E.4 Other Pre-Conditions

E.4.1 Affordability Analysis – Fund Available and Fund Affordable

Solid waste issues are moving to the forefront of public attention. Among others, the issue of efficiency and associated high cost structure, as has previously been discussed in the PAHO report[2] and the subsection C.6.5 in this Report, is becoming a focal point for officials in charge of instituting an overall framework for SWM. Increasing costs for waste management during the period of this controversy now rivals the vast amount of financial and social resources endowed in the society, while being left untouched by the City administration. The aggregate amount of Hidden costs, or social costs as borne by households and entities in the form of *Tips* and *Fincas,* directly paid to the collectors by beneficiaries in Mexico City is now envisaged to be around US$ 1.4 billion, which is equivalent to 0.3 percent of aggregate supply (GDP) of the country.

In view of the foregoing, this section is prepared to primarily analyze the size of investment outlays *of avail* for DGSU during the Master Plan period of 1999 through 2010, while the two alternatives being set forth herewith, notably, (i) the private sector resources NOT being incorporated in the public accounting, and (ii) those being. This part definitely delineates the difference in size of the pecuniary resources available to the public work undertaking in line with the both ways of funds flow as defined above. Sequential to the hypothetical framework in placing the size of funds available to DF, the ascertainment of funds *affordable* to the agency is considered, while assuming the funds in the form of (i) equity-own funds, (ii) loan-equity mix, and (iii) loan-equity-grant mix in exchange of funds available to DGSU in the years that come. The analysis numerically elucidates the size of investment(s) possible for DGSU to carry out with its financial endowments now and on, and the impact of project implementation on the flow of funds attributed to the current DF government.

E.4.2 Available Funds

The *tentative* and *indicative*, and could be *"hypothetical"*, estimates of available funds for DGSU to invest in the SWM sub-sector have duly been considered in this report in lieu of the fully equipped ascertainment of available and affordable funds with technical, social, and financial data of avail and consistency. As noted above and specified in the ensuing subsection, estimation of available fund for DGSU is made on the two assumptive alternatives, vis-à-vis, (i) without Beneficiaries' Contribution (*"tips"* and *"fincas"*) being incorporated in public accounting, thereby no new money for reinvestment from the private sector except that currently being paid by large dumping customers, and (ii) with Beneficiaries' Contribution (*"tips"* and *"fincas"*) possibly being incorporated in public accounting, a proportion of which will be mobilized for partial fulfillment of investment lag in the sub-sector.

a. Willingness to Pay

Only a report of the Population Opinion Survey (POS) undertaken by the team in August and September of 1998 is of avail, thereby furnishing limited numerical

[2] Pan-American Health Organization, *Analysis Sectoral de Residuous Solidos en Mexico Valley Metropolitan Zone, #14*, February 1998, chapter 5

information relevant to the estimation of people's willingness to pay for waste disposal in the city.

Figures applied in the current analysis include the percentage share of "voluntary payers" in, and the amount and intervals of tips paid by households, respectively with 81 percent of the total and 7.0 pesos per household per week. Provided that the average income of household in Mexico in 1996 reveals P. 25,776 per annum[3], or US$ 3,391.6 equivalent as per 1996 quotation of P.7.6 per US$, coupled with P.7.0 per week of presumably taken "bid price" of people on the marginal unit of supply of waste disposal, people's willingness to pay (*WTP*) for the public service in concern in 1998 worked out around one percent of their income[4]. While considering that household income in Mexico City is considerably higher than that of Mexico as a whole, people's *WTP* for waste management in Mexico City is notably lower than those in the major cities in Asian region where *WTP* ranging around 2 percent of income[5].

b. Estimation of Available Fund, Mortgage for Expedient Borrowing

Solid waste management (SWM) services are becoming one of the major and urgent items on the agenda of federal and local officials in due course of increased demand by the population, rising economic and social costs and management complications associated with a large work force. The concerned sub-sector investment requires amounts of capital and other scarce resources of the country, it is imperative that investments be economized with the financial and economic returns at maximum, while striving for social conflicts and political friction at minimum. Alternatively, essential to the proper planning is the allocation of scarce resources to its best advantage. The framework, the model configuration, and the assumptive parameters in use for the analysis is set forth *vide infra*.

