

5 Conclusions and Recommendations

5.1 Conclusions

a. Necessity of Municipal SW Management Improvement

In this Study, the Basic Study was carried out regarding all infrastructures related with USE in Granada City. From the results, it was judged that the municipal solid waste management sector embraces diverse problems ranging from the collection/transport system to final disposal so that the urgent but comprehensive measures for improvement is vital. This is to say, illegal dumping into the public water bodies is frequently observed due to the insufficient refuse collection service, leading to the contamination of rivers and Lake Nicaragua. Furthermore, in spite of the fact that the present La Joya disposal site is located upstream from the ground water wells, the source of water supply for citizens in Granada Municipality, no countermeasures has been taken to prevent groundwater contamination. Therefore, moving the municipal SW disposal site to an appropriate location is an urgent issue for securing safe drinking water. Hence, "F/S-1; Municipal SW Management System Improvement Project" was adopted as a priority project followed by an F/S.

b. Urban Sanitation Environment (USE) of Urban Fringe Area (UFA)

The UFA is formed around the urban area (traditional city center) of Granada City. The UFA is a relatively newly developed area and is inhabited by people on lower income from local areas. While the infrastructures for USE in the city center are well established, this is not the case in the UFA, except for the water supply system. However, the population density of the UFA is higher than that of city center where the infrastructure has already been established, and the effect of poor USE infrastructure is extremely serious. Moreover, illegal dumping of waste and discharge of untreated domestic wastewater into the public water bodies, a common practice in the UFA, is polluting Lake Nicaragua, which is precious for the Nicaraguan tourist industry, in particular, Granada City and could be the source of future water supply for the principal areas. Therefore, the improvement of the USE in UFA's should be urgently promoted. Furthermore, it is expected that this USE improvement shall improve living standards of poorer people and contribute to eliminate social inequity, bringing social stability to the country, which is still plagued by insecurity, a legacy of the civil war and economic decline experienced in the past.

Based on these conclusions, model communities were selected from the UFA and "F/S-2: Model Community Integrated USE Improvement Project" was adopted as a priority project followed by an F/S.

c. Problems of Each Sector

There are a number of improvement needs to be made in the USE of Granada Municipality, besides the projects adopted as priority projects in this Study. The main issues for respective sectors that are the components of USE confirmed in this Study are as follows:

c.1 Water Supply System

The coverage rate of potable water supply (to the population) in Granada Municipality is very high, reaching 89.7%, and as is the case in other principal cities in Nicaragua, most urban households have taps including UFA's. This can be highly evaluated as the outcome of the efforts made by the Nicaraguan Government and people concerned with INAA thus far. However, as the priority was placed in improving the potable water supply coverage rate in the USE improvement, several problems reside in the existing systems. Among all, as the buried depth of the water pipe was extremely shallow in many cases, this caused the water pipes to burst frequently. Meanwhile the shallow water pipes made the road repairs and stormwater drainage provision difficult. This problem needs to be solved as soon as possible so that the countermeasures should be formulated urgently.

c.2 On-Site Domestic Wastewater Treatment

Although INAA's responsibility includes the sewer system as well as water supply system, the sewer coverage rate is very low (21.9%) in Granada compared with the water supply coverage rate. In comparison with other developing countries, the water consumption rate and water supply coverage are extremely high in the city so that the treatment of the wastewater generated is a critical issue for USE, that needs to be solved urgently. INAA actively recruits finances (e.g., from IDB) not only for studies but also for construction of sewer system expansions based on the existing long-term plans of sewer improvement. However, for the UFA such as the model communities, even a plan (of sewer provision or other alternative solutions) for domestic wastewater management is absent. Therefore, a key issue is what system should be adopted to improve the coverage rate of domestic wastewater treatment for the entire city.

c.3 Stormwater Drainage Management

"Stormwater Drainage Management" is a great concern for the citizens. The reason why respective municipalities can not appropriately deal with the inundation damages are because the frameworks for the improvement of stormwater drainage facility listed below are not established yet.

