K.3 Selection of a First Priority City

K.3.1 Outcome of the Evaluation

The outcome of the evaluation is analyzed for the following 3 cases, where respective cases assume different point weighting.

Case-1	Point weighting is as decided in the Progress Report (1): Needs for formulating M/P (50 points), Economic benefit expected (20 points), Social welfare contribution (20 points), and Capability to implement relative projects (10 points).
Case-2	4 principal evaluation items receive equal weighting i.e.,: Needs for formulating M/P (25 points), Economic benefit expected (25 points), Social welfare contribution (25 points), and Capability to implement relative projects (25 points).
Case-3	Without weighting on principal evaluation items, all "detailed evaluation elements" receive same weighting.

a. Case-1

Result of the Case-1 analysis is shown in Table 25 and Figure 1. As is shown in the table, Granada has 71.9 points, Chinandega 60.9 points, and Leon 56.3 points.

b. Case-2

Result of the Case-2 analysis is shown in Table 26 and Figure 2. As is shown in the table, Granada has 65.7 points, Leon 59.0 points, and Chinandega 55.3 points.

c. Case-3

As is shown in the table 27, even when weighting on 4 principal evaluation items is eliminated and detailed evaluation items receive same weighting, Granada has 82 points, Chinandega 71 points, and Leon 64 points and thereby Granada gains the highest points in all three cases.

With above evaluation analyses results, Team proposes that Granada should be selected as the first priority city of the Study.

Table K-25: Outcome of Evaluation (Case - 1)

Detailed Evaluation Elements	Results of Evaluation		
	Leon	Chinandega	Granada
a. Needs in Formulating M/P			
1. Urgent Needs in Improvement of USE			
1.1 Contamination of drinking water	1	1	2
1.2 Contamination of surface water	2	2	2
1.3 Contamination of ground water	2	2	2
1.4 Inundation	1	2	1
1.5 Public nuisance (offensive odor, etc.)	2	2	2
1.6 Adverse impacts on fishery and agriculture	1	1	1
1.7 Aesthetic degradation	2	2	2
1.8 Averse impacts on tourism	1	1	1
1.9 Adverse impacts on fauna/flora	0	0	2
1.10 Needs expressed by citizen	1	1	1
2. Absence of Plans			
2.1 City development M/P	0	2	2
2.2 Water supply system plan	0	0	0
2.3 Sewerage system improvement plan	0	0	0
2.4 Industrial wastewater management plan	1	2	2
2.5 Storm water management plan	2	2	2
2.6 Municipal SWM plan	1	1	0
2.7 Industrial SWM plan	2	2	2
2.8 Medical SWM plan	2	1	2
3. Problems caused by Absence of the Plans			
3.1 Absence of Industrial wastewater management plan	1	2	2
3.2 Absence of storm water management plan	1	2	1
3.3 Absence of municipal SWM plan	2	2	2
3.4 Absence of Industrial SWM plan	2	2	2
3.5 Absence of medical SWM plan	2	1	2
4. Planning deficiency			
4.1 Planning capability of municipality(1)	1	0	2
4.2 Planning capability of municipality(2)	0	2	1
4.3 External supports in planning(1)	1	1	2
4.4 External supports in planning(2)	0	1	2
sub-total	31	37	42
50 weighted point	28.7	34.3	38.9
b. Economic Benefits Expected			
1. Economic Benefits expected on USE Sectors			
1.1 Prevention of drinking water contamination (municipal level)	1	1	2
1.2 Prevention of drinking water contamination (regional level)	0	0	2
1.3 Prevention of surface water contamination	1	1	2
1.4 Prevention of ground water contamination	2	2	2
1.5 Prevention of inundation	1	2	1
1.6 Prevention of public nuisance	2	2	2
2. Economic Benefits expected on Other than USE Sectors			
2.1 Prevention of adverse impacts on fishery and agriculture	2	2	2
2.2 Prevention of aesthetic degradation	2	2	2
2.3 Prevention of adverse impacts on tourism	1	0	2
2.4 Prevention of adverse impacts on fauna/flora	0	0	2
sub-total	12	12	19
20 weighted point	12	12	19
c. Social Welfare Contribution			

Detailed Evaluation Elements	Results of Evaluation		
	Leon	Chinandega	Granada
1.Contribution to Social Equity			
1.1 Coverage rate of water supply system	0	2	1
1.2 Coverage rate of sewer system	0	1	2
1.3 Coverage rate of toilet	0	1	2
1.4 Coverage rate of refuse collection service	0	2	1
1.5 Coverage rate of pluvial drainage	1	2	0
1.6 Amount of foreign aid per citizen	0	2	1
1.7 Amount of subsidy from central government per citizen	1	0	2
1.8 Expenditure for water supply system improvement (per citizen)	1	2	0
1.9 Expenditure for sewerage system improvement per citizen	0	1	2
1.10 Expenditure for SWM per citizen	1	2	0
1.11 GRDP	2	0	1
1.12 Unemployment rate	2	0	1
2. Contribution to the Improvement of Health Indicators			
2.1 Maternal death rate	1	0	2
2.2 Neonatal death rate	2	0	1
2.3 Morbidity rate of major epidemic diseases	2	1	0
2.4 Mortality rate of major epidemic diseases	0	2	1
2.5 Health damage by poor USE facilities	0	0	0
sub-total	13	18	17
20 weighted point	7.6	10.6	10
d. Capability to Implement Relative Projects			
1. Financial Capability of Executing Body and Citizen			
1.1 Financial capability of municipality	2	0	1
1.2 Financial capability of citizen(1)	0	1	2
1.3 Financial capability of citizen(2)	2	1	1
2. Administrative Implementation Capability			
2.1 Administrative capability of municipal staffs	2	1	0
2.2 Preparedness to receive foreign/domestic supports	2	1	0
sub-total	8	4	4
10 weighted point	8	4	4
Grand Total	64	71	82
50,20,20,10 weighted point	56.3	60.9	71.9

Principal Evaluation Items	Leon	Chinandega	Granada
a. Needs in Formulating M/P	28.7	34.3	38.9
b. Economic Benefits Expected	12	12	19
c. Social Welfare Contribution	7.6	10.6	10
d. Capability to Implement Relative Projects	8	4	4
Total	56.3	60.9	71.9

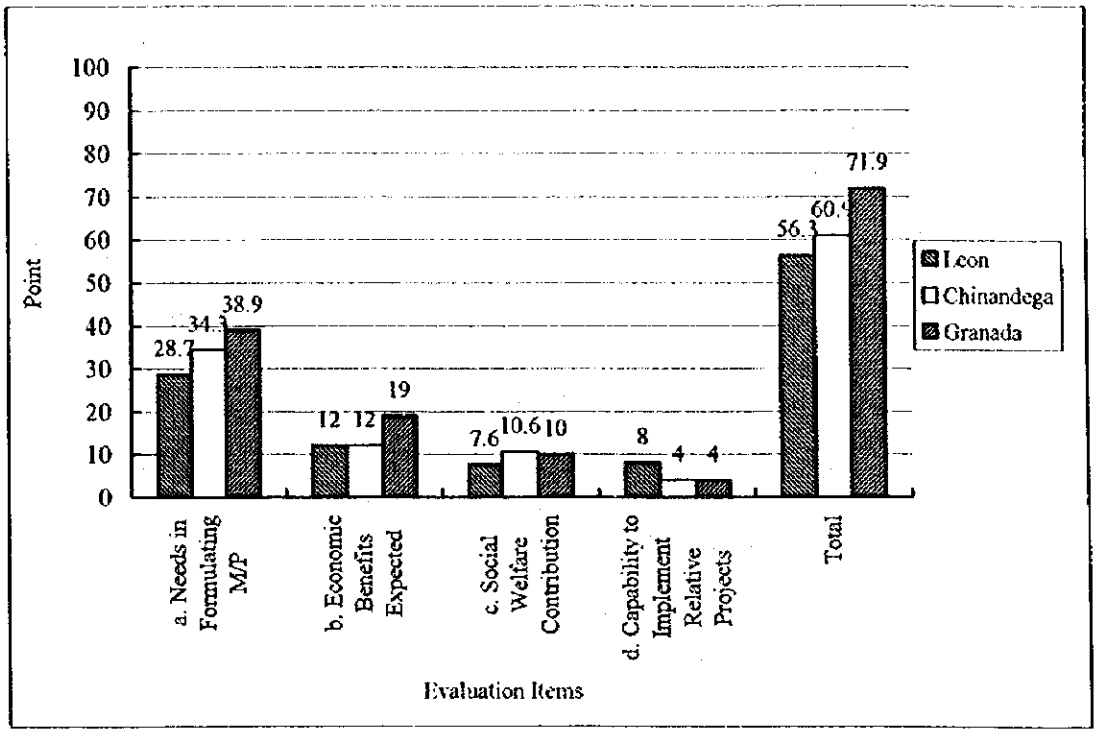

Figure K-1: Outcome of Evaluation (Case - 1)

Table K-26: Outcome of Evaluation (Case - 2)

Detailed Evaluation Elements	Results of Evaluation		
	Leon	Chinandega	Granada
a. Needs in Formulating M/P			
1. Urgent Needs in Improvement of USE			
1.1 Contamination of drinking water	1	1	2
1.2 Contamination of surface water	2	2	2
1.3 Contamination of ground water	2	2	2
1.4 Inundation	1	2	1
1.5 Public nuisance (offensive odor, etc.)	2	2	2
1.6 Adverse impacts on fishery and agriculture	1	1	1
1.7 Aesthetic degradation	2	2	2
1.8 Averse impacts on tourism	1	1	1
1.9 Adverse impacts on fauna/flora	0	0	2
1.10 Needs expressed by citizen	1	1	1
2. Absence of Plans			
2.1 City development M/P	0	2	2
2.2 Water supply system plan	0	0	0
2.3 Sewerage system improvement plan	0	0	0
2.4 Industrial wastewater management plan	1	2	2
2.5 Storm water management plan	2	2	2
2.6 Municipal SWM plan	1	1	0
2.7 Industrial SWM plan	2	2	2
2.8 Medical SWM plan	2	1	2
3. Problems caused by Absence of the Plans			
3.1 Absence of Industrial wastewater management plan	1	2	2
3.2 Absence of storm water management plan	1	2	1
3.3 Absence of municipal SWM plan	2	2	2
3.4 Absence of Industrial SWM plan	2	2	2
3.5 Absence of medical SWM plan	2	1	2
4. Planning deficiency			
4.1 Planning capability of municipality(1)	1	0	2
4.2 Planning capability of municipality(2)	0	2	1
4.3 External supports in planning(1)	1	1	2
4.4 External supports in planning(2)	0	1	2
sub-total	31	37	42
25 weighted point	14.4	17.1	19.4
b. Economic Benefits Expected			
1. Economic Benefits expected on USE Sectors			
1.1 Prevention of drinking water contamination (municipal level)	1	1	2
1.2 Prevention of drinking water contamination (regional level)	0	0	2
1.3 Prevention of surface water contamination	1	1	2
1.4 Prevention of ground water contamination	2	2	2
1.5 Prevention of inundation	1	2	1
1.6 Prevention of public nuisance	2	2	2
2. Economic Benefits expected on Other than USE Sectors			
2.1 Prevention of adverse impacts on fishery and agriculture	2	2	2
2.2 Prevention of aesthetic degradation	2	2	2
2.3 Prevention of adverse impacts on tourism	1	0	2
2.4 Prevention of adverse impacts on fauna/flora	0	0	2
sub-total	12	12	19
25 weighted point	15	15	23.8
c. Social Welfare Contribution			