b.1 Methodology

As previously noted with a bearing on the sector policy and investment, Mexico faces somewhat crooked way of resource crunch for medium and long-term capital investment programs, with the SWM sub-sector in particular. At issue in this financial position is that how much of funds would possibly be mobilized from the public and the private sectors in the formal sector during the target period up to 2010 in preparation of the prospective SWM project(s). At the outset, it may be instructive to point out that the focus on the methodological issue herein is initially confined to the "micro" approach pertaining to the desegregated funding sources by possible donors, vis-à-vis, the Federal government, external assistance, the DF government, the Delegation involved, and the beneficiaries of the prospective projects. The current expenditures by the central government and beneficiaries in the service catchment areas are the basis of the estimates on which the anticipated grants and contributions emanated from these sub-categorical fund sources are extrapolated in line with the hypothetical benchmarks and parameters as shown below and further summated to reach the total available fund for projects. It would be noted that the latter part of the

[3] Source: INEGI, *El Ingreso y el Gasto Publico en Mexico*, 1997, p. 29
[4] Household income in 1998 is assumed to be P.33,776, or US$ 3,711.6 (P.9.1/US$), with the inflation rates of 17 percent and 12 percent in respective of 1997 and 1998 in view.
[5] Source: The World Bank Technical assistance to Indonesia, Institutiotnalization of Integrated Urban Development, 1995, p. 9

estimation herewith is, in economics jargons, a "macro" approach such that the fund projection is linked to the intuitive macroeconomic parameters, inter alia, growth of national/regional value added, city population, and benchmarked fund allocation targets to the sectors. This involves making explicit assumptions regarding a steady supply elasticity of funds available for the SWM sub-sector in DF with regard to these indicators.

Alternatively, a number of other macroeconomic techniques like econometric approach, trend analysis had been considered to rigorously estimate the funds most likely allocated to the sub-sector concerned. Of these, a simple macro econometric model relating annual growth of funds available to GDP (at the margin) had been considered appropriate in connection with analogy to the electricity demand forecasting. Nonetheless, the estimates of GDP elasticity of supply of public/private funds for the public services concerned did not fall on the upward sloping linear nor curvilinear supply schedule, and hence, no clear quantitative correlation between the variables have been confirmed. Other hypothetically relevant independent, or explanatory variables such as income level or economic prices of alternative services could not be confirmed given the problems arising from the scarce availability of and non-consistency in data.

b.2 Assumptions and Model Configuration

Basic Assumptions for Model Configuration

The following financial framework in brief with model configurations and assumptive parameters readily presents the possible fund raised for the Mexico City for which a paucity of affordable credit in the formal sector is considered to be one of the serious constraints to upgrade the efficiency of urban sanitation services.

Table E-11: Key Socioeconomic and Financial Indicators and Assumptive Parameters

Gross Domestic Products, 1997	US$ 402.5 billion
Real GDP/GRP Growth per annum	5.0 percent in average
Gross Regional Products, DF, 1997	US$ 93 billion
Average Household Earning Nation-wide, 1998	P. 33,776 per annum
Annual Growth of Beneficiary contribution	3.0 percent in real terms
Elasticity of Contribution Increase with regard to Growth	0.6
Annual Population Growth	0.59 percent in average
DGSU Budget for SWM in 1998	P. 987 million, (excl. Delegation)
Real Growth Rate of DGSU Budget for SWM	-0.5 percent
Benchmark Investment Target in SWM	0.05 percent in terms of GDP
Social Discount Rate	7.9 percent
Master Plan Duration	12 years (1999 – 2010)

i. Sources and Uses of Funds – Two Alternatives

As a guiding principle for the analysis herewith and on, the two interrelated ways of fund mobilization in the economy are considered as reiteratively noted above, vis-à-vis, (i) funds from all or part of the sources possibly involved (Federal, External Assistance, DF, Delegation, and the private sector) would be engaged and utilized in processing of SWM through the public channel, namely, DGSU, and (ii) private sector resource currently in place as "*tips*" and "*fincas*" will be stashed in the hands of collectors directly from beneficiaries in service areas. Foreign aid funds would implicitly be incorporated in state fund, if any, in the form of sub-loan, equity investment and grant to DF government in the forthcoming analysis. Presumably, no external private funds in conjunction with any private sector partnership projects (BOT, BOO, contract out, and so forth) are in sight.