- Stormwater drainage management plan has not formulated.
- There are no guidelines for formulating stormwater management plan.
- Organizational systems necessary for formulating stormwater drainage management plan and its improvement are not fully established in each city.
- The financial source to construct and/or maintain the stormwater drainage management facility is insufficient.

c.4 Industrial Wastewater Management and Industrial SWM

Granada City, in comparison with the other two cities subject to the Study, generates a large amount of industrial wastewater, which is discharged into the public watercourses and/or soaked into the ground without prior treatment. In particular, the raw industrial wastewater discharged in to the crater located upstream, close to INAA's well, is suspected of causing serious pollution. The total generation amount of industrial solid waste (ISW) is small in comparison with industrial wastewater. The vast majority is disposed of at municipal landfill sites, etc. without any control.

Since the legislation regarding industrial wastewater control is newly established, detailed regulations and technical instructions to complement it are not prepared at present. Moreover, the organizational system of MARENA to regulate and administrate industrial wastewater and ISW is insufficient. Dischargers are not aware of the necessity to minimize wastewater and solid waste generation as well as to treat and dispose them properly. In order to establish a proper industrial, wastewater and ISW management system, the industries' improvement and authorities' enforcement in every aspect are vital.

c.5 Municipal Solid Waste Management

As stated above, the municipal solid waste management sector has various problems ranging from collection/haulage to final disposal, therefore, urgent but comprehensive improvement is essential. Especially, there are a number of problems in the organizational system of Granada Municipality which is in charge of municipal solid waste management. For instance, the refuse collection service department and the department in charge of vehicle and machinery maintenance, necessary for waste collection and disposal, are under a different bureau.

c.6 Medical SWM

Medical SWM plans do not exist either at a national or municipal level. A "Code of Practice" for medical SWM focusing mainly of infectious and hazardous medical waste management is also not established. That is to say, the administrative system to promote appropriate medical SWM and to monitor and issue guidance is not established yet. The majority of infectious/hazardous medical waste, not separated in many medical institutions, are collected and disposed of through the municipal services.

d. Priority Project

Based on the frameworks for the Priority Projects proposed by the Team, a discussion was held with Nicaraguan side. As a result, the following projects were selected as priority projects to be implemented by 2005, and then the F/S was carried out. Table 5-1 shows the outline of the project.

Table 5-1: Priority Projects and the Project Cost (Investment Amount)

Unit: CS 1,000

		Investment Amount							Grant Aid			
		2000	2001	2002	2003	2004	2005	Total	2000	2001	2002	Total
Municipal Solid Waste Management System Improvement Project	Collection/haulage Improvement											
	Procurement of refuse collection equipment, etc.	Equip.	5,182	775	0	61	775	-	6,793	5,182	-	5,182
	Improvement of the Modulo de Operacion Workshop											
	Renovation of the workshop, procurement of maintenance equipment, etc.	Facility	1,168	-	-	-	-	-	1,168	1,168	-	1,168
		Equip.	1,313	-	-	-	-	-	1,313	1,313	-	1,313
		Sub-T	2,481	-	-	-	-	-	2,481	2,481	-	2,481
	Establishment of Final Disposal Site											
	Establishment of SJV final disposal site, procurement of equipment for sanitary landfill, etc.	Facility	31,865	-	-	-	-	-	31,865	31,265	-	31,265
		Equip.	3,270	-	-	-	-	-	3,270	3,270	-	3,270
		Sub-T	35,135	-	-	-	-	-	35,135	34,535	-	34,535
Model Community Integrated USE Improvement Project	Design/Supervision											
	Sub-Total		4,220	78	-	6	78	-	4,382	4,220	-	4,220
			47,018	853	-	67	853	-	48,791	46,418	-	46,418
	Water Supply/Domestic Wastewater Treatment System Improvement Project											
	Improvement of water supply system to deal with increased population in the community, Improvement of on-site domestic wastewater treatment system	Water Supply	6,642	6,865	7,101	7,342	7,590	-	35,540	-	-	-
		Wastewater	2,899	2,899	2,899	2,901	2,901	-	14,499	2,899	2,899	8,697
		Sub-T	9,541	9,764	10,000	10,243	10,491	-	50,039	2,899	2,899	8,697
	Stormwater drainage/Road Improvement Project	Facility	1,234	1,234	1,234	1,234	1,234	-	6,170	1,234	1,234	3,702
	Design/Supervision		1,077	1,099	1,123	1,147	1,172	-	5,618	413	413	1,239
	Sub-Total		11,852	12,097	12,357	12,624	12,897	-	61,827	4,546	4,546	13,638
Grand Total			58,870	12,950	12,357	12,691	13,750	-	110,618	50,964	4,546	60,056

e. Project Evaluation of Priority Projects

Project evaluation of the priority projects were carried out from technical, social, environmental, financial, and economic perspectives for the two F/S projects.