Detailed Evaluation Elements	Results of Evaluation		
	Leon	Chinandega	Granada
1.Contribution to Social Equity			
1.1 Coverage rate of water supply system	0	2	1
1.2 Coverage rate of sewer system	0	1	2
1.3 Coverage rate of toilet	0	1	2
1.4 Coverage rate of refuse collection service	0	2	1
1.5 Coverage rate of pluvial drainage	1	2	0
1.6 Amount of foreign aid per citizen	0	2	1
1.7 Amount of subsidy from central government per citizen	1	0	2
1.8 Expenditure for water supply system improvement (per citizen)	1	2	0
1.9 Expenditure for sewerage system improvement per citizen	0	1	2
1.10 Expenditure for SWM per citizen	1	2	0
1.11 GRDP	2	0	1
1.12 Unemployment rate	2	0	1
2. Contribution to the Improvement of Health Indicators			
2.1 Maternal death rate	1	0	2
2.2 Neonatal death rate	2	0	1
2.3 Morbidity rate of major epidemic diseases	2	1	0
2.4 Mortality rate of major epidemic diseases	0	2	1
2.5 Health damage by poor USE facilities	0	0	0
sub-total	13	18	17
25 weighted point	9.6	13.2	12.5
d. Capability to Implement Relative Projects			
1. Financial Capability of Executing Body and Citizen			
1.1 Financial capability of municipality	2	0	1
1.2 Financial capability of citizen(1)	0	1	2
1.3 Financial capability of citizen(2)	2	1	1
2. Administrative Implementation Capability			
2.1 Administrative capability of municipal staffs	2	1	0
2.2 Preparedness to receive foreign/domestic supports	2	1	0
sub-total	8	4	4
25 weighted point	20	10	10
Grand Total	64	71	82
25 weighted point	59	55.3	65.7

Principal Evaluation Items	Leon	Chinandega	Granada
a. Needs in Formulating M/P	14.4	17.1	19.4
b. Economic Benefits Expected	15	15	23.8
c. Social Welfare Contribution	9.6	13.2	12.5
d. Capability to Implement Relative Projects	20	10	10
Total	59	55.3	65.7

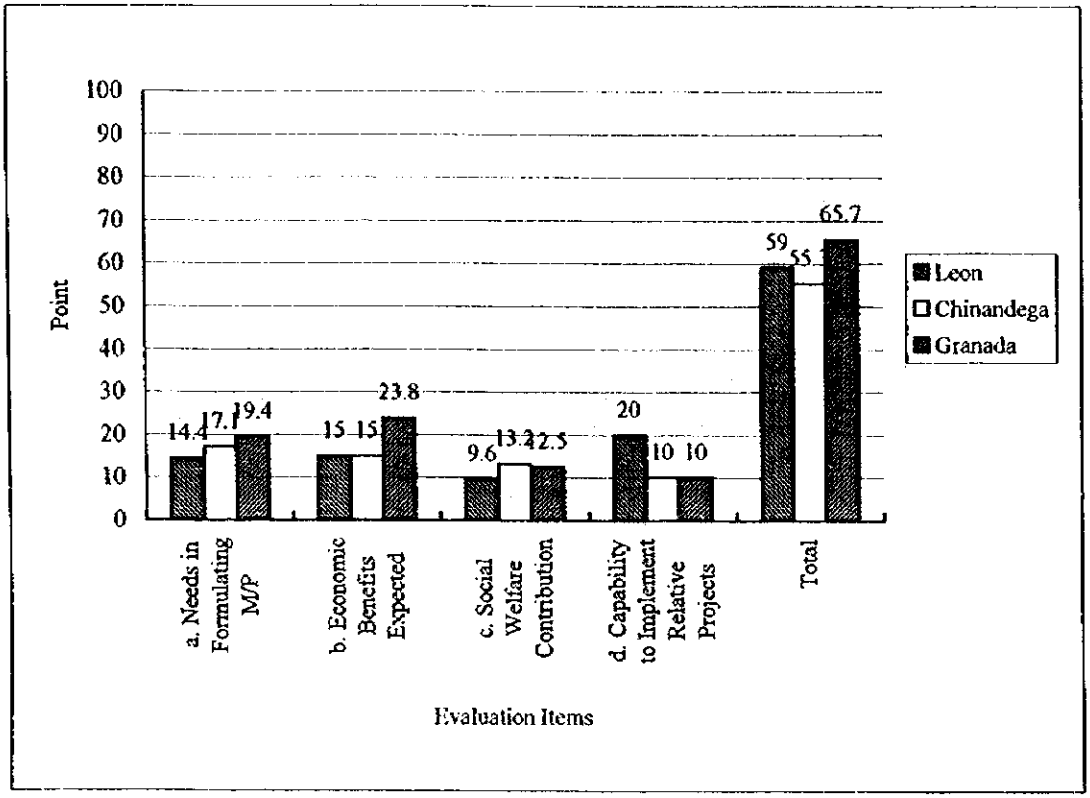

Figure K-2: Outcome of Evaluation (Case - 2)

Table K-27: Outcome of Evaluation (Case - 3)

Detailed Evaluation Elements	Results of Evaluation		
	Leon	Chinandega	Granada
a. Needs in Formulating M/P			
1. Urgent Needs in Improvement of USE			
1.1 Contamination of drinking water	1	1	2
1.2 Contamination of surface water	2	2	2
1.3 Contamination of ground water	2	2	2
1.4 Inundation	1	2	1
1.5 Public nuisance (offensive odor, etc.)	2	2	2
1.6 Adverse impacts on fishery and agriculture	1	1	1
1.7 Aesthetic degradation	2	2	2
1.8 Averse impacts on tourism	1	1	1
1.9 Adverse impacts on fauna/flora	0	0	2
1.10 Needs expressed by citizen	1	1	1
2. Absence of Plans			
2.1 City development M/P	0	2	2
2.2 Water supply system plan	0	0	0
2.3 Sewerage system improvement plan	0	0	0
2.4 Industrial wastewater management plan	1	2	2
2.5 Storm water management plan	2	2	2
2.6 Municipal SWM plan	1	1	0
2.7 Industrial SWM plan	2	2	2
2.8 Medical SWM plan	2	1	2
3. Problems caused by Absence of the Plans			
3.1 Absence of Industrial wastewater management plan	1	2	2
3.2 Absence of storm water management plan	1	2	1
3.3 Absence of municipal SWM plan	2	2	2
3.4 Absence of Industrial SWM plan	2	2	2
3.5 Absence of medical SWM plan	2	1	2
4. Planning deficiency			
4.1 Planning capability of municipality(1)	1	0	2
4.2 Planning capability of municipality(2)	0	2	1
4.3 External supports in planning(1)	1	1	2
4.4 External supports in planning(2)	0	1	2
sub-total	31	37	42
b. Economic Benefits Expected			
1. Economic Benefits expected on USE Sectors			
1.1 Prevention of drinking water contamination (municipal level)	1	1	2
1.2 Prevention of drinking water contamination (regional level)	0	0	2
1.3 Prevention of surface water contamination	1	1	2
1.4 Prevention of ground water contamination	2	2	2
1.5 Prevention of inundation	1	2	1
1.6 Prevention of public nuisance	2	2	2
2. Economic Benefits expected on Other than USE Sectors			
2.1 Prevention of adverse impacts on fishery and agriculture	2	2	2
2.2 Prevention of aesthetic degradation	2	2	2
2.3 Prevention of adverse impacts on tourism	1	0	2
2.4 Prevention of adverse impacts on fauna/flora	0	0	2
sub-total	12	12	19
c. Social Welfare Contribution			
1.Contribution to Social Equity			
1.1 Coverage rate of water supply system	0	2	1

Detailed Evaluation Elements	Results of Evaluation		
	Leon	Chinandega	Granada
1.2 Coverage rate of sewer system	0	1	2
1.3 Coverage rate of toilet	0	1	2
1.4 Coverage rate of refuse collection service	0	2	1
1.5 Coverage rate of pluvial drainage	1	2	0
1.6 Amount of foreign aid per citizen	0	2	1
1.7 Amount of subsidy from central government per citizen	1	0	2
1.8 Expenditure for water supply system improvement (per citizen)	1	2	0
1.9 Expenditure for sewerage system improvement per citizen	0	1	2
1.10 Expenditure for SWM per citizen	1	2	0
1.11 GRDP	2	0	1
1.12 Unemployment rate	2	0	1
2. Contribution to the Improvement of Health Indicators			
2.1 Maternal death rate	1	0	2
2.2 Neonatal death rate	2	0	1
2.3 Morbidity rate of major epidemic diseases	2	1	0
2.4 Mortality rate of major epidemic diseases	0	2	1
2.5 Health damage by poor USE facilities	0	0	0
sub-total	13	18	17
d. Capability to Implement Relative Projects			
1. Financial Capability of Executing Body and Citizen			
1.1 Financial capability of municipality	2	0	1
1.2 Financial capability of citizen(1)	0	1	2
1.3 Financial capability of citizen(2)	2	1	1
2. Administrative Implementation Capability			
2.1 Administrative capability of municipal staffs	2	1	0
2.2 Preparedness to receive foreign/domestic supports	2	1	0
sub-total	8	4	4
Grand Total	64	71	82

Principal Evaluation Items	Leon	Chinandega	Granada
a. Needs in Formulating M/P	31	37	42
b. Economic Benefits Expected	12	12	19
c. Social Welfare Contribution	13	18	17
d. Capability to Implement Relative Projects	8	4	4
Total	64	71	82

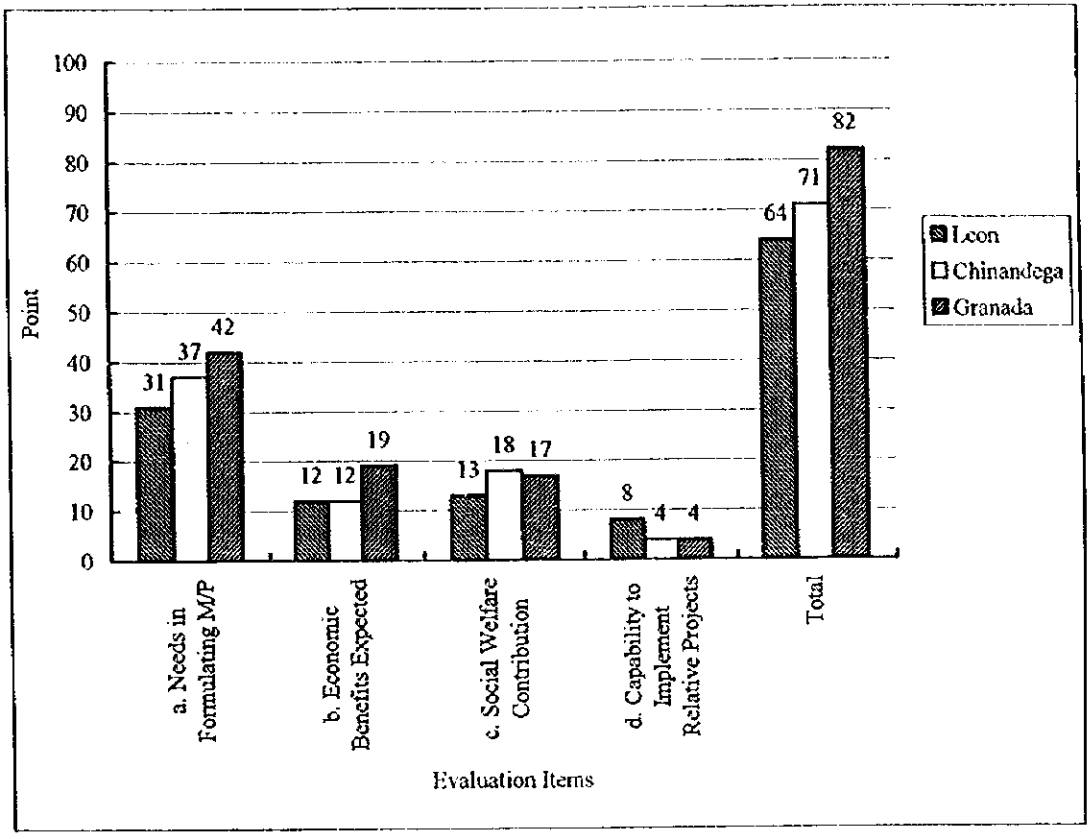

Figure K-3: Outcome of Evalucation (Case - 3)

K.3.2 Requirements for the Selected First Priority City

Aiming to select a city which is in the utmost needs of formulating an USE M/P, Team proposed that Granada be the FPC. Granada being the FPC means that the city, in comparison to other 2 cities, requires the most cooperation by the Team in formulating plans, improving administration and consolidating the implementation capacity.