ii. Capital Accumulation

The capital accumulation and investment outlay lasts for 12 years in the SWM sub-sector concerned, while commencing in 1999 up to the year 2010. It is assumed that there is no change in correlation of the variables involved with the passage of time.

iii. Resource Mobilization from Private Sector

As defined in (ii) above, *tips* and *fincas*, both broadly defined as a kind of tariff, or fees donated from households and entities, respectively, will accrue during collection and transfer in SWM processing. In this connection, the alternatives are made whether or not the funds collected are utilized through the public channel in support of self-reliance and financially sound management of the SWM service undertaking in DF.

iv. Elasticity (Sensitivity)

Elasticity of fund supply with regard to real GDP growth would presumably be set at a certain level, for instance 0.6, in analysis. Nonetheless, there is no supply elasticity assumed herewith.

Model Configuration

Considering the analytical framework by and large, the following model configuration is set out to draw the possible size of funds available for capital investment and recurrent works with the associated numerical parameters. To be noted that not all the pieces as articulated below are in use for the current analysis, largely due to paucity of time and numerical information of avail and of reliance. A bird's eye view illustrating model configuration and assumptive parameters is provided in Table E-18 and Table E-19, as attached.

i. Sources of fund: In principle, the two fund sources by category are being assumed, namely, the public and the private sectors. Of this, the Federal, International lending institutions and/or Aid Agencies, District of Federal (DF), and Delegation constitute the public sector, whereas the latter comprises beneficiaries' contributions in the form of *Tips* and *Fincas*. Nonetheless, funds from loan assistance/foreign aid sources are implicitly included in fund flow from the state in the form of on-lent proceeds, equity

investments, and grants, as appropriate. Meanwhile, funds from the Federal government and external sources are primarily treated as *nil* under the study in place, while taking into account that the investment efforts by the aforementioned sources have thus far taken place mostly outside DF. Policy commitment of DF government to waste disposal service in the city is assumed to be represented by the effort to increase nominal budget for DGSU in line with inflation, striving for keeping afloat the budget above negative line in real terms.

ii. Fiscal transfer from the Federal to DF: It has been assumed that, should the Federal has a chance and will to financially support DF in SWM investment by according grant fund or equity participation, a marked-up funds would be transferred to DF in line with WTP basis rather than the size of regional economy.

iii. Fiscal transfer from Federal to the Delegation: It is envisaged that an ear-marked funds out of the annual sector investment outlays be transferred to the Delegation through DF, thereby making it impossible for DF to allocate funds from Delegation budget for DF own use.

iv. DGSU Budget for SWM: Subsequent to what they assume semi-hyper inflation in 1995 and 1996 following the currency crisis in 1994, DF budgets for SWM during the Master Plan period will not be annually pegged at a mark-up point against the regional gross outputs (GRP). It is also assumed that DGSU budget for SWM will negatively increase to a little extent in real terms, while considering the high pace of devaluation and associated spiral inflation currently in place in the city.

v. Project fund: Of the total DF budget allocated to the SWM sub-sector concerned, partial funds will be available to the prospective Project(s) that come.

vi. Growth in regional income: Household income of the City will increase in proportion to real GDP growth. Alternatively in use of the economics jargon, the unit elasticity of supply of private fund in terms of GDP growth is being assumed.

vii. Willingness to Pay (WTP, "Voluntary" User's Charge): The maximum extent people are willing to pay for the urban sanitation service without undue hardship is estimated annually in compliance with the annual growth of GDP in real terms.

viii. Use of funds for Prospective Investment Project: It has been assumed that part of the private sector fund be allocated to this prospective project in compliance with the parameters set forth for DGSU budget allocation to the project.

ix. Growth in number of households: In association with the growth in population, while the number of households in the city are to be increased in proportion to population growth in the city, no hike of population has been assumed for simplicity of analysis.

x. Financial healthiness of DF: Debt Service Ratio (total debt services inclusive of principal repayments and interest payments over the revenue) is normally used as a bench-mark index to represent the soundness of public finance. Nonetheless, an incremental burden of debt service accrued to the prospective project is currently used to look into the pecuniary impact on cash flow of DF.

c. Fund Available for Prospective Project

In line with the model configuration and indicative parameters as articulated above and in the table, the total *funds available* in the case of Alternative I (without private sector contribution except large-scale dumping beneficiaries), within the time-slice of 12 years, is temporarily estimated at P. 756.2 million (equivalent to US$ 83.1 million as per 1998 price) up to the year 2010, of which 5.6 percent of fund emanates from the private sector source. Meanwhile in the case of Alternative II (with private sector fund reincorporated in public finance), the present value of fund available in aggregate hypothetically worked out P.13,412.5 million, or equivalent to US$ 1,473.9 million as per 1998 quotation, of which 94.7 percent come from the private sector. In terms of the annual fund allocation for the planning period, the levelized amounts for the alternative one and two will reach US$ 4.8 million and US$ 84.6 million, respectively.

