementation of Second Priority (Phase II) Sewerage System Projects (based on SS22)	C	B	BMA	WMA/ MOSTE	II	46,890	46,890			
SS32: Implementation of Extended Project for Sewerage System Development	C	B	BMA	WMA/ MOSTE	II	1,070	1,070			

Table 11.2 Proposed Projects/Prograsm for Bangkok Environmental Improvement (6/9)

Title of Projects/Programs	Type of Project A: Development Study B: Institutional Building C: Infrastructure Dev. D: Others	Prioritization Criteria M: Minimum B: Basic S: Strategic	Implementing Body	Related Agencies	Private Participation I: Major II: Supporting	Cost and Allocation (million baht) Total Cost	BMA	Central Government	State Enterprise	Private
River and Khlong Water Improvement										
Urgent Actions										
WE11: Extension of the on-going Khlong Beautification Program in the Eastern Bank Area	C	M	BMA		II	200	200			
WE12: Feasibility Study for Khlong Waterway and Boat Piers Improvement Project (related to ET13)	A	M	BMA	MOTC		30	30			
WE13: Formulation of "Khlong Water Beatification Program" in Thonburi Area	A	M	BMA	MOSTE/ MOTC		30	30			
WE14: Master Plan Study for Chao Phraya River Water Front Regeneration Project	A	M	BMA	MOSTE /MOTC /MOI		30	30			
WE15: Promotion of Public Campaign for "Clean, Green, Khlongs"	D	M	BMA	MOSTE	II	90	90			
Medium-term Projects/Programs										
WE21: Implementation of Khlong Waterway and Boat Piers Improvement Project (based on WE12)	C	M	BMA	MOTC	II	530	530			
WE22: Implementation of "Khlong Water Beatification Program" in Thonburi Area" (based on WE13)	C	M	BMA	MOSTE /MOTC	II	200	200			
WE23: Implementation of Phase I Project for Chao Phraya River Water Front Regeneration (based on WE14)	C	S	BMA	MOSTE /MOTC /MOI	I	980	490			490
WE24: "Green and Water Network" Project along Major Khlongs	C	B	BMA	MOI	II	780	780			
Long-term Projects/Programs										
WE31: Implementation of the Extended Phase II Projects for Chao Phraya River Water Front Regeneration (following-up WE23)	C	S	BMA	MOI	I	980	490			490
Plan 6: Up-grading of Quality of Living Environment										
Solid Waste Management										
Urgent Actions										
SW11: Master Plan, Feasibility and Engineering Study for Final Disposal Sites/Facilities Development in Bangkok	A	M	BMA			60	60			
SW12: Feasibility and Engineering Study on Intermediate Solid Waste Treatment Facilities and Long-term System Development (including Improvement of Collection and Transport Systems)	A	M	BMA			40	40			

Table 11.2 Proposed Projects/Prograsm for Bangkok Environmental Improvement (7/9)

Title of Projects/Programs	Type of Project A: Development Study B: Institutional Building C: Infrastructure Dev. D: Others	Prioritization Criteria M: Minimum B: Basic S: Strategic	Implementing Body	Related Agencies	Private Participation I: Major II: Supporting	Cost and Allocation (million baht)				
						Total Cost	BMA	Central Government	State Enterprise	Private
SW13: Bangkok Incineration Plant Development Project (based on a review of the existing BOT/Turn-key program)	C	B	BMA	MOSTE	II	9,180	4,590			4,590
SW14: Public Campaign for Promotion of People's Awareness for Solid Waste Reduction and Community Collection System	D	M	MOSTE	BMA	II	90		90		
SW15: Implementation of Projects for BMA Fifth Five-year Plan * Facilities Development * Disposal contract	C	B	BMA		II	23,930	23,930			
Medium-term Projects/programs										
SW21: Development of "Solid Waste Recycling Center" and Encouragement of Recycling Industries	C	B	BMA	MOID	I	4,750	2,380			2,370
SW22: Implementation of Final Disposal Site/Facility Development Project (based on SW11)	C	M	BMA	MOSTE	II	5,430	5,430			
SW23: Implementation of Intermediate Waste Treatment System Development (following-up SW12)	C	B	BMA		II	980	980			
SW24: Extended Project of Incineration Plant Development (linked with SW13)	C	B	BMA	MOSTE	I	27,550	13,780			13,770
Long-term Projects/Programs										
SW31: Implementation of Extended Projects of Solid Waste Intermediate and Final Disposal Facilities Development (linked with SW21-23)	C	B	BMA	MOSTE	II	5,430	5,430			
Water Supply System										
Urgent Actions										
WS11: Feasibility Study for Improvement and Rehabilitation of Existing Water Supply Facilities and Subscriber Management System	A	M	MWA	BMA		60			60	
WS12: Review of the Existing Long-term Master Plan of Water Supply System Development	A	M	MWA	BMA		30			30	
WS13: Implementation of Projects for MWA 5th Five-year Plan	C	B	MWA	BMA		114,900			114,900	
Medium-term Projects/programs										
WS21: Implementation of Improvement/Rehabilitation of Water Supply System (based on WS11 and WS12)	C	M	MWA	BMA		58,620			58,620	
WS22: Development of Computerized Management and Maintenance Systems for Water Supply Facilities and Subscribers	C	S	MWA			780			780	