Meanwhile, it is anticipated and worried that a M/P to be formulated with many efforts may not be substantiated through relative projects, possibly due to lack of the implementation capacity of the FPC. Therefore, Team requires that Granada should improve its capability along with the "joint study" in the course of proceeding the works for M/P and F/S formulation.

Whereas, although it is strongly anticipated that present final disposal of municipal SW might be polluting the environment and causing serious USE problems, Granada proposes only one candidate site for new landfill. It is envisaged that this site is not suitable as the new landfill because the distance from the city center to the site is considerably long and may require huge initial investment for the improvement of the access road and which will lead to higher disposal cost in future. In this connection, Team requires that Granada should soon propose other alternative sites that could alleviate future financial burden of SW collection services.

ANNEX L

M/P and Conceptual M/Ps

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L M/P and Conceptual M/Ps

L.1 USE Master Plan for Granada

L.1.1 Planning Frameworks for an USE M/P

L.1.1.1 Goals, Targets and Strategy

a. Goals

The principal goal of the Master Plan for Granada is to improve the Urban Sanitation Environment (USE) of the Granada City till the target year 2010 where people and major economic activities of the Region IV are centered.

Through the improvement of USE in Granada City, ***the Plan aims to:***

- **promote the Citizens' Well-being;**
- **support Sustainable Development of the City; and**
- **contribute to the Growth of the Regional Economies.**

The goals in practice of the Master Plan are as follows:

1. Improvement of public health in the city;
2. Reduction of health hazards in and around the city;
3. Protection of natural resources and environment (e.g., underground water resources, Lake Nicaragua's water resources and ecology, etc.);
4. Encouragement of citizens' environmental consciousness;
5. Increased provision of USE services (i.e., water supply, sewer, SW collection, etc.) in affordable and appropriate levels;
6. Establishment of self-sustainable management systems on USE services;
7. Establishment of a Beneficiary-Pay-Principles (BPP) under which services recipients pay for the USE services;
8. Development and promotion of community participation in USE systems;
9. Employment of satisfactory measures for protection of environment/human health in the operation and maintenance of USE facilities;
10. Prevention of pollution by industrial wastewater and solid waste;

11. Establishment of appropriate legislation, regulations and guidelines on USE through modifications and revisions of the existing ones; and

12. Establishment of a coordination mechanism for the city with national institutions for USE management.

b. Targets

Target years are, in accordance with the S/W of the Study, set up as follows:

Master Plan: Year 2010

Feasibility Study: Year 2005

In order to achieve the principal goals, target figures in 3 major sectors comprising USE are set up as indicated in the Table below.

Table L-1: Target Figures of Technical System in Granada

	Present(1995/96)	F/S(2005)	M/P(2010)
Water supply coverage	89.7 %	*85 %	*85 %
Domestic wastewater system			
Off-site sewer system	21.9 %	38 %	55 %
On-site system	1.6 %	10 %	17 %
Soak system	37.5 %	24 %	13 %
Latrine only system	28.1 %	22 %	15 %
No system	10.9 %	6 %	0 %
Municipal SWM			
Coverage rate (to waste amount)	82.0 %	90 %	100 %
Coverage rate (to population)	63.0 %	89 %	100 %

Note: * The INAA established a target water supply coverage rate of urban population as 85% for the country. The above-mentioned target figure is set up in accordance with the INAA's target. Consequently, the coverage rates of the year 2005 and 2010 is lower than 89.7%, the rate of 1995/1996. However, the supplied population in 2005 will be about 1.6 times more than that in 1995/1996 and that in 2010 will be about 1.8 times.

c. Strategies

Strategic actions to reach the goals and targets should, in practice, be deployed in a stepwise manner toward the target year 2010. Therefore, it is recommended herewith to divide the period to the target year 2010 into 3 phases.

Table L-2: Strategies for the Realization of USE Master Plan

Classification Phase	Technical Aspects	Institutional Aspects
Phase 1 **(1998 - 2000) Preparation for Priority Projects Implementation**	**Water Supply System** • The water supply system should be consolidated to maintain target coverage of 85% for the increasing population. **Domestic Wastewater System** • In order to execute the priority projects (F/S projects), the required funds shall be secured and the detailed design of the projects shall be conducted. • As for sewer area, connection to sewer should be promoted and system improvement necessary for maintaining the present sewer coverage (21.9%) should be provided. • As for the non-sewer area, in order to prepare for "model communities integrated USE improvement" projects, public education program should be deployed to encourage citizens' environmental consciousness. **Stormwater Management** • Technical guidelines necessary for storm water management should be prepared. • Basic investigation (e.g., topographic survey) for inundation prone area should be conducted for planning the improvement and recruiting necessary funds. • Rain drainage in urban fringe areas (UFA) should be improved through PECM. **Municipal SWM** • In order to execute the priority projects (F/S projects), the required funds shall be secured and the detailed design of the projects shall be conducted. Then, construction of the facilities and procurement of vehicles and equipment shall be done. • Technically satisfactory level of sanitary landfill operation should be maintained in the present landfill until its closure, in order to reduce the pollution impacts to the environment. Meanwhile, illegal dumping should be reduced through improved collection services. **Industrial Waste Management** • Based on the "polluter pays principle", industries should be instructed to implement appropriate on-site management of their solid/liquid wastes and residual water.	**Common Aspects** • Regulations of wastewater discharge into sewer/public water body should be legally and practically enforced. • The municipality should provide norms and guidelines regarding USE to the citizens, from which citizens should easily understand appropriate sanitary practices and civil procedures. • Urban development plan of the city (at least including the land use regulations) should be prepared. Meanwhile, a cadastre of real property and public services should be established. **Domestic Wastewater System** • Guidelines for appropriate on-site DWWM should be elaborated. • INAA, MINSA and the municipality should coordinate to establish a steering committee for "Special Program for Model Community Integrated USE Improvement Project" (PECM) necessary for introducing on-site DWW treatment system and to seek foreign and domestic grants for such projects. **Stormwater Management** • Authoritative competency for storm water management (planning, maintenance and repair) should be reviewed respectively for macro- and micro- drainage. • INAA, MINSA and the municipality should coordinate to establish a steering committee for PECM necessary for improving rain drainage in UFA and to seek foreign and domestic grants for such projects. **Municipal SWM** • Regulations on urban cleansing should be established to clarify municipality's powers (including placing penalties) and duties as well as citizen's rights and duties. • The municipality should improve collection of municipal taxes and charges for the services. **Industrial Waste Management** • Waste classification suited for Nicaraguan authorities' present IWM should be established. Management of hazardous waste should be prioritized.

	Medical Waste Management • Appropriate on-site management (e.g., separation of hazardous/infectious medical waste from other waste) in institutions should be promoted.	• Inventory of factories and their waste generation should be made for identifying ISW and IWW. • With regard to ISWM and IWWM, authorities should be empowered to conduct administrative measures such as monitoring, supervision and guidance. **Medical Waste Management** • Classification of medical waste should be established. Code of practice for respective medical waste categories should be formulated.
Phase 2 **(2001 - 2005) Priority Projects Implementation**	**Water Supply System** • The water supply system should be consolidated to maintain target coverage of 85% for the increasing population. **Domestic Wastewater System** • Facilities and equipment provided in Phase-1 should be operated and maintained appropriately. • In order to prepare for M/P projects, designs and funds recruitment for the projects should be prepared. Then, facilities construction should be implemented. • Sewer provision should be improved to attain the target coverage of 38%. • In the non-sewer area citizens' participation in the "model communities integrated USE improvement" projects should be substantiated in order to sustain the projects in affordable and appropriate levels. Meanwhile coverage rate of on-site system should be raised to 10%. **Stormwater Management** • Drainage should be improved in accordance with Flood Damage Area Improvement Plan. • Integrated Arroyo Management Plan (comprising: land use regulation; catchment conservation with reforestation; and drainage channel improvement) should be formulated. • Rain drainage in UFA should be further improved through PECM. **Municipal SWM** • Facilities and vehicles acquired in Phase-1 should be appropriately operated and maintained. • Technically satisfactory level of sanitary landfill operation should be maintained in the new landfill. Meanwhile, illegal dumping should be further reduced through improved collection services.	**Common Aspects** • The norms and guidelines regarding USE provided by the municipality should be demonstrated through public education programs in order for the citizens to practice appropriate sanitation measures and civil procedures. • The urban development plan should be put in practice to guide and to restrict the land use, in order to maintain a preferable urban environment (e.g., protect potable water sources in southern part of the city, regulate industrial activities and NIMBY facilities in designated areas). • The cadastre of real property and public services, perhaps applying crossed subsidies; should be utilized for establishing the management system on USE services and also promoting a Beneficiary-Pay Principles for the services. **Domestic Wastewater System** • PECM steering committee should further seek foreign and domestic grants for constructing on-site DWW treatment projects. **Stormwater Management** • Respective institutional system (e.g. funds, design guidelines) for macro- and micro-drainage should be established. • PECM steering committee should further seek foreign and domestic grants for constructing rain drainage facilities. **Municipal SWM** • Authorities should encourage recycling activities by waste generators and private recyclers. However, the administrative support should be such a manner with least financial burden on authorities. **Industrial Waste Management** • Legislative framework to obligate appropriate IWM (e.g., manifest system)

	Industrial Waste Management • On-site ISWM and IWWM should be further strengthened. • Treatment/disposal by private sectors, mainly for hazardous waste, should be implemented. **Medical Waste Management** • Appropriate on-site management (e.g., separation of hazardous/infectious medical waste from other waste) in institutions should be obligated. • Treatment/disposal of hazardous/infectious medical waste should be implemented by private sectors.	should be established. • With regard to ISWM and IWWM, authorities should practice administrative measures (e.g., monitoring, supervision and guidance) and apply penalties (if necessary) against illegal measures by industries. • Formulation of commercial mechanism for appropriate treatment/disposal should be promoted. **Medical Waste Management** • Code of Practice on medical waste management should be enforced.
Phase 3 **(2006 - 2010)** **M/P Projects Implementation**	**Water Supply System** • The water supply system should be consolidated to maintain target coverage of 85% for the increasing population. **Domestic Wastewater System** • The M/P projects should be reexamined and implemented, with reference to the outcome of the priority projects (F/S projects). • As for sewer area, the off-site system should be consolidated to maintain target coverage of 55% of the population. • As for no sewer area, the on-site system should be consolidated to maintain target coverage of 17% of the population. • As for area served with "model communities integrated USE improvement" projects, self-help of communities should be employed in operation and maintenance of the facilities. **Stormwater Management** • Reforestation, drainage improvement works, etc. should be implemented in accordance with Integrated Arroyo Management Plan. • Rain drainage facilities in UFA should be further constructed through PECM. **Municipal SWM** • The M/P projects should be reexamined and implemented, with reference to the outcome of the priority projects (F/S projects). • Satisfactory municipal SWM both technically and environmentally should be continued. In maintaining 100% waste collection rate, illegal dumping should be eradicated. **Industrial Waste Management**	**Common Aspects** • Public education programs related with the norms and guidelines regarding USE provided by the municipality should be deployed widely. • The urban development plan should be put in practice to restrict the land use, in order to maintain a preferable urban environment. Meanwhile the plan should serve for planning USE services corresponding to the urban expansion and the population increase therein. **Domestic Wastewater System** • PECM steering committee should raise funds for constructing on-site DWW treatment projects, from water and wastewater charges collected. **Stormwater Management** • PECM steering committee should raise funds for constructing rain drainage facilities, from automobile taxes etc. **Municipal SWM** • Introduction of separate collection system should be examined in order to promote waste minimization and resource recovery from waste. **Industrial Waste Management** • Authorities should promote introduction of "cleaner production" mainly for factories that generate hazardous waste. **Medical Waste Management** • Appropriate control, treatment and disposal of medical waste should be enforced in line with the Code of Practice for Medical Waste Management.