Meanwhile, it should be noted that these chunks of cash during the aforementioned period does NOT mean the fund in hand of DF for investments in 1999. This is the amount that would be accumulated over the 12 years and would be understood in analogy as a kind of mortgage for possible credit.

E.4.2.1 Fund Affordable and Impact on DF Finance

a. Model Configuration, Tool and Parameters

In anticipation of the DF Government's further commitment to urban environmental management at a higher level, the need for external financing at an early point in time is pressing. In carrying out a further analysis to give hands with whatever the DF administration might require to commission the preparation of the prospective solid waste management project (the Project) in 1999, *fund affordable* for DF government and the Project as well is estimated in lieu of the available funds above. In view of nature of the fund estimated in due course of analysis, the subsequent financing model and the estimates will present an indicative measurement of loan credibility and budget for the prospective project confining to the limited size, design and procurement. In facilitating the perusal of the analysis herewith, the estimates are categorized in a three-way financing plan, vis-à-vis, (i) Own Fund, (ii) Equity-Loan mix, and (iii) Equity-Loan-Grant mix, in the two alternatives of credit lines, notably, (a) International lending institution, and (b) Bi-lateral lending agency.

The size of public investment projects depends on the availability of affordable funds (how much money you have in the chest for free use in 1999?) and its loan credibility (how much you could borrow now for what you would accumulate and retain in currency by the year 2010?). With this in view, the analysis will be initiated by instituting the overall account on the size of project in the three alternatives of financing plans. The underlying conditions of equity-loan mix and equity-loan-grant mix in financing plan are 25-75 and 17-50-33 in shares out of the total amount,

respectively, while considering the views of and comments on the most likelihoodness of possibility of combination from officials concerned at DF and international lending institutions. The case has also been looked into where collateral fund (three quarters of equity-loan mix) be split into loan and grant. To this end, the numerical combination worked out around 30-45-25. Subsequently, the prospective repayment plans and annuitized debt services associated with each of the financing plans are simulated to measure the financial impacts on the DF finance. The benchmarked policy target for investments in SWM has been assumed specifically that 0.05 percent of GDP be earmark to SWM in Mexico City, of which 10 percent be allocated to development budget. Further, 70 percent of DF development budget is presumed to be non-committal fund for new projects. The model configuration and assumptions are set forth in an immediately following part in a bid to draw the indicative funds affordable for the Project.

To be noted that the issue of direct contribution of the private sector to DF account through possible payments of tariff/user's charge to the administration (Alternative II) is NOT sorted out herewith, except that of the payments currently in place by large-scale beneficiaries, with due recognition of cultural and mental background of people in the way of pecuniary compensation for public services.

Underlying Assumptions

Financial Terms

Loans from international lending institutions assume 20 years of repayment including 5 years of grace period, at the Banks' standard variable interest rate. As for the World Bank, the current variable interest rate from Ordinary Capital Resource (OCR) is set at 7.5 percent. Japan's financial aide agency assumes 30 years of repayment inclusive of 10 years of grace at the interest rate 2.6%. For both of the agencies, annuity payments will be made twice a year, at the end of the second and fourth quarter. Interest will be payable on the diminishing balance of the outstanding principal. Consequently, interest costs will decrease proportionately as principal is amortized. Government loan facilities under the Bank usually assume 15 years of repayment including 3 years of grace period with interest rate at *cetes* (Mexico's benchmark yields on 28-day Treasury bill) plus 5 percent[6]. Annuity payments will be made twice a year, at the end of the second and fourth quarter. Interest accrued to the disbursements during construction period (IDC) will be capitalized, thereby bearing no obligation of debt service during the initial 5-year stage of the Project. The current lending conditions of international lending institutions (multi-lateral agencies), such as World Bank, the Inter-American Development Bank, the Asian Development Bank and others, also assume this IDC capitalization clause. Indicative financial terms and conditions as specified above is summarized in a Table E-12 below.