- F/S-1: Municipal Solid Waste Management System Improvement Project
- F/S-2: Model Community Integrated USE Improvement Project

e.1 F/S-1: Municipal Solid Waste Management System Improvement Project

The result of the financial evaluation indicate that:

- if grant aid is to be acquired for the entire investment cost for the year of 2000;
- if the forecasted increase (5.4%) in municipal tax revenue and current budget allocation rate for SWM (10%) of the total budget is expected, which falls into moderate scenario, and
- moreover, regarding waste collection charges, household refuse collection charges are collected according to the different collection service levels (high rate (CCA): C\$ 15/household/month, normal rate (CCB): C\$ 10/household/month, low rate (PCA): C\$ 5/household/month), and refuse collection charges for other wastes are collected according to the amount of waste generated (unit rate charge of C\$ 363/ton for covering actual collection and disposal costs)

The FIRR is calculated at 13% which is higher than cut-off rate, and the project is financially feasible. In this case, the profit and loss statement would be in the black and an internal reserve of C\$11 million can be accumulated by 2005, enabling Granada Municipality to independently provide investments required after 2005.

The economic evaluation clarified that:

(1) if the entire project cost was covered by loan, (2) tax revenue growth of the Municipality (5.4%) and SWM budget allocation (10%) is the most probable case, (3) if WTP (according to the result of the POS) was taken as a benefit and furthermore, environmental benefits (enhanced public health, increase in land prices and real estate values and increased domestic consumption due to developments in the tourist industry) were taken into account, the EIRR is calculated at 13.3%, which exceeds the cut-off rate of 8.5%. Therefore, the implementation of the project is presumed to contribute to the national economic development.

As a total evaluation, it is concluded that that the implementation of the Municipal SWM System Improvement Project is feasible in technical, social, environmental, financial, and economic aspects, as it is a prerequisite for the conservation of USE and public health of Granada Municipality, and for sustainable development of municipal activities.

e.2 F/S-2: Model Community Integrated USE Improvement Project

The results of the financial evaluation for the water supply system and on-site domestic wastewater treatment system improvement projects, in which INAA is the main executing body, indicate that:

- if grant aid covers the investment cost for on-site domestic wastewater treatment system for three years from 2000 to 2002;

- if charges (C\$49.8/household/month for water supply and C\$ 16.7/household/month for wastewater) were collected from the beneficiaries of water supply and on-site domestic wastewater treatment in the model communities,

The FIRR is calculated at 12.4%, which exceeds the cut-off rate. Therefore, the projects are financially feasible. In this case, the profit and loss statement would be in the black and an internal reserve of C\$3.28 million can be accumulated by 2005, enabling INAA to independently provide investments required after 2005.

The result of the financial evaluation for the stormwater drainage improvement project, in which Granada Municipality is the main executing body indicate that;

- if grant aid covers investment cost for stormwater drainage improvement for three years from 2000 to 2002;
- if 70 % of potential revenue from vehicle tax shall be collected; and
- if 20% of it is allocated to the stormwater drainage improvement project.

The FIRR is calculated at 8.3% and is almost the same as the cut-off rate (8.5%). Therefore, the project is financially feasible. In this case, the profit and loss statement would be in the black and an internal reserve of C\$ 740 thousand can be accumulated by 2005, enabling Granada Municipality to independently provide investments required after 2005.

The economic evaluation was carried out for the entire "Model Community Integrated USE Improvement Project" including water supply system improvement, refuse collection improvement, on-site domestic wastewater treatment system improvement and stormwater drainage improvement. The evaluation revealed that; (1) if the entire project cost was covered by a loan, (2) if WTP (according to the result of the POS) of the beneficiaries increased through the implementation of the projects and environmental benefits (public health enhancement, increase in land prices and real estate values and increased domestic consumption due to developments in the tourist industry) were taken into account, EIRR was calculated at 3.9%. Although this would put the finances in the black, it is extremely lower than the cut-off rate. However, the implementation of this project is considered to contribute to the national economic development in view of the various favorable impacts, which, although were not measured during the study such as the conservation of Lake Nicaragua as future potable water supply sources for the capital, Managua City.