	• Industries should take initiatives for introducing "waste minimization and cleaner production" technologies for their production. **Medical Waste Management** • Appropriate collection, treatment and disposal should be practiced for all medical waste (including hazardous and infectious ones).	

d. Strategic Management

d.1 General Directions in the Management

d.1.1 The Municipality as the Citizens Main Support

The municipality should manage and coordinate all the services and public needs for the USE in the municipal territory. In order to reach this goal, the municipality should be able to:

- Provide norms and directives to the population with respect to the location, sanitary structures and civil procedures to live and work under satisfactory environmental and sanitary conditions;
- Provide services of their own competence, and coordinate and promote other institutions' services for the citizens.

The main rational measures by the municipality should be:

- An urban development plan or, at least, zoning and regulations for urban land use;
- A regulation for construction/extension/rehabilitation of residential and non-residential buildings and/or other installations;
- A cadastre for real property and public services to be offered for the citizens;
- Regulations for the municipality responsible services such as waste collection and disposal, public areas cleaning and micro-drainage.

d.1.2 Legal Improvement

The Constitution of the Republic establishes the principle of Municipal Autonomy, which is explicit in the Law of Municipalities No. 40-88, article 2, 6, 7, 9 and 10 (which refers sanitary and environmental issues). This municipal competence is also declared in the Environmental Law No. 217-96, article 16 and 129.

Municipal Ordinance (MO) are the documents dictated by the Municipal Council after accepting the Mayor's request (Law No. 40-88, article 28 and 34), which will empower the municipal government to administrative measures and necessary sanctions for the municipal government in order to execute municipality's functions and demand citizens burden sharing.

d.1.3 Organizational Improvement

The Annex N presents organizational structures and respective functions recommended to the municipality, which are compatible with the needs to develop a Master Plan. It

recommends a transition from the actual organization to the proposed one. The transition phase should be assisted by an expert in organization and methods, and should personnel.

d.1.4 Municipal Personnel Training

The training should be done stepwise in order to obtain results (i.e., operational instruction; training; and professional formation) immediately. Furthermore such training should be selective in accordance with the necessity of reaching the targets.

It is recommended that it should be programmed and evaluated by an expert, with a priority on training of:

- Department chiefs;
- all the personnel of the sections very linked to what proposed in the M/P (e.g., assistance to the cadastre on real property);
- chiefs of the sections and sectors in "Waste Collection and Public Cleaning", and "Vehicles and Equipment";
- chiefs of "Administration" and "Finances" sections; and
- chiefs of "Fee Collection" and "Audit" sectors.

It is very important that the directors and chiefs be selected according to their formation and personal aptitudes which should make a perfect match to their attributions in their operational branches and divisions.

d.1.5 Coordination with the National Entities that Provides Public Services in the Municipal Territory

The municipality should coordinate and offer to the citizen **instructions** (concerning services of municipal competence and other entities' competence), in the pursue to make the instructions simple and to have a quick access to services. In such a way the citizens will have the opportunity to obtain the required information in just one place.

The **instructions** should be simple, specific and prompt documents (i.e., which should be an easy-to-understand translation of the regulations, technical and administrative norms). It should be presented in words, drawings and other basic forms that makes them easier to understand for the common citizens. They do not require legislative approval to be emitted, but they should be prepared by the entity that offers such services.

The municipality should try to coordinate with the national entities in order to develop intersectorial projects, in such a manner the municipality could always remain expected to request better services by the institutions. Along with MINSA, the municipality should intensify its pro-active mobilization of the communities involved in the sanitation projects. In agreement with MCT, the municipality should begin joint works to clean and protect the dry ditches and streams (arroyos). The municipality at the same time should prevent the illegal disposal of solid waste in such places. On the other hand, INAA and MINSA should control the liquid waste disposal. The municipality should correspond to MARENA to classify the urban ditches and to define responsibilities for their maintenance and protection. Meanwhile, MARENA should supply the instructions

regarding industrial waste and "infectious" medical waste to the municipality (and also to those interested in).

The Municipal Council and INIFOM should unite together in order to support the municipality's plans firmly and to request cooperation from national entities. Assistance by INIFOM is considered as a fundamental requirement for the success of the Master Plan, specially in view of institutional improvement and municipal personnel training.

d.1.6 New Services by INAA

With regard to on-site sewage treatment/disposal systems, INAA (through an agreement with the municipality) should extend its services, including the construction and operation/maintenance of the on-site collective systems, as well as the removal of sludge from individual/collective septic tanks.

d.2 Management on Constructions and Urban Development

d.2.1 Residential Constructions

The municipality should establish the Permission System which comprises: permission for construction; and permission for the use of constructed residences (which should include the real property cadastre, so that it proceeds to receive all the public services available in the micro-region, and the services should be paid for).

Issues of the construction permits will indicate the services demand in the future (in the medium term). Meanwhile issues of permits for use of constructed residences will indicate the immediate demand of the services and the potential incomes corresponding to that.

The municipality should supply, to those interested to construct, the Instructions and orientations, in order for that the constructions fulfill the sanitary requirements and others requirements without bearing needless costs. Meanwhile the municipality should maintain the design submitted in files. Once the construction works are concluded, the municipality should inspect whether it is constructed as proposed in the design, and then the use permission is granted. This should be informed immediately to the other public services suppliers. The immediate transmission of such information should be through the data processing network among the municipality and the services suppliers in order for that those service suppliers should also fulfill their duties and rights.

The permission process should be simple and at a low cost in order to make it feasible. Some models of low-cost housing should be designed, pre-approved and permitted by the municipality. Furthermore such low-cost housing should be offered by the municipality to low income citizens, however, the inspection and register in cadastre should not be exempted once the work has finished.

Similar procedures should also be applied to: renovations of existing residence for other use purposes; and reforms with extension of constructed one.

The municipality, by the Municipal Ordinance, should also establish the obligation of connection to the sewer (of off-site or on-site system) from all residential buildings where such sewer exists in the adjacent street or neighboring property.

d.2.2 Non-Residential Constructions

For buildings of non-residential use, the pre-approved designs and permits (as mentioned above) should not be applicable. The construction permission for non-residential building should establish the obligation to observe the Decree 33-95, in order to permit to connect them to the existing sewer system.

d.3 Management of Wastewater in Non-Sewer Areas.

The municipality should establish, by Municipal Ordinance, the obligatory nature of citizens to make an appropriate disposal of their wastewater. For such purpose, viable alternatives and a reasonable assistance will be offered, before applying sanctions as they are established in the Ordinance.

In the micro-regions where sewer system would not be feasible, on-site treatment (preferably a collective system) should be adopted. However for the time being, it should be tolerated with the more primitive solutions of current practices, but with an appropriate sanitary control.

The municipality should coordinate a Special Program for Model Community Integrated USE Improvement Project (PECM) to be developed by INAA and MINSA, with initial funds from a Rotating Fund which will be maintained and will support the continuity of PECM through the payments of the services for the system construction, connection to the houses, operation and maintenance of the system. These payments will be facilitated and could be reduced through the beneficiary citizens' burden sharing by participation, which should be stimulated by a community mobilization.

The municipality should also establish the obligatory nature and tolerance for those who operate commercial and industrial establishments. To the existing industrial establishments, it will be demanded to certify that they have complied with the ordinance of article 72 of the Decree 33-95 and the Gradual Decontamination Plan accepted by MARENA or INAA.

d.4 Urban Cleaning Management

The municipality, by Municipal Ordinance, should regulate whatever regarding the Urban Cleaning (e.g., the waste collection as an result of the citizen behavior, provision of norms for the cleaning services, etc.). One clear issue is that the feasible level of the cleaning service is defined by the citizens' behavior and the financial capacity of the society to sustain it. The cleaning is shared by the municipality and the citizen, but the latter should support the cleaning service and should operate one part in order to reduce the costs incurred therein.

Meanwhile, the municipality should establish a tariff plan (that should be socially viable) so that everybody pays for the service a compatible amount of money according to their income. It is recommended that the total amount collected should not be less than 50% of the costs; as it is established in the Municipal Tax Plan (Decree No. 455-89, article 40). It is desired that the percentage be gradually increased up to 100% according to the stepwise improvement in providing *regular and frequent* services.

The urban cleaning services should be previously planned in a "permanent" nature or in the long term, or they should be programmed for the short term. On such basis, the services should be controlled and then their results and costs be evaluated.

The "privatization" of the services, in other words, the contract or cession to a third party, will not be prudent whenever the municipality does not have structure nor capable personnel to make or hire the planning of services. Only when the municipality has such structure and capable personnel, parameters for control are established and the control of results and costs are effectively executed.

L.1.1.2 Forecast of Future USE Services Demands

a. Projected Service Area

During the discussion of the Inception Report (IC/R), the Nicaraguan side requested to expand the boundary of the Study Area (1995). The Team agrees to expand the present Study Area up to the urban limits by the target year 2010, provided that the counterpart supplies the team with relevant information, e.g. boundaries, population estimates, for the projection of the outcome of the USE improvement plan in 2010.

Based on the above discussion, the counterpart from the Municipal Government of Granada (MGG) presented a map showing the boundary for urban expansion in Granada. Using the digital planimeter and based on the map, the coverage of the urban expansion program for 2010 was calculated at 14.30 km^2 by the Team. This area shall be defined as the projected service area in Granada for the selected years 1995, 2000, 2005, and 2010.

Accordingly, the main objective of this section is to provide relevant fundamental data for future USE service demands to forecast urban growth, water supply, DWW, municipal and medical solid waste conditions within the projected service area.

b. Population Forecast

b.1 Population

The population estimates established in the Interim Report (1) shall be used to forecast USE service demands and to formulate the USE M/P for Granada. The study shall use the 1995 population census data of INEC, the latest INAA population projection, and shall consider the future expansion of urbanized areas in Granada.

Accordingly, the population of the service area for 2005 and 2010, the respective target years of the feasibility study and master plan, is estimated at approximately 115 thousand and 135 thousand, respectively. The average annual population growth rate in the projected service area for the period 1995-2010 is estimated at about 4.3%.

The following table shows the population forecast by selected years (1995, 2000, 2005 and 2010).

Table L-3: Population Forecast

Year	1995	2000	2005	2010
Urban (Service Area)	71,783	97,078	114,760	135,106
Rural	25,213	29,229	33,070	36,512
City Total	96,996	126,307	147,830	171,618
Service Area (km^2)	14.30			

Source: 1995 statistical census data of INEC
2000, 2005 and 2010, projected urban population provided by INAA
2000, 2005 and 2010, projected rural population estimated by Team

b.2 Population Density by Zones

Occupying 2.7% of the municipality, the population density of the projected service area in Granada was estimated at 50 persons/ha in 1995, and is expected to reach 95 persons/ha by 2010.

Zones were distributed according the zone distribution for sewerage system plan made by INAA.

The population density by zones is shown in Table L-4 below and zone distribution is illustrated in Figure L-1.