[6]In the face of the possible currency crisis being engulfed by the Asian and Russian melt-down, cetes skyrocketed upwards 10.92 percent reaching 47.86 percent in the advent of the country's independence day of 15 September 1998.

Table E-12: Indicative Financial Terms and Conditions by Source of Funds

	Foreign Cost Portion		Local Cost Portion	
	Multi-Lateral	Bi-Lateral	Multi-Lateral	Bi-Lateral
Financing Coverage (%)	100	100	100	100
Loan Period (years)	20	30	20	30
Grace Period (years)	5	10	5	10
Loan Repayment Period (years)	15	20	15	20
Interest Rate (%)	7.5	2.6	24.9	24.9

Equity-Loan, Equity-Loan-Grant Mixes

As initially indicated in the preceding paragraphs, investment requirements of the prospective project are assumed to be financed by (i) own fund (equity), (ii) equity plus loans through the national development bank (BANOBRAS) with the central government as guarantor, or (iii) equity, loan plus fiscal transfers from the central government to DF government. In the case of the second choice, equity-loan mix is intuitively set at 25-75. Should the Federal government has a chance to offer grant to DF to meet pressing challenge in the city, proceeds of foreign loan will be either surmounted to equity-loan mix, or split into two components. In the former, the numerical combination appears 17-50-33. Alternatively, when part of loan proceeds be borne by the Federal government in the form of grant, vis-à-vis, around 65 percent on-lent from the central government to the undertaking(s) and the remaining 35 percent grant, it is figured out to be 30-45-25.

b. Findings

Maximal Sizes of Investments in SWM

In the context of the foregoing, and with an annuity of around P. 43.7 million (equivalent to US$ 4.8 million), the maximunds (maximum values) of investment projects for each of the alternative financing are figured out at US$ 7.1 million (Own Fund), US$ 28.2 million (Loan-Equity mix), and US$ 42.3 million (Loan-Equity-Grant mix, where grant is assumed to be an accretion to equity-loan mix). Provided that grant covers part of loan-equity mix, the combination connected with equity-loan-grant mix remains at US$ 28.2 million (Loan-Equity mix), without any surprise. A summary Table E-13 is given below.

Table E-13: Conditional Maximunds by Type of Combination of Financing Source

Mix-Finance Sources	Maximunds	Combination
Own Fund	P. 64.6 million (US$ 7.1 mil)	100-0
Equity–Loan	P. 256.6 million (US$ 28.2 mil)	25-75
Equity-Loan-Grant (accretion)	P. 384.9 million (US 42.3 mil)	17-50-33
Equity-Loan-Grant (part of loan)	P. 256.6 million (US$ 28.2 mil)	30-45-25

c. Repayment Plan

The technical, environmental, institutional, financial, and economic appraisal of the prospective project is still underway, thus leading to the temporary observation where it would still be early at this point in time to draw more than highly indicative repayment plans as a kind of financial benchmarks. No breakdown of prospective fund allocation from the DF government or equity investment by the Federal government. With this, the DGSU counterparts and the mission would, as appropriate, discuss further details in due course of project processing that come.

In line with the advice by the technical team of the mission on the financial size of the prospective project, it has been assumed on this preliminary stage that the base cost remain somewhere around P. 200 million (equivalent to around US$ 22 million as per 1998 foreign exchange quotation). With this in view as a benchmark for the initiation of current financial analysis, the repayment schedules of the base cost portion are preliminarily figured out. In a bid to simplify the model, annuity payments are assumed to be made once a year, at the end of the fourth quarter. Commitment charge of 0.75 percent which is payable to the agreed amount of loan is not included either in discussion for the same reason. Amortization is on a levelized basis, and interest which is payable all over the project duration will be on the diminishing balance of the outstanding principal, as such interest costs will decrease proportionately as principal is amortized. It should be noted that financial cost in aggregate, inclusive of duties and taxes with value added tax and import duties in particular, physical contingency, price contingency, and interest during construction wherever appropriate should be worked out in due course of further refinement of prospective project.