Table 11.2 Proposed Projects/Prograsm for Bangkok Environmental Improvement (8/9)

Title of Projects/Programs	Type of Project A: Development Study B: Institutional Building C: Infrastructure Dev. O: Others	Prioritization Criteria M: Minimum B: Basic S: Strategic	Implementing Body	Related Agencies	Private Participation I: Major II: Supporting	Cost and Allocation (million baht) Total Cost	BMA	Central Government	State Enterprise	Private
Long-term Projects/Programs										
WS31: Implementation of Extended Water Resource Development and Supply System Development (based on WS12)	C	M	MWA	BMA		87,930			87,930	
Housing and Community Development										
Urgent Actions										
HC11: Feasibility and Engineering Study of the NHA Five-Year Program for Provision of Low and Middle Income Households (related to UR11)	A	B	NHA	BMA		40			40	
HC12: Feasibility Study for Slum Resettlement and Up-grading Programs with Enhancement of Financial Support Programs	A	M	NHA	BMA	II	40			40	
HC13: Public Campaign for Promotion of Community Participation in Solving Environmental Problems (related to SW14)	D	M	NHA	BMA	II	40			40	
HC14: Master Plan and Action Programs Study for Metropolitan Sub-center Development	A	M	BMA	NESDB /MOI /NHA		60			60	
Medium-term Project/Programs										
HC21: Implementation of the NHA Five-Year Program for Provision of Low and Middle Income Households (based on HC11)	C	B	NHA	BMA		15,630			15,630	
HC22: Implementation of Slum Resettlement and Up-grading Programs with Enhancement of Financial Support Programs (based on HC12)	C	M	NHA	BMA /MOF /NESDB /MOI	I	39,080			19,540	19,540
HC23: Support Program for Development of Community Parks, Environmental Green and Pedestrian Facilities (following-up HC13)	C	B	BMA		II	3,910	3,910			
HC24: Implementation of Redevelopment Projects of NHA Housing Areas (given to priority to Din Daeng Project)	C	B	NHA	BMA	I	19,540	3,910		7,820	7,810
HC25: Implementation of Infrastructure Projects of Sub-center Zone Development (based on HC14)	B, C	S	BMA /NHA	NESDB /MOI /MOTC, etc.	I	116,030	23,210		46,410	46,410

Table 11.2 Proposed Projects/Prograsm for Bangkok Environmental Improvement (9/9)

Title of Projects/Programs	Type of Project A: Development Study B: Institutional Building C: Infrastructure Dev. D: Others	Prioritization Criteria M: Minimum B: Basic S: Strategic	Implementing Body	Related Agencies	Private Participation I: Major II: Supporting	Cost and Allocation (million baht)				
						Total Cost	BMA	Central Government	State Enterprise	Private
Long-term Projects/Programs										
HC31: Implementation of Infrastructure Projects of Extended Sub-center Zone Development (based on HC14)	C	S	BMA /NHA	NESDB /MOI /MOTC, etc.	I	254,320	50,860		101,730	101,730
Special Projects/Programs for Urban Planning and Institutional Enhancement										
Urgent Actions										
UR11: Formulation and Empowerment of Local Environmental Plans and Guidelines by District	A	M	MOSTE			40		40		
UR12: Strategic Study for Urban Management System and Financial Enhancement Programs of BMA	A	M	BMA	MOSTE		70	70			
UR13: Establishment of "Bangkok Information & System Development Center (BISDC)" in BMA	C, D	B	BMA	MOI /MOF		780	780			
UR14: Development of Large Scale Topographical and Cadastral Maps for Urban Planning and Tax Assessment Administration (linked with UR12 and UR13)	C, D	B	BMA			1,370	1,370			
Medium-term Projects/programs										
UR21: Computerization of Local Tax Administration in BMA (based on UR14 and UR15)	B, C	M	BMA			290	290			
UR22: Establishment of "Environmental Engineering & Technology Center (EETC)" in BMA, for Staff Training and R&D Promotion	C, D	B	BMA		II	780	780			