Table L-4: Population and Population Density by Zone (1995, 2000, 2005 and 2010)

No.	Zone	1995		2000		2005		2010	
		Population	Density	Population	Density	Population	Density	Population	Density
A1	77.7	6,718	86.5	7,546	97.1	8,476	109.1	9,521	122.5
A2	45.5	4,802	105.5	5,176	113.8	5,578	122.6	6,012	132.1
A3	68.9	6,698	97.2	7,536	109.4	8,480	123.1	9,541	138.5
A4	9.7	1,617	166.7	1,689	174.1	1,765	182.0	1,844	190.1
B1	84.5	8,405	99.5	9,639	114.1	11,053	130.8	12,675	150.0
B2	46.2	5,085	110.1	6,205	134.3	7,572	163.9	9,240	200.0
C1	32.7	4,997	152.8	5,466	167.2	5,979	182.8	6,540	200.0
C2	30.7	3,992	130.0	4,608	150.1	5,319	173.3	6,140	200.0
C3	66.8	7,789	116.6	8,471	126.8	9,213	137.9	10,020	150.0
C4	24.2	2,146	88.7	2,814	116.3	3,691	152.5	4,840	200.0
C5	22.6	2,720	120.4	2,841	125.7	2,968	131.3	3,100	137.2
C6	10.6	798	75.3	877	82.7	964	90.9	1,060	100.0
C7	60.4	869	14.4	1,899	31.4	4,147	68.7	9,060	150.0
E1	120.3	7,860	65.3	8,208	68.2	8,572	71.3	8,952	74.4
E2	35.8	6,676	186.5	6,973	194.8	7,283	203.4	7,606	212.5
F1	113.4	611	5.4	1,228	10.8	2,466	21.7	4,955	43.7
G (*)	580.0	(**)	(**)	15,902	27.4	21,234	36.6	24,000	41.4
Total	1,430.0	71,783	50.2	97,078	67.9	114,760	80.3	135,106	94.5

Source: INAA

Note : (*) Future expansion
(**) No data

According to the population forecast, E2, B2, C1, C2, and C4 will be the most densely populated zones in Granada, and G zone shall be the least densely populated. G zone is presently considered as the area to be subjected to future expansion. Figure L-2 classifies population density by zone (2010).

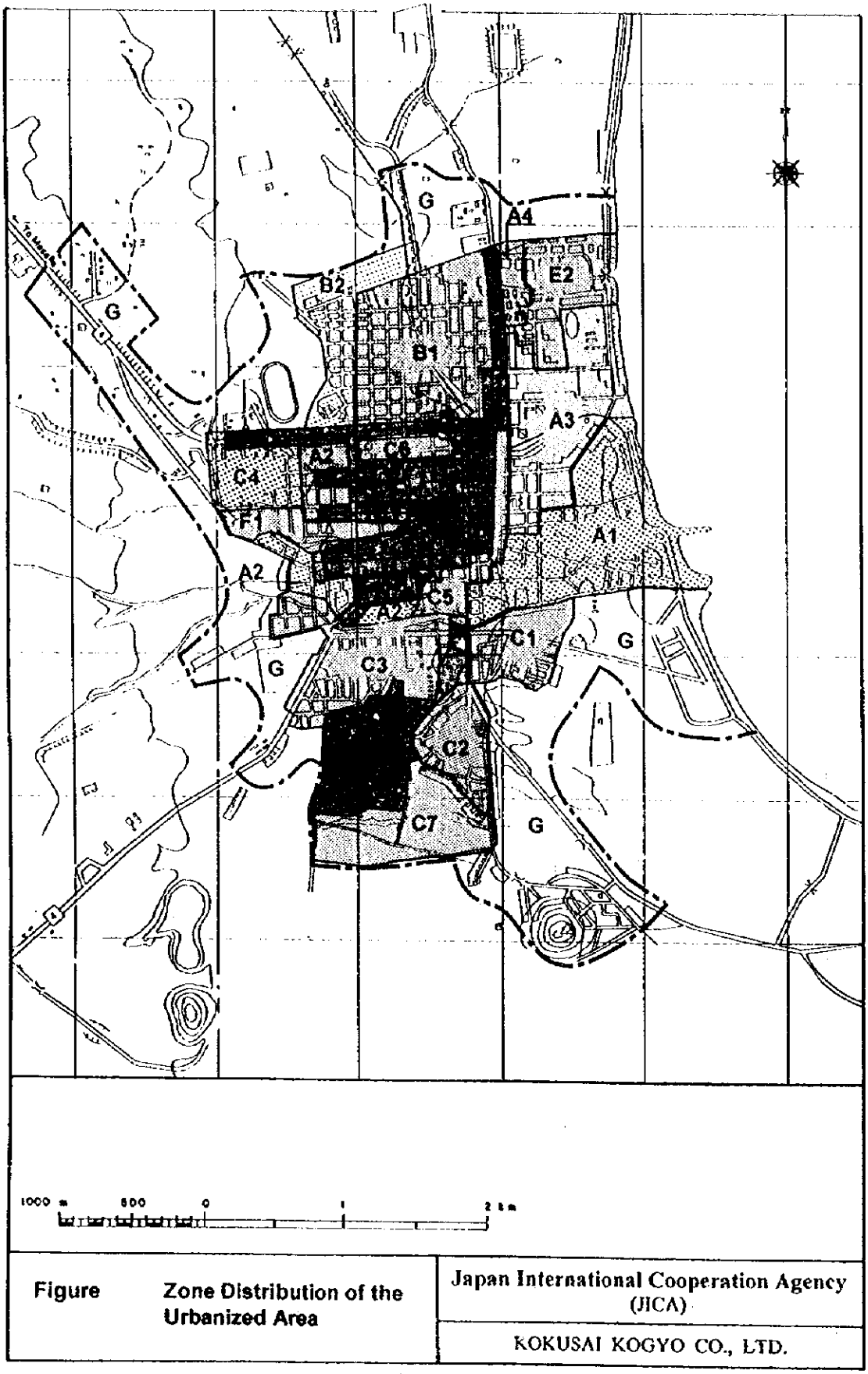

Figure	Zone Distribution of the Urbanized Area	Japan International Cooperation Agency (JICA)
		KOKUSAI KOGYO CO., LTD.

Figure L-1: Zone Distribution of the Urbanized Area

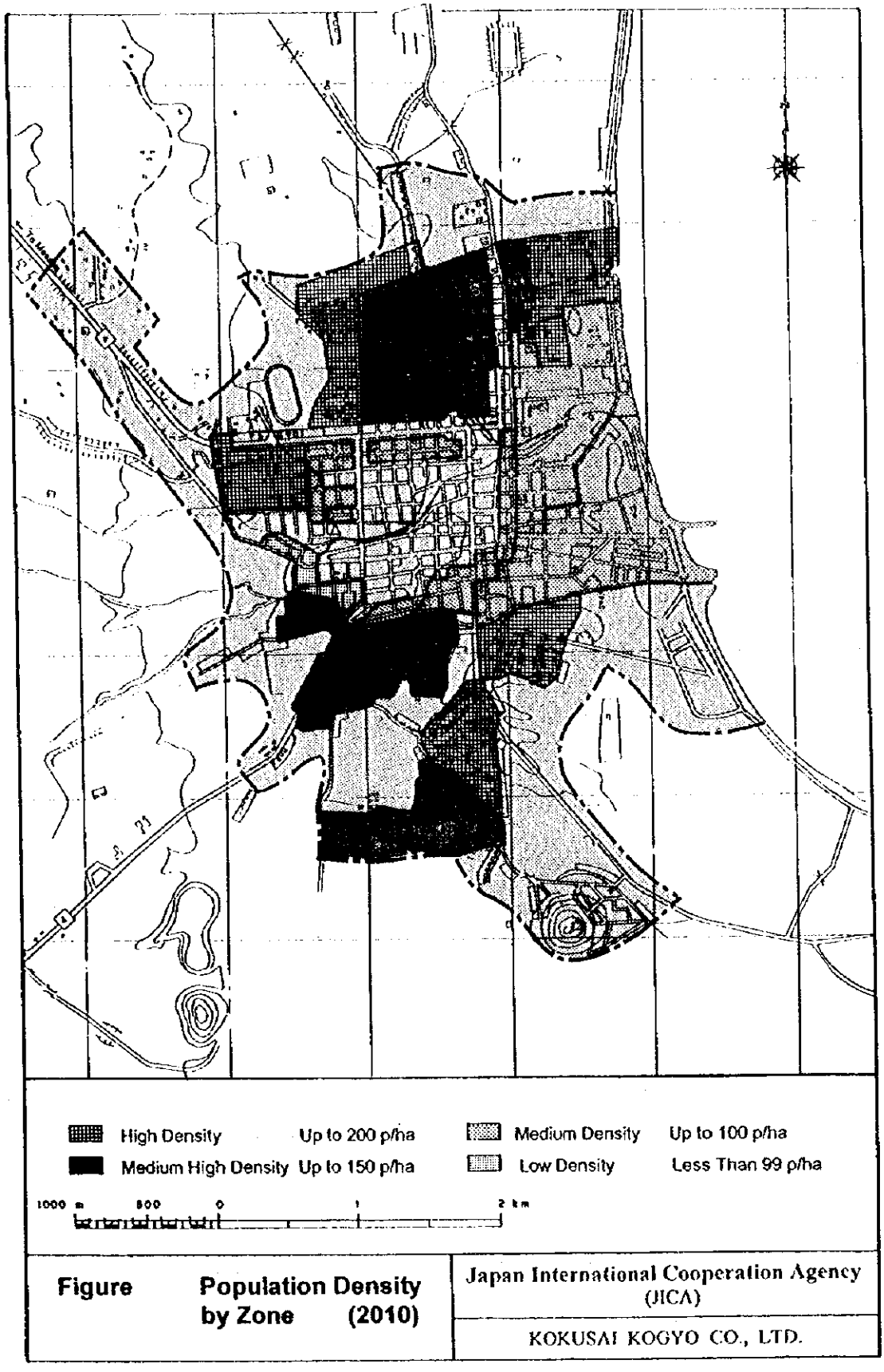

Figure L-2: Population Density by Zone (2010)

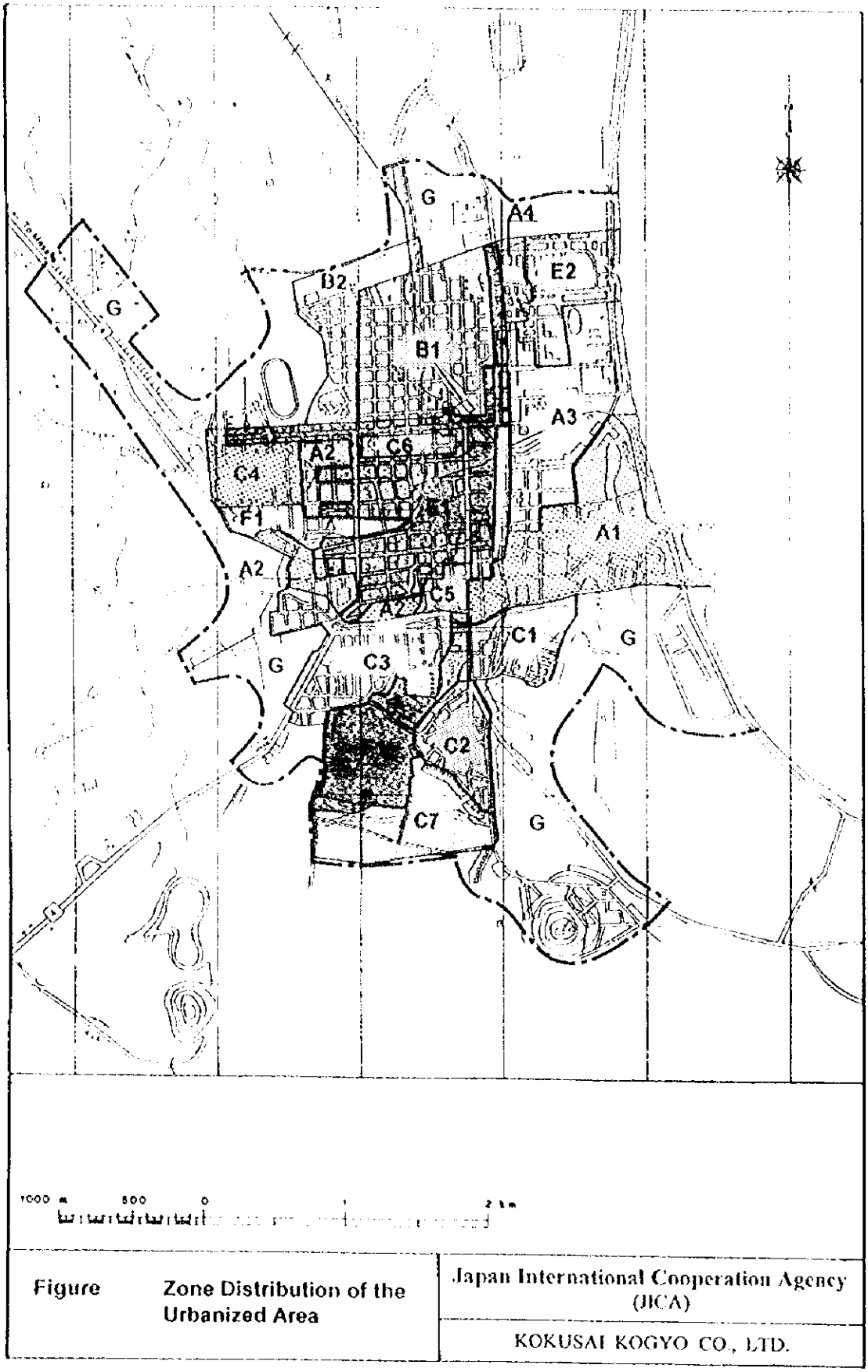

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Figure L-1: Zone Distribution of the Urbanized Area