Meanwhile, in the case of borrowing from international lending institutions in general, interest during construction (IDC) will be capitalized and hence difficulties will be encountered by executing agencies when debt servicing commences with an inflated principle and interest payments associated. In appreciation of hardship to draw external finance on "multi-lateral funding scheme", it would also be considered to assume that DF get borrowings on "bi-lateral funding scheme" where borrowers pay back interest charge without debt carry-forwards during the disbursement period. The results are summarized in Table E-14 and Table E-15 as follows.

Table E-14: Assumptive Repayment Schedule by Source of Fund & Interest Rate Associated

	Indicative Loan Amount, US$15.0		Indicative Loan Amount, US$10.0	
	International	Bi-Lateral	International	Bi-Lateral
Disbursement ($million)	15.0	15.0	10.0	10.0
Interest Rate (percentage rate)	7.5	2.6	7.5	2.6
Principal ($million)	17.4	15.0	11.6	10.0
Cumulative Repayment ($million)	25.3	21.9	16.9	14.6
Annual Payment ($million)	2.5	0.9	1.7	0.6

Table E-15: Assumptive Repayment Schedule by Interest Rate – 24.9 percent per annum

	Indicative Loan Amount, US$15.0		Indicative Loan Amount, US$10.0	
	International	Bi-Lateral	International	Bi-Lateral
Disbursement ($million)	15.0	15.0	10.0	10.0
Interest Rate (percentage rate)	24.9	24.9	24.9	24.9
Principal ($million)	23.96	15.0	11.6	10.0
Cumulative Repayment ($million)	67.0	99.5	44.6	66.3
Annual Payment ($million)	6.7	3.7	4.5	2.5

Of the deliverables as shown in the tables above, annuity payments are highlighted and compiled below in Table E-16 and Table E-17, respectively. For further reference, the schematic presentation of repayment schedules payable to international lending institutions and bi-lateral aid agencies for the foreign and local cost portions are attached as Table E-18 and

Table E-20, respectively. Subsequently, a diagrammatic information on the difference in terms and conditions as reflected in repayment schedules between multi- and bi-lateral lending agencies is given as Figure E-8.

Table E-16: Foreseeable Debt Service commencing after 5 and 10 years of Loan Effectuation, 1998 FX quotation (Interest rates as per lending institutions)

	Indicative loan amount – US$ 15.0	Indicative loan amount - US$ 10.0
Multi-Lateral Lending Scheme	P. 21.8 million (US$ 2.4 million)	P. 15.5 million (US$ 1.7 million)
Bi-Lateral Lending Scheme	P. 8.2 million (US$ 0.9 million)	P. 5.5 million (US$ 0.6 million)

Table E-17: Foreseeable Debt Service commencing after 5 and 10 years of Loan Effectuation, 1998 FX quotation (Interest rate as per domestic on-lent rate)

	Indicative loan amount – US$ 15.0	Indicative loan amount - US$ 10.0
Multi-Lateral Lending Scheme	P. 61.0 million (US$ 6.7 million)	P. 41.0 million (US$ 4.5 million)
Bi-Lateral Lending Scheme	P. 33.7 million (US$ 3.7 million)	P. 22.8 million (US$ 2.5 million)

d. Sound Management of DF Finance - Borrowings and Change in Financial Position

As is fully aware, financial healthiness of entities, either public or private business undertakings, is a function of an expense accrued each year but also the share of debt services out of the funds generated in a year. Viewed in this light, ratio analysis in management accounting using debt-service ratio would preferably be exercised in the part of the report. Nonetheless, the incremental impacts arising from the external borrowings for the sector on the current cash-flow of DF will take place in lieu of the ratio analysis. Numerically, the section highlights the percentage increase in DF debt service currently in place as a proxy index to take a quick overlook at the change in financial position at DF.

Referring back to Table E-16 and Table E-17 with the debt service of P. 2,609.4 million (US$ 286.7 million (equivalent with the quotation at P. 9.1/US$ in September 1998)) owed by DF government in 1998[7], incremental portion of debt service as borne by DF government corresponds to 0.3 percent at maximum and 0.05 percent at minimum reaching respective of 12.5 percent and 12.25 percent[8], while assuming interest rates charged by lending agencies and through national development banks in Mexico for the borrowing of US$ 15 million.