As a total evaluation, it is concluded that the implementation of the Model Community Integrated USE Improvement Project is feasible in technical, social, environmental, financial, and economic aspects, as it is a prerequisite for conservation of USE and public health of Granada Municipality, and for sustainable development of the municipal activities.

f. The result of EIA of SJV A New Municipal Disposal Site

As a result of the IEE, works required for the EIA of "SJV A New Municipal Disposal Site Development Project" summarized as follows were conducted:

Topographical Survey, Geological Survey, Hydrological Survey, Traffic Survey, Noise and Vibration Survey, Odor Survey, Water Quality Survey, Air Quality Survey, Soil

Pollution Survey; Fauna and Flora Survey; Economic Survey; Land Use Survey; Risk Assessment of the Landfill Site; Meteorological data collection and analysis; Urban Development Planning; Water use in area; Landscape assessment with photomontage; Cultural property survey; Estimation of construction waste (from the project); Research on location and availability of soil suitable for use as impermeable liner and coverage.

From the result of these surveys, both positive and negative impacts can be predicted by implementing the project. Negative impacts caused by both traffic of collection vehicles (occurrence of dust, vibration, noise, and increase of traffic volume), and topographical alteration by landfill work causing the change in the landscape of the site during the landfill operation period and after its closure, will be mitigated by the asphalt pavement of the present access road (Granada-Santa Rosa Road) and re-vegetation over the final covering of the landfill. Accordingly, it was concluded that due to the mitigation measures to be carried out during various stages (i.e., construction, operation and closure and post closure stages) of the project, the environmental quality during and after the project should be maintained equal to the current conditions.

5.2 Recommendations

a. Implementation of M/P

The principal goal of this M/P is "to improve the USE of Granada Municipality by the year 2010". The improvement of USE promotes citizens' well-being, support sustainable development of the city and contribute to the growth of the regional economies.

The M/P is evaluated as feasible from technical, social, environmental, financial, and economic viewpoints. Therefore, Granada Municipality and INAA Region IV should implement this M/P based on the strategies proposed in this Study with the cooperation of the Central Government.

b. Solution to the Problems for Each Sector

In order to realize the M/P, the main problems need to be solved in the sectors that are the components of USE as shown below.

Improvement of Regulations and Guidelines

The establishment of the administrative system to actually carry out the improvement, setting necessary regulations and administrative guidelines, and monitor the projects are important in order to promote USE improvement. Legislation and technical guidelines play an extremely important part in improving the administrative system of the municipality. Legislation and technical guidelines can be classified into "individual" norms that are exclusive to the municipality and "combined" norms shared with other national authorities. Granada Municipality and other related institutions should cooperate with other national authorities that are involved in the USE, in order to establish necessary legislation and technical guidelines to promote USE improvement. The institutional system improvement proposed in the M/P for Granada Municipality should be referred to.

Water Supply System

Water supply coverage rate in Granada is presently about 90%, which exceeds INAA's target coverage (85%) in the years 2005 and 2010. It presently covers almost all the urban population in Granada Municipality. Even though considering future population increase, future water supply through the good maintenance of the present system and its expansion, if necessary, it might be capable of complying with the target. Accordingly, water supply system improvement should be improved along with INAA's existing plan.

The problem regarding the depth of the water pipes can be solved for the areas where a water supply system is not provided yet, if INAA strictly complies with the water pipe basal norms buried depth (i.e., more than 1.2 meters) when the construction of a new water supply system takes place. As for the areas where the water supply system is already provided, the problem related to the shallow burial depth of the water pipes can be solved by improving it simultaneously when other USE infrastructure works are newly provided.

Domestic Wastewater Management

As for the sewer areas, its provision should be improved along with the plan formulated with financial assistance from the IDB.