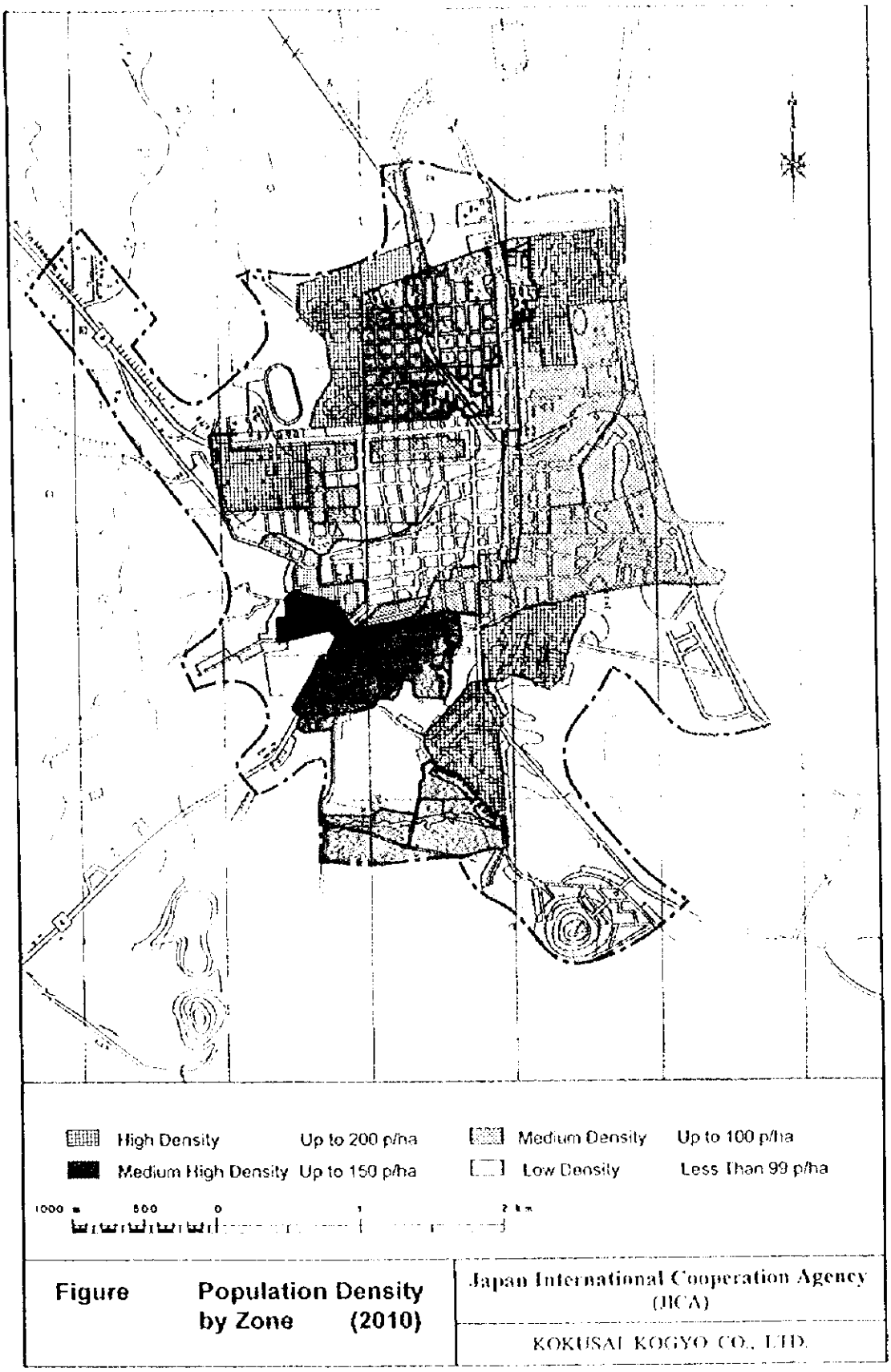

Figure L-2: Population Density by Zone (2010)

b.3 Conclusion and Recommendations

Population and other relevant factors provide the basis for the planning of USE improvement in Granada. It must be recognized, however, that future government programs and land use conditions in the projected service areas for USE may influence population growth.

Future land use and zoning plans in the urban area of Granada forecast that migration shall move toward the intermediate and outer areas as opposed to the central urban area (consolidated zone) in the past. Nevertheless, development plans and environmental programs will be implemented in phases to accommodate unexpected changes in population, land use, and government policies.

Urban environmental problems are outcomes of a deteriorating ambient environment and the inability of public infrastructure to meet the demands imposed by the growing population. These problems include poor housing conditions, watercourses polluted by domestic and industrial wastes, hazardous and toxic wastes from industries, hospitals and households, and flooding during the rainy season.

Granada is not in a position to respond to environmental challenges facing the municipality due to economic instability. Although the municipal government is economically poor, there is a high level of public consciousness of environmental issues in Granada and a willingness on the part of municipal government to take action. On the other hand, urban development plan reflects the principles that the government alone cannot deliver sustainable development and USE improvement. It requires the cooperation of businesses and the public.

c. Water Supply

Future water supply demand for the Study is forecast in compliance with the INAA's Pre-feasibility study[1] and based on the following conditions. The results are shown in Table L-5 and Figure L-3.

- Water supply coverage in years 2005 and 2010 are 85% of total population in the urban areas in respective year;
- Water consumption ratio is 160 l/person/day;
- Water supply ratio for no water supply system non covered area is 30 l/person/day; and
- Commercial, institutional, and industrial water use are 8%, 8% and 2% to the total water consumption of served population respectively.

[1] Estudio de Priorizacion de Inversiones en el Sector de Agua Potable y Alcantaillado Sanitario Marzo 1996, INAA, ITS, Lotti, Lamsa

Table L-5: Forecast of Future Water Supply Demand

		1995	2000	2005	2010
Urban Population		71,783	97,078	114,760	135,106
Service Coverage (%)		89.7	85	85	85
Served Population		64,411	82,516	97,546	114,255
No Served Population		7,372	14,562	17,214	20,851
Daily Demand (m^3/day)	Served Population	-	13,203	15,607	18,281
	No Served population	-	437	516	626
	Commercial	-	1,056	1,249	1,462
	Institutional	-	1,056	1,249	1,462
	Industries	-	264	312	366
	Total	9,464	16,016	18,933	22,197

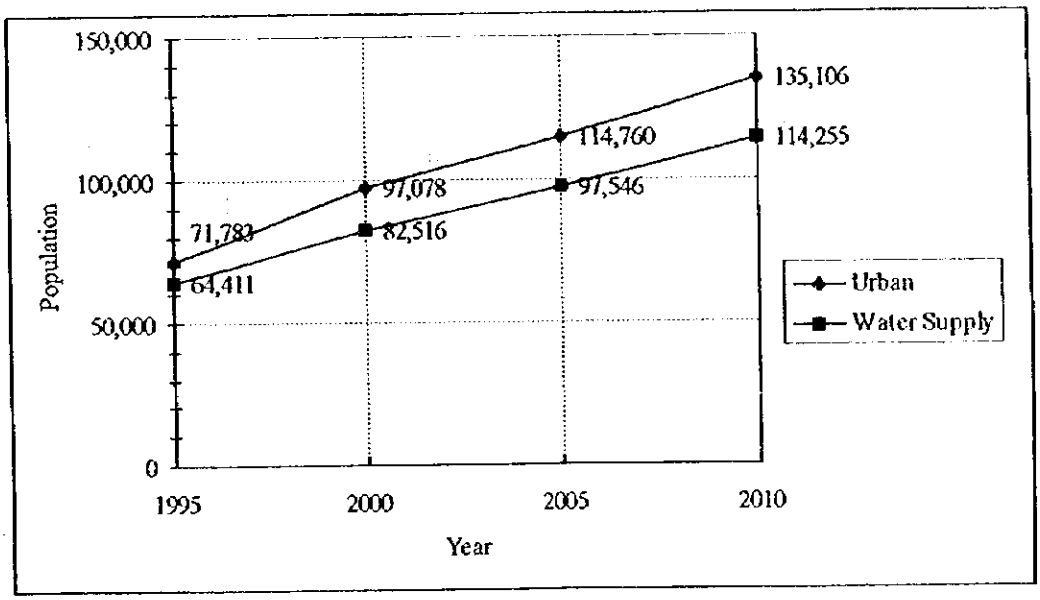

Figure L-3: Forecast of Future Water Supply Population

d. Domestic Wastewater

d.1 Definition of DWWM System

Domestic wastewater mainly comprises from night soil and DWW generated from households. Systems for DWWM in Granada comprise:

- system of joint treatment/disposal for nightsoil and DWW e.g., sewer system and septic tank;
- system of without treatment but disposal through infiltration e.g., soak pit;
- system of nightsoil only disposal through infiltration e.g., latrine; and

- no system.

Table L-6 shows prevalence of the respective systems in the city.

Table L-6: Present Domestic Wastewater Treatment / Disposal System

Unit : population

	Treatment & Disposal System		Disposal System (without treatment)		No System
	Sewer System	Septic Tank	Soak Pit	Latrine	
Night Soil + Sullage	15,706 / (21.9 %)	1,122 /(1.6 %)	26,917 /(37.5 %)	-	7,850 /(10.9 %)
Night Soil	-		-	20,188 / (28.1 %)	-

In view of the present system, definitions of respective DWWM systems listed below are clarified as follows:

Sewer System:

Nightsoil and DWW generated through citizens' household activities are collected in a large scale through sewers and treated at off-site (i.e., sewage treatment plant).

On-site System:

Nightsoil and DWW generated through citizens' household activities are collected in a small scale (only one to a couple of decade households) through channels (open or closed) and treated locally in the vicinity of generation sources (e.g., septic tank, community collective system, etc.).

Soak System:

Nightsoil and DWW (or only nightsoil) generated through citizens' household activities are individually disposed in a wet system through infiltration locally in the vicinity of generation sources.

Latrine System:

Only nightsoil generated through citizens' household activities are individually disposed in a dry system through infiltration locally in the vicinity of generation sources.

No System:

There is no system to treat nor dispose nightsoil/DWW generated through citizens' household activities.

d.2 Forecast of Future DWWM Service Demand

As indicated in Table L-6, present sewer coverage in Granada ranges only about 20% of the urban population, and septic tank (i.e., on-site system) coverage is minimal. Soak pit (sumidero), which avoids treatment and directly disposes the nightsoil and DWW for infiltration and therefore being potentially an underground water contamination source, covers about 38% of the total urban population today. In recent years, many of newly constructed soak pit receives only nightsoil in a wet system in order to prolong its

service life, and therefore DWW are discharged to roadside and/or rivers without any treatment.

To the current total urban population, about 60% are subject to sewer, septic tank (on-site) or soak systems. About 30% are subject to latrine system, which only disposes nightsoil. About 10 % are subject to no-system.