In the meantime, it should be considered that the direct comparison of hypothetical debt services incurred to the borrowing for the still assumptive base cost and the amount of principal repayment (amortization) plus interest payments (debt service) for DF in 1998 is only indicative and purposefully provided in a bid to by and large visualize the size of the investment scheme(s) that would come. In due course of further investigation in financial and economic segments of the project, the issue of sound management of DF finance will take place with financial debt service ratios in the years when those repayments attributed to the borrowing are in place, that is 5 or 10 years in the wake of loan effectuation, and the technically refined project cost.

[7] Source: *Cuenta Publica del DF 1998*
[8] *DSR* herewith is being defined as debt service over own revenue of DF in 1998.

Table E-18: Model Configuration and Assumptive Parameters (1)

Key Parameters

Policy Target (Bdgt Allocation for the Solid Waste Subsector)		
MC SWM Alloc (Fm Fed)	0.05%	of Investment Outlay
MC SWM Alloc (Fm DF)	0.1%	of GRP
External Assistance	0.0%	of the total public investment outlays
Real GDP Growth	4.0%	per annum
Population Growth	0.59%	per annum
FX Quotation	9.1	P/US$
Devaluation	0.0%	in FY2001 0.0% in FY2015
Share of Devt Bdgt	10.0%	of DGSU SWM Budget
Share of non-committal funds	70.0%	of DGSU SWM Development Budget
Household Ratio	70.0%	of the total population
# of Entities	330,000	in MCity 1998
WTP (for Solid Waste service)	0.5%	of income
Beneficiary Contrn	2.9	P. million/yr, 1998 (PAHO Report)
Annual Real Increase in BenContn	3.0%	per annum
Ben Contn (Agg.HH *tip*, '98)	324	US$ million
Ben Contn (Agg.*Finkas*, '98)	1,036	US$ million
Ben Contn (Agg.Current, '98)	2.9	P. million/yr, 1998 (PAHO Report)
Social Discount Rate	6.6%	
Inflation *vide infra*	0.0%	per annum
Nominal case	12.0%	per annum
Nominal GR of DF Bdgt 95-98	28.7%	
Av Inflation 95-97	31.6%	
Real GR of DF Bdgt, SWM	-2.9%	
Buffer Coefficient	0.8	

Key Economic Indicators

	$ million	P. million	
GDP ('97)	402,500	3,260,250	(Ref:WB)
GNP ('97)		NA	
Gov Rev ('97)	90,173	730,400	(Ref:BdeMexico)
Gov Exp ('97)	92,840	752,000	(Ref:BdeMexico)
DF GRP ('93)	22,958	71,465	(Ref:Censo Industrial, Comercial y servicios, 94, INEGI)
DF GRP (est.,'97)	93,000	846,300	
DF Secretariat Exps ('98)	2,833	25,784	(Ref:Oficial Gaceta)
DF Expenses ('98)	4,678	42,574	(Ref:Oficial Gaceta)
Del Budget ('98)	818	6,630	(Ref:Oficial Gaceta)
DF SWM Bdgt ('98)	109	988	(Ref:DGSU)
Del SWM Bdgt ('98)	63	573	(Ref:DGSU)
Av Earning/pc/yr (Mexico,'96)	3,392	25,776	(Ref:Ingreso y Gasto, 97,p.29)
Av Earning/yr (MCity,'96)	30		
Av Earng/yr (Mexico,'98)	3,712	33,777	
Min Wage/day,Mexico,'98	3.32	30.2	National Average - P.27.99/day
GDP p.c (Mexico,$,1997)	4,091	33,137	Ref:Mexican Bulletine of Statistical Information
GRP p.c (DF,est.,1997)	12,149	98,407	
XR (P/$) 1998	9.1		
XR (P/$) 1997	8.1		
XR (P/$) 1996	7.6		
Inflation ('93-'95)	8.0%		
Inflation 1998	12.0%		
Inflation 1997	17.0%		
Population, mil, 1998	8.6		
Interest Rate (*cetes*,'97)	25.6%		
Fed Inv Plan for SWM		NA	
DF Inv Plan for SWM		NA	
DF Debt, agg (as of '98)	109,373	12,019	(Ref:Oficial Gaceta)
DF Ecological Preservation('98	23,323	2,563	(Ref:Oficial Gaceta)

Alternative 1: No Tips/Fincas Mobilized in Formal Sector, Contribution of Large-Scale Waste Generators Currently in Place

#	Year	Inflation per annum	Real GDP Growth	Population Growth	GDP	Population	Federal Target SWM	