Regarding non-sewer areas, the on-site domestic wastewater treatment system should be improved together with the stormwater drainage improvement project, based on the "Special Program for Model Community Integrated USE Improvement Project (PECM)" proposed in this Study. In this case, INAA, MINSA and the municipality should coordinate to establish a steering committee for PECM necessary for introducing on-site domestic wastewater treatment system and promoting residents' voluntary participation and consensus for the construction. Securing the grants for the system construction is also vital.

Stormwater Drainage Management

In order to mitigate inundation in Granada, it is necessary to: conduct basic investigations such as topographic survey; formulate drainage improvement projects for channels with insufficient flow capacities; and secure financial resources for the drainage improvement projects. However, under the current circumstances, it is financially, technically and in view of human resources, difficult for Granada Municipality alone to conduct all these works. Therefore, the Study reviews the current institutional system for stormwater management (i.e., the municipality is currently responsible for all construction, operation and maintenance of stormwater facilities), and proposes appropriate institutional systems for stormwater management (e.g., separate institutional system for macro-drainage and micro-drainage). Then, guidelines necessary for each stormwater system management should be formulated in line with the institutional system.

Stormwater drainage improvement project in the Model Community should be carried out together with the on-site domestic wastewater treatment system improvement project, in line with "Special Program for Model Community Integrated USE Improvement Project (PECM)". In this case, the municipality, INAA and MINSA should coordinate to establish a steering committee for PECM necessary for introducing

on-site domestic wastewater treatment system and promoting residents' voluntary participation and consensus for the construction. Securing the grants for the stormwater drainage facility construction is also vital.

Industrial Waste (Wastewater and Solid Waste) Management

Since industrial wastewater and solid waste are generated and discharged as a result of industrial production activities, cost of its safe treatment/disposal should be born by the industries, based on the "polluter pays principle (PPP)".

The following are the key solutions to the problems in the improvement of industrial wastewater management from technical management viewpoint.

- Reduction of wastewater generation amount and reduction of its pollution load by introduction of cleaner processes (including raw/auxiliary materials).
- Waste water treatment by industries themselves in their premises.

In this context, authorities' administrative measures and empowerment in conducting industrial wastewater management are awaited. Since actual application and enforcement of Decree 33-95 will be essential for this management, an integrated mechanism to bind both industries and authorities in facilitation of appropriate industrial wastewater management should be sought and established.

The following are the key solutions to the problems in the improvement of industrial solid waste management from a technical management viewpoint.

- Reduction of ISW generation amount and reduction of its pollution load by introduction of cleaner production processes (including raw/auxiliary materials).
- Establishment of appropriate treatment/disposal methods and systems for respective ISW categories.

A key issue of ISWM is the management of hazardous ISW. Exclusive treatment and/or disposal facilities for hazardous IW should be urgently introduced. For the time being, till such exclusive treatment/disposal facilities are operated, it is recommended the authorities practice the following measures in the management of hazardous ISW.

- Industries shall be required to practice waste minimization, on-site treatment, and storage of hazardous IW.
- Utilization of existing facilities (e.g. incineration at cement kilns) shall be examined for hazardous IW treatment. Industries shall be obliged to take the necessary actions if they generate hazardous waste to which such treatment is applicable. In case it is not applicable, the industries shall be obliged to store the hazardous IW on-site.
- Mixed disposal of ISW and municipal SW in municipal disposal site shall be avoided. For that purpose, a monitoring system to prevent hazardous ISW disposal in municipal SW disposal site shall be established. In this context, for industries categorized as highly potential hazardous IW generators, only when the industries proves that their waste is not hazardous, shall the waste be eligible for disposal of at municipal landfill sites.

However, under such circumstances, legislation for treatment and/or disposal of ISW is not established at this moment, which is urgently needed and awaited. Once the legislation is established, the mechanisms to operate the legislative system also need to be established in collaboration with administrators side and the companies.

Municipal Solid Waste Management

There are various problems in municipal solid waste management system ranging from collection/haulage to final disposal. Comprehensive improvement needs to be made in line with the Municipal Solid Waste Management System Improvement Project. The most important issue is to consider that, even though the weak technical system is strengthened by domestic and/or foreign financial assistance, the present institutional system cannot make the most of the technical system and physical resources (e.g., equipment and facility) obtained. That is to say, as was clarified in the institutional system improvement recommended in Municipal Solid Waste Management System Improvement Project, it is very important to improve the institutional system, for example, by establishing the Urban Environmental Maintenance Bureau in the municipality's structure.