Therefore, untreated DWW are discharged here and there along the roads and rivers. Consequently it accelerates deterioration of USE in the city.

In view of the present situation of USE, followings are raised as target figures:

- coverage of nightsoil disposal systems in water supply areas and no water supply areas in the target year 2010; and
- DWW treatment systems (sewer and/or on-site systems) coverage is 85% of water supply population in the target year 2010.

Future USE service demand is estimated for the years 2005 and 2010 based on the following conditions, which is shown in Table L-7 and Figure L-4.

- Water supply coverage is 85% (i.e., 114,255 persons) of total urban population in the year 2010; and
- Sewer coverage is 65% of the urban population served with water supply in the year 2010.

The population covered by the on-site domestic wastewater treatment system from 1995 to 2000 are the residents from the high income bracket who install septic tanks at their own expenses. Supposing that, as a result of the increase in off-site sewerage system, these domestic wastewater treated in the septic tank is discharged into off-site sewerage system, the service population of the on-site treatment system (i.e., septic tank only) will be zero in 2005.

Table L-7: Forecast of Future DWWM Service Demand

		1995	2000	2005	2010
Urban Population		71,783	97,078	114,760	135,106
Water Served Population		64,411	82,516	97,546	114,255[2]
Sewer System Area					
Served Area (km^2)		2.0	2.0	3.7	5.6
Served Population		15,706	21,260	44,125	74,266[2]
Service Coverage (%)		21.9	21.9	38.5	55[2]
Treatment Amount (daily average, m^3/day)		2,592	3,402	8,750	11,883
Non Sewer System Area					
On-site System (Night Soil + Sullage Treatment)	Population	1,122	1,553	11,555	23,110
	Service Coverage (%)	1.6	1.6	10.1	17.1
Soak System (Night Soil + Sullage Disposal System)	Population	26,917	36,356	27,817	16,879
	Service Coverage (%)	37.5	37.5	24.2	12.5
Latrine System (Night Soil Disposal System)	Population	20,188	27,298	24,991	20,851
	Service Coverage (%)	28.1	28.1	21.8	15.4
No System	Population	7,850	10,611	6,277	0
	Service Coverage (%)	10.9	10.9	5.5	0

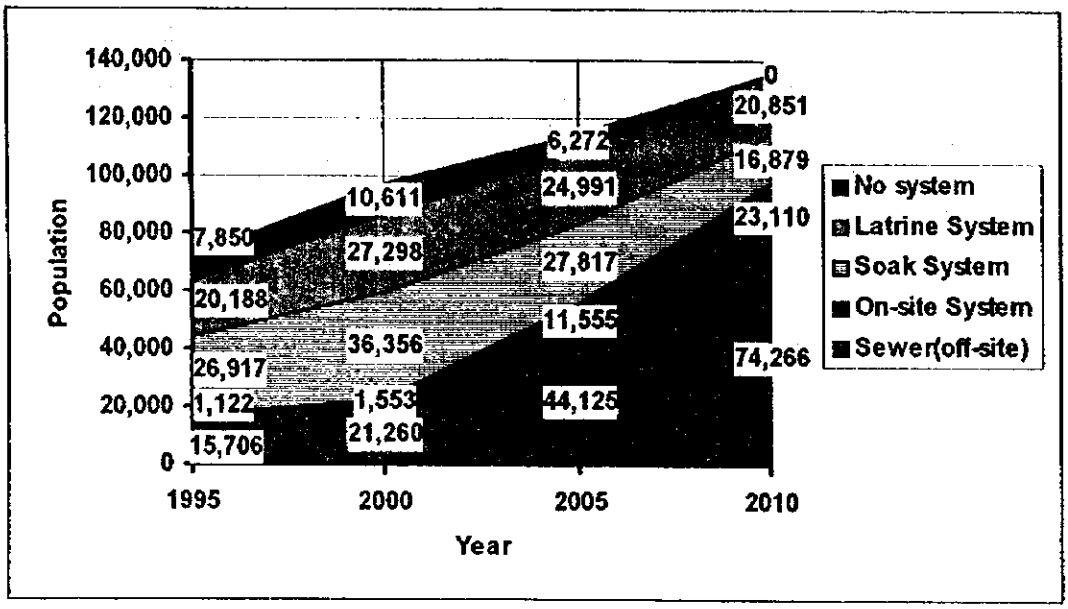

Figure L-4: Forecast of Future DWWM Service Population

e. Municipal Solid Waste

The future demand on Municipal Solid Waste Management is almost determined by the future population. The demand on collecting and disposing waste will rapidly increase

[2] INAA Region IV, 28 Feb/97

with the steep increase of population in urbanized cities in developing countries. This can be applied to Granada City.

The items concerning to the future demand on the MSWM in Granada are shown in the following table.

Table L-8: Future Demand on MSW in Granada

	1996	2000	2005	2010
Population in the study area	76,250	97,078	114,760	135,106
Waste generation amount (ton/day)	57.1	76.6	97.3	123.0
Waste discharge amount (ton/day)	43.2	59.5	78.0	101.6
Waste collection amount (ton/day)	35.4	48.8	70.2	101.6
Final disposal amount (ton/day)	36.9	50.2	72.5	104.1
Coverage rate (to waste amount) (%)	82.0	82	90	100
Coverage rate (to population) (%)	63.0	63	89	100
Served population	48,037	61,159	101,843	135,106
Non served population	28,213	35,919	12,917	0
Length of sweeping served road (km)	35	35	35	35

f. Medical Solid Waste

f.1 Medical Solid Waste

The estimation of the future medical solid waste in Leon is summarized in Table L-9, which is obtained through extrapolation of the Team's survey as summarized in Table L-69 and Table L-71.

Table L-9: Future Medical Solid Waste Generation Amount in the Medical Institutions (Whole Institutions) in Granada

Item		1996	2000	2005	2010
Basic data	Population in the Study Area	76,250	97,078	114,760	135,106
	Inpatients beds growth rate	1.000	1.273	1.505	1.772
	Number of beds for inpatients	175	223	263	310
Risky Waste*1 (kg/day)	Risk *2	48.0	61.1	72.2	85.1
	Hazardous*3	1.6	2.0	2.4	2.8
	Special*4	0.6	0.8	1.0	1.1
	Subtotal	50.2	63.9	75.6	89.0
Common*5		49.1	62.5	73.9	86.9
Grand total		99.3	126.4	149.5	175.9

Note : *1 Study team's prepared category
*2 Waste with infection (sharps, blood, blood sustained and etc.), infected waste from laboratories, waste from infectious disease patients and wastewater etc.
*3 Chemical waste (medicines, drugs, etc.), radioactive waste etc.
*4 Ash from incinerator, sludge etc.
*5 Office waste, kitchen waste, packing waste, bulky waste, garden waste, domestic wastewater etc.

f.2 Medical Wastewater in the Whole Institutions

The estimation of the future medical wastewater generation amount is summarized as shown in Table L-10, which is obtained through extrapolation of the Team's survey.

Table L-10: Future Medical Wastewater Generation Amount in the Medical Institutions(Whole institutions) in Granada

Category	Item	1996	2000	2005	2010
Population	population in the study area	76,250	97,078	114,760	135,106
	growth rate of population	1.000	1.273	1.505	1.772
Water (ton/day)	Water Consumption	98.0	124.7	147.5	174.7
	Wastewater Generation	78.4	99.8	118.0	139.8

L.1.1.3 Other Pre-Conditions

a. Economic and Financial Conditions in the Region

- The Gross Regional Domestic Product (GRDP) of Granada in 1995 was calculated based on the data of INSSBI on the number of people insured (adjusted by regional ratio of participation) and the average salary by industry and region. After 2001, it is assumed to grow in proportion to the national Gross Domestic Product (GDP).
- The municipal budget of Granada is assumed to increase in proportion to the GRDP growth.
- The family income in 1995 was calculated based on the data of the Ministry of Labor (MITRAB) on the number of employees by income. After 2010, this is estimated to increase in proportion to per capita GRDP multiplied by average family size, which is assumed to slightly increase from 5.674 in 1995 to 5.81 after 2000.
- In proportion to the overall budget of the INAA financial plan, the budget of INAA Region IV is assumed to remain as it was in 1995.

The major economic and financial indicators are summarized in the following table.

Table L-11: Major Economic and Financial Indicators

		1995	2000	2005	2010
GRDP	C$ million /year	247.0	325.7	415.7	500.9
Municipal Budget	C$1,000/year	13,616	17,957	22,918	27,617
Family Income	C$/month/household	1,275	1,273*	1,375	1,407
INAA Region IV Budget	C$1,000/year	9,026	10,883	12,375	14,184

Note *: Because the increase in the number of households from 1995 to 2000 is estimated to be slightly higher than the growth in GRDP, the family income in 2000 is forecast to slightly decrease.

b. Conditions for Cost Estimation

- All prices are expressed in terms of the market price levels as of September 1997.
- The exchange rate of US$ 1.0 = C$ 9.6 = J¥ 120 as of the September 1997 was used.

Personnel Cost

- The personnel cost for the waterworks and wastewater management projects is assumed to be US$ 7,693/person/year (C$ 5,480/person/month), as is shown in the INAA F/S.
- The personnel cost and unit rate of works of the Granada SWM section is as shown in the following table.

Table L-12: Personnel Costs

Unit: C$

SWM services	Personnel Description	Daily Wage
Collection	Driver	117
	Worker	78
Street sweeping	Supervisor	88
	Sweeper	19
Disposal	Supervisor	233
	Driver	117
	Worker	78

c. Future Land Use Proposal

Due to the absence of a land use or zoning plan for the urbanized area in Granada, a tentative zoning plan is proposed for USE improvement and is detailed in the subsequent sections.

To achieve the targets of the M/P for Granada a future final disposal site was proposed. Granada currently has no large scale disposal site. The only disposal site functioning in the city is located in the southern section of "La Joya" where abundant groundwater reserves are found. Urbanization in this section has led to a dramatic increase in the SW volume and soil contamination, posing a serious threat to the future utilization of groundwater resources and USE conditions in Granada. Also, the inefficiency of the municipality in carrying out management functions and the lack of equipment to handle the present generation volume of domestic and industrial wastes result in the frequent and direct discharge of these wastes into the "arroyos" (streams) and public areas. Many watercourses in Granada urban and its surrounding areas are, therefore, seriously polluted.

Consequently, a new disposal site is proposed in the north where groundwater resources are of poor quality, very salty, and unsuitable for drinking and irrigation. Therefore, this area, which is also close to the existing sewage treatment plant, is considered by the municipality of Granada (MGG) as a suitable location for the final disposal site.

A city cannot further its own growth without service facilities, e.g. sewage treatment plant and final disposal site, and well planned city facilities are essential for USE improvement in the city of Granada.

Immediate policy measures and actions described hereafter are required to mitigate adverse environmental impacts and rehabilitate degraded natural resources, to avoid the possible decline in future USE conditions. These measures and actions represent the first step towards a comprehensive response strategy for USE improvement. These will, however, require more efforts from the MGG and the residents, hence success in this endeavor shall fully depend on government and public cooperation.

As the main agency responsible for the implementation and enforcement of land use regulations and zoning ordinances, MGG shall strictly enforce these actions and measures and make the final zoning plan, to properly instigate urbanization and create a good urban environment.

c.1 Integrated City Planning and Environment

Based on the review of the current state of the Granada City planning system, planning and developments, e.g., urbanization, should be in harmony with environmental conditions.

It is undeniable that urban environmental problems due to urbanization are becoming more complex, and that efficient and effective urban services are required more than ever.

To realize the general plan formulated by the Municipal Government of Granada (MGG) for proper urbanization and the creation of a sound human settlement, all measures such as land use, land management, zoning, building control, subdivision control and the likes should be mobilized, in addition to direct investments in infrastructure and site development, with due consideration of USE.

These urban development and management measures have not been well institutionalized and are, therefore, not effectively enforced at present. Even the existing measures of the available regulating plan seems not to have been utilized and synchronized for urban development control and management.

To realize the plan, the extension of guidance, direction and supervision of urban development activities including infrastructure and urban facilities development projects alone would not be sufficient. The updated city regulating plan stipulates that urban development activities must be in compliance with the general plan. However, infrastructure projects, for instance, were mostly found to be arbitrary, unsystematic, and even without any basis. This may be partially attributed to the vagueness of the general guidelines of MGG and the absence of institutional bases for the examination of the implementation plan of urban projects.

The absence of practical measures for the enforcement of land use plans and of the basis for the implementation of urban development also exacerbate the condition.

To facilitate the development of city planning measures and the expansion of urban coverage, the administrative sector for city planning and development must be restructured as stated below.

The MGG central city planning office shall be responsible for the implementation and enforcement of regulations.

The main responsibilities of the central planning office are to guide, supervise and assist local developers and the public in the conduct of city planning and development works. It is also responsible of the following for integrated planning and development:

- Formulation/legalization of plans
- Monitor and control urban development
- Facilitate and implement/enforce urban development

Accordingly, being the only central agency technically competent in city planning and development, MGG must aggressively conduct the following:

- Examination and approval of plans formulated by local agencies mainly based on national standards for the improvement of urban environment and services, financial and economic viability, etc.
- Examination and authorization of urban development projects.
- Guidance in the formulation and implementation of plans.
- Implementation of projects of regional importance or beyond the capacity of local agencies and others.

c.2 Required Technical Competence of MGG

To cope with the shift in its duties, from making general plans to the extension of guidance, supervision and assistance in city planning and development programs, MGG must equip itself with knowledge of the management and coordination of city development programs, and insight to properly guide, supervise and assist the public in coping with various urban problems.

This means MGG must keep on technically improving itself, conducting research studies not only for the preparation of general or specific plans but also, more intensively, for obtaining knowledge and information leading to policy-making to alleviate urban problems and USE problems.

The studies for the development and improvement of the functions of MGG must be conducted continually. The Team is only to assist MGG take a initiating step for the study to be conducted by MGG for the urban development of the city.

c.3 Regulations on Land Use and Zoning

At present, there are land use regulations for the Historic Center and obsolete land use regulations for the rest of Granada. Land use should be regulated under zoning regulations which are usually determined by a regional or municipal agency. These should be strictly enforced with regard to the conduct of any kind of development project and all proposals should be subject to their stipulations. It is necessary to formulate a urban development master plan and zoning ordinances so as to encourage desirable developments and restrict objectionable ones. Not only do zoning regulations regulate the trend of urban development, they also plan the development of town or settlement areas in different places.

Zoning protects residential areas from the harmful effects of slum and industry that ensures from it. It prevents over-crowding of buildings and land, thus facilitating the provision and continued adequacy of water, sewerage, transportation and other facilities.

Allocation of land for community facilities and services and all future land use shall be governed by zoning plans under a urban development master plan to be prepared by MGG. Zoning regulations and their administration are the major tools in carrying out the land use program of the master plan.

c.4 USE Improvement and Urbanization

The environment is an important physical factor directly relevant to land use activities. The present final disposal site ("La Joya") is located in the southern part of the city where groundwater reserves are abundant. This location is a serious threat to the future water supply of Granada, therefore, the removal of this site is an urgent concern. However, because no city can exist without its service utilities, e.g. sewage treatment plant and SW disposal site, the relocation of the site to the area next to the existing sewage treatment plant, where groundwater resources are of poor quality, was proposed. This proposal was also made in view of USE improvement in Granada.

According to past data on urban development in Granada, the present trend indicates growth around the consolidated urban area. At present, growth is slow. Gradual development is, however, observable in Villa Tepetate Sur, in the northeastern sector, regardless of the presence of an existing sewage treatment plant and groundwater conditions. At the same time, various construction projects are also carried out within and around the city periphery. These projects do not abide by any guidelines and regulations to control urban growth, land use, etc.

Residential and commercial activities have to be established in favorable environmental conditions. Therefore, urbanization for the development of residential and commercial zones shall be restricted to the vicinity of the service facility zone. A greenbelt should be created to serve as a transition zone between the urbanized area and the city service facilities. The greenbelt zone shall act as a major environmental conservation area.

Further industrialization within the urban area, particularly in the consolidated urban area and the suburbs, intensify environmental problems. Therefore, economic bases should be constructed away from urbanized areas, such as in rural areas.

c.5 Proposed Zoning Plan

Presently, there are no concrete plans, neither on the part of the central government nor the MGG for the proper use of lands in Granada and around Lake Nicaragua. The arrangement of such a plan at the earliest possible moment is desirable for USE improvement.

Land use planning should be established upon consideration of predictions of present and future land use demands and environmental conditions. However, with insufficient data, it is difficult to propose terms that would adequately serve as a foundation for the plan. The basic concept and the proposed zoning plan currently established are shown in Figure L-5 and summarized below:

- **Urban Zone**

The present development trends suggest the urbanization of the peripheries of Granada within the next twenty years. Routes Granada-Masaya, heading northwest to Managua, and Granada-Nandaime towards the southwest and southern sections of the city, are likely to be urbanized. Given this assumption, it is urgently necessary to construct basic infrastructure to ensure the suitable management of the urban environment, including the quality of its water supply. Accordingly, the removal of the existing SW disposal site from its present location is of utmost urgency to counter-act soil contamination and the contamination of the groundwater resources of the city.

- **Industrial Zone**

Industries in Granada concentrate in the consolidated urban area, mostly along the "arroyos" (streams), which are a main environmental concern in the area.

Policies concerning the relocation of pollution-intensive industries and the banning of new industrial expansions from urban areas to designated areas must be enforced, as well as policies encouraging industrial development in rural areas. These policies must allow the planning and provision of centralized waste treatment facilities to service newly industrialized zones.

Industrial locations are likely to be established along the main roads and power lines for accessibility and economic convenience, but should be distanced from urban areas as stated above.

- **Greenbelt and City Service Facility Zone**

A greenbelt shall be created around the INAA existing sewage treatment plant and the proposed final disposal site as a borderline for urbanization and the transition zone between urbanized areas and city service facilities. This zone shall promote environmental conservation.

This greenbelt must extend up to areas along the coastal fringe of Lake Nicaragua restricted for development, for additional protection and the preservation of the lake and its shore from harmful uses.

The creation of a greenbelt and conservation areas would not only provide sources of recreation, but would also contribute to the alleviation of social and environmental problems.

- **Conservation Zone**

The northeastern conservation zone (wetlands) greatly contributes to the removal of pollutants entering the lake. This role of the northeastern swamp is not considered universal, although it is definite that it purifies the water to a certain extent. The destruction of the wetlands, therefore, would most likely pollute the lake. Consequently, it is desirable to conserve the wetlands and prohibit any development which would deteriorate the zone's functions and reduce its significance.

- **Tourism and Recreational Zone**

The southeastern area shall be designated as a recreational zone where no settlements are to be developed. Although it is not internationally renowned, the southeastern zone is already recognized locally as a famous resort area. Therefore, with the establishment

of proper facilities, the development of this area as a unique recreational center may be expected. However, in order to harmoniously conduct tourism and recreational zone development with water quality conservation, it is necessary to designate the water bodies and shore of the lake for public use, to assign environmental monitoring experts, establish sewage treatment plants and waste disposal sites as forms of environmental conservation techniques, and to establish the necessary basic facilities.

- **Forest Zone**

Forests resources effectively retain stormwater, purifying the pollutants in stormwater. Forests by rivers and lakes effectively prevent soil, sand and pollutant inflow from the banks. Given these conditions, it is very important to conserve forest resources, not only for lake water quality maintenance but also to preserve the scenery and an amenable environment. As shown in Figure L-5, the decrease in forest zones is remarkable, particularly in cultivated and pasture areas. Accordingly, reforestation is most desirable.

- **Agricultural Zone**

Urban growth results in the remarkable decline in agricultural lands. It is, therefore, important to conserve good agricultural lands, e.g. particularly the highly productive farmlands of the northwestern zone, because they are not only important sources of food but also provide the urban environment with open spaces.

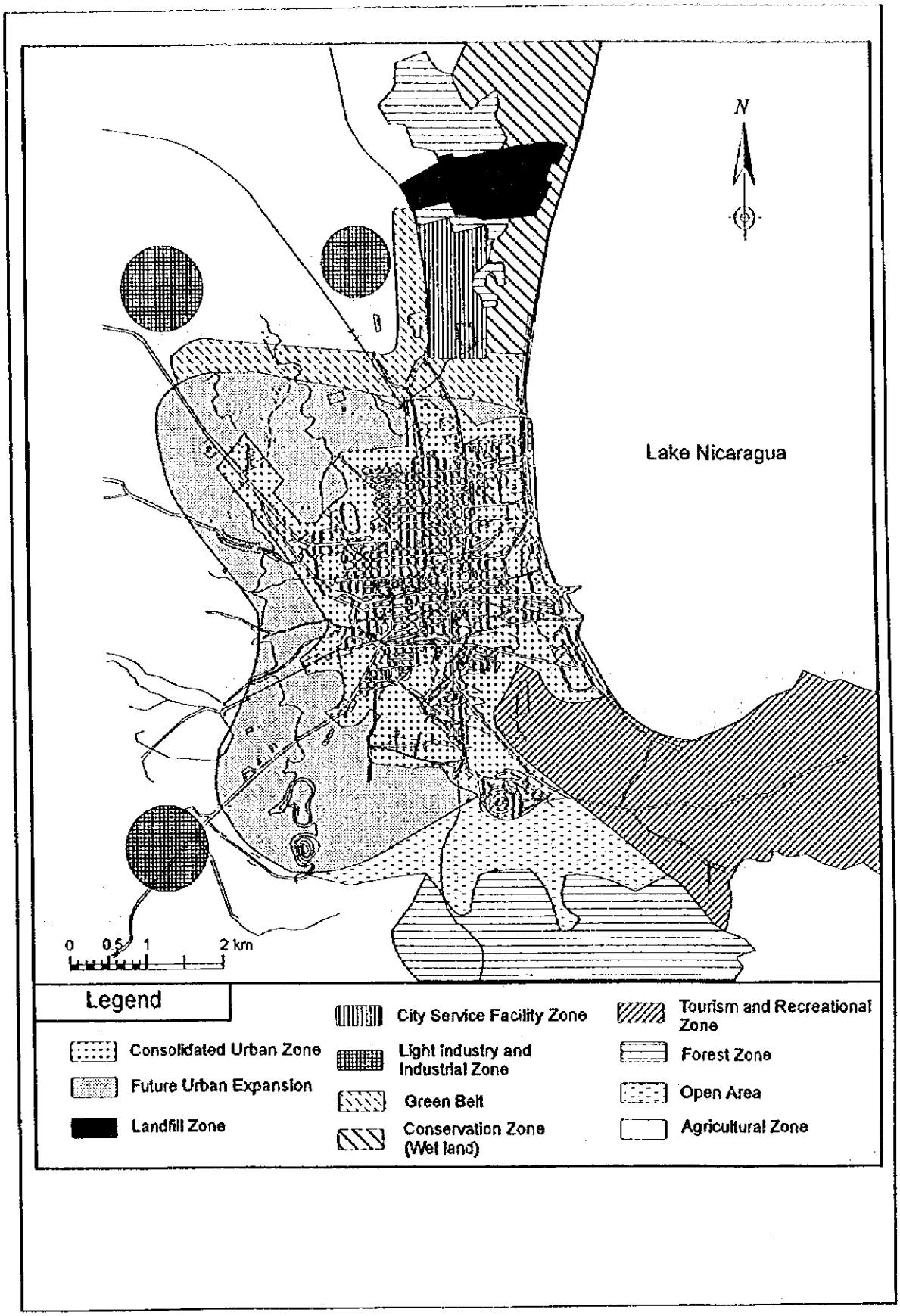

Figure L-5: Proposed Zoning Plan