Medical Solid Waste Management

In order to establish an appropriate medical waste management system, MINSA should take a leading role in defining classification of medical waste and should formulate and enforce handling guidelines (i.e., Code of Practice) for the different types of medical waste. Consequently, medical institutions should be obliged to practice appropriate medical waste management according to the Code of Practices (e.g., separate collection and haulage of hazardous/infectious medical waste).

In order to realize the above-mentioned plan, it is indispensable to establish an institutional system which promotes, instructs, oversees, and regulates the execution of appropriate management for medical waste. Furthermore, the separation of infectious and non-infectious waste at generation should be assured and education for workers including collection workers should be provided without exception in order to practice appropriate collection, treatment, and disposal of separated hazardous/infectious medical waste. Institutions such as SILAIS should take leading roles in taking these actions.

c. Approach for Implementing the Model Community USE Improvement Project

The on-site domestic wastewater treatment system and stormwater drainage improvement requires significant amount of construction costs. Moreover, in order to implement the projects, various issues (e.g., *land acquisition, cooperation and participation of residents, etc.*) are need to be resolved. *The questionnaire survey that polled 155 residents in the model community showed that priorities in USE establishment were on-site domestic wastewater treatment system, and stormwater drainage facility improvement.*

Firstly, Granada City, INAA(Granada), and MINSA/SILAIS(Granada) will establish a steering committee to encourage the project implementation. The each institution will chose representative members for the committee. The committee as a main will be obliged to raise funds for facility construction.

Secondly, each institution will respectively establish its own task force for the organization of the project. The three task forces gathered are expected to monitor public opinion, and to carry out project planning and promotion.

Thirdly, clear roles of public entities and beneficiaries should be defined on the cost sharing in the project. INAA itself has covered the cost for land acquisition and internal pipe connection to the catch pits in the case of Adelita II, that is, the wastewater treatment project. These costs, however, should basically be shouldered by beneficiaries themselves.

As the responses of questionnaire surveys indicated, the residents have emphasized the necessity of the improvement projects for both wastewater treatment and storm drainage facilities/systems. To relieve the financial burden of the municipal authorities, mainly MINSA/SILAIS(Granada) is expected to establish a system encouraging public motivation in formulating the project.

After these issues are resolved, the priorities in improving the facilities in the model community should be set up in consideration of the following:

- Placing a priority on communities of where problems on USE are serious.
- A community, which has already determined the site for facility with the agreement of the community and has residents' positive consensus on facility construction, should receive a priority among the communities prioritized in the above consideration.
- Moreover, give a further priority to the community that expressed the intention of bearing a portion of construction cost (e.g., cost of internal connection and labor cost).

d. SJV A New Municipal SW Disposal Site Development Project

The construction and operation of a sanitary landfill site with an impermeable liner (level 3 or above) bring about increase of cost sharing by both the residents and Granada Municipality. This is because the cost with an impermeable liner is several times as one without it. Thus, meetings were held among MARENA, INIFOM, and Granada Municipality etc., to review the appropriate level of improvement of a municipal SW disposal site with the focus on the necessity of an impermeable liner. Whether or not residents can bear the increased cost was also examined in these meetings. As a result, it was concluded, at first, that even though cost sharing by the residents and the municipality increases, an impermeable liner should be installed, considering the conservation of Lake Nicaragua's water quality and the surrounding areas.

In order to realize a sanitary landfill operation, the executing body (i.e., Granada Municipality) should not only solve technical problems but also the issues of considerable financial burden sharing for its construction, and operation and management. Therefore, the Study Team classified appropriate levels of sanitary landfill improvement into the following four levels and recommended to improve it in a stepwise manner in accordance with the capability of sharing the financial burden.

Level 1: Controlled tipping (casual soil covering)

Level 2: Sanitary Landfill with a dike and daily soil covering (without an impermeable liner)

Level 3: Sanitary Landfill with leachate circulation (an impermeable liner, leachate collection and leachate circulation facility) (**Judging from the rainfall data of Granada City, discharge of untreated leachate into public water sometimes becomes necessary during and/or after rains, no examination was carried out for Level 3 options in this Study.*)

Level 4: Sanitary Landfill with leachate treatment (an impermeable liner, leachate collection and leachate treatment facility).

Approximate cost of the SJV project with the respective option of sanitary landfill levels are summarized in the Table 5-2.

Table 5-2: Approximate Cost Comparison of Different Sanitary Landfill Level

Case	Construction Cost (C\$ 1,000)	O&M Cost (C\$ 1,000)	Total (C\$ 1,000)	Unit Disposal Cost (C\$/ton)
Case-A: Level 2	13,535 (20,729)	4,630	18,165 (25,359)	62.3 (87.0)
Case-B: Level 4 Treatment at SJV Disposal Site	42,992 (50,186)	4,890	47,882 (55,076)	164.3 (188.9)
Case-B/Case-A	3.2 (2.4)	1.1	2.6 (2.2)	2.6 (2.4)

(N.B) Operation period of SJV disposal site is assumed for ten years starting in 2001 and ending in 2010.

Total treated amount of waste during this time is estimated as 291.5 thousand ton (364.6 thousand m³)

The figures in parenthesis include the disposal site equipment cost.

The present La Joya disposal site greatly improved by implementing the pilot project. However, the sanitary landfill level of it is Level 1. Table 5- shows that sanitary landfill level 4 requires a heavier share of financial burden compared with that of level 2.

As present, La Joya disposal site is located close to the ground water well, the source of water supply. The contamination of the water supply system became a big concern. Thus, the closure of La Joya disposal site and early establishment of SJV disposal site are urgent issues to be solved regarding the municipal SW problem in Granada Municipality.

Therefore, in case that no grant aid can be expected from either domestic or foreign institutions, it is necessary to examine the possibility of gradual improvement of the sanitary landfill.

e. Source of Funds

The results of the financial analysis of the Municipal Solid Waste Management System Improvement Project indicate the need to cover the investment cost required in 2000 for one of the take-off priority projects of the Master Plan, either by Central Government subsidy or the acquisition of grant aid from foreign countries, etc. Other expenses to be incurred in this project for the replacement of vehicles and equipment, facility expansion, etc., will be covered using internal reserves from waste collection fees and disposal fees, and the budget allocated from municipal tax revenues.

Based on the results of the financial analysis of the Model Community USE Integrated Improvement Project, the investment required for a 3 year period, from 2000~2002, for the on-site domestic wastewater treatment system installation and stormwater drainage

improvement projects should be covered either by Central Government subsidy or the acquisition of grant aid. After this period, any expenses incurred to sustain these projects will be covered by internal reserves amassed from water supply and sewage charges, and the budget allocated from municipal tax revenues.

In order to increase municipal tax revenue, business tax revenue should be increased with promoting tourism, inter-regional trade and so on. Tax collection rates on vehicle tax and the fixed property tax should be also raised. For this, Granada Municipality should establish a database for taxation such as the cadastre, inventory of business establishments and vehicle owners, etc. and ensure a sound tax collection rate every year. In addition, a social system does not tolerate tax evasion and other illegal practices should be created through clarification of administrative systems to demand tax payment, cautioning and imposing penalties on non payment of taxes. Furthermore, the municipal government should improve its tax collection capacity through training of tax collectors.

In addition, to establish a sound financial system, an accurate method of calculating the expenses should be formed first in order to efficiently conduct operations. Next, the use of funds accumulated from waste collection fees, and water supply and sewage charges should be limited to the operation and maintenance of the waste management, water supply, and on-site domestic wastewater treatment systems.

The prerequisites that would make this Master Plan and its priority projects financially feasible are outlined in the following table.

Table 5-3: Prerequisites to Make Priority Projects Financially Feasible

Priority Project	Items	Conditions
Municipal Solid Waste Management System Improvement Project (F/S-1)	Municipal Tax Revenues	<p>Tax revenue of Granada City should be increased on average by 5.4% 1995-2005 in total as below:</p> <ul style="list-style-type: none"> • An annual increase rate of 2.9% on business tax revenue will be secured, despite future cuts of business tax rate; from the current 2% to 1.5% in 1998 and 1% in 2000. • An annual increase rate of 12.9% on vehicle tax revenue will be secured. • An annual increase rate of 15.5% on fixed property tax revenue will be secured. • An annual increase rate of 5.4% on service fee will be secured.
	Budget Allocation for Solid Waste Management Services	<ul style="list-style-type: none"> • The current budget allocation rate of 10% will be maintained until 2005.
	Household Waste Collection Fee	<ul style="list-style-type: none"> • Joint billing with the water supply charges • Refuse collection fee: The refuse collection fee is set as follows according to the collection service level: high service charge: C\$15/household/month; ordinary service charge: C\$10/household/month; low service charge: C\$5/household /month. • Refuse collection fee collection rate: 82% • Refuse collection fee collection expenses: 5% of the collected refuse collection fee will be paid to INAA.

Priority Project	Items	Conditions
	Other Waste Collection Fee	<ul style="list-style-type: none"> As it is favorable to combine the collection fee with municipal taxes such as business tax, for efficient collection, collection shall be relegated to the municipal tax office as before. Refuse collection fee: The refuse collection fee is set as follows based on waste volume: C\$363/ton for waste collection and disposal; C\$222/ton as waste disposal cost (directly hauled by generators). Waste collection fee collection rate: 100%
	Source of Funds	<ul style="list-style-type: none"> The entire investment cost for 2000 shall be covered by grant aid.
Organizational System (F/S-1)		<ul style="list-style-type: none"> Establishment of the Urban Environmental Maintenance Bureau (UEMB) Enactment of regulation on SWM Joint billing of waste collection fees and water supply charges Promote education programs for the residents
Model Community USE Integrated Improvement Project (F/S-2) Works to be carried out by INAA	Source of Revenue	<ul style="list-style-type: none"> Collect charges from the entire beneficiaries of the water supply system and on-site domestic wastewater treatment system in the model community. The average water charge of C\$49.8/household/month in the entire Granada Municipality in 1996 will be collected from the model community beneficiaries for water supply services (collection rate of 96%). Beneficiaries in the model community will pay C\$16.7/household/month (the average sewer charges paid in Granada Municipality in 1996) for the use of the on-site domestic wastewater treatment system (collection rate of 96%).
	Source of Funds	<ul style="list-style-type: none"> The entire investment cost from 2000 to 2002 will be covered by grant aid.
Model Community USE Integrated Improvement Project (F/S-2) Works to be carried out by Granada Municipality	Source of Revenue	<ul style="list-style-type: none"> 20% of revenues from vehicle taxes will be allocated for roads and stormwater drainage improvement (this budgetary measure does not exist at present). An annual increase rate of 12.9% on vehicle tax revenue will be secured.
	Source of Funds	<ul style="list-style-type: none"> The entire investment cost from 2000 to 2002 will be covered by grant aid.
Organizational System		<ul style="list-style-type: none"> Establish a steering committee for PECM made up of representatives from INAA, Granada Municipality, and MINSASILAIS. Formation of task force in INAA, Granada Municipality and MINSASILAIS respectively in order to promote "Model Community USE Integrated Improvement Project". Promote education programs for the residents.

5.3 Alternative Scenario for SJV A New Municipal SW Disposal Site Development Project

The Nicaraguan side issued its final comments on the Study in December 1997, requesting a preliminary design and EIA for a level-2 landfill at the SJV A New Municipal SW Disposal Site Development Project, in order for the project proponent Granada Municipality to submit its EIA report based on level-2 (instead of level-4) and to obtain an environmental permit from MARENA.

In response to the request, the Study Team additionally formulated a "preliminary design of a new disposal site with level-2 landfill" and its EIA, which are presented the Annex-S and T respectively in the Volume IV.

Granada Municipality, which is the proponent of SJV A New Municipal SW Disposal Site Development Project, will have to examine and review Annex-S&T (level-2). Firstly

in submitting the EIA report and subsequently in modifying it following, MARENA's further comments on its revision and/or rejection(if any).

The Study Team is not in the position to: modify the SJV project and its EIA report, nor is it able to explain and negotiate with MARENA for getting an environmental permit. Therefore, the proponent of the project, Granada Municipality, should be responsible for all the procedures in getting the permit.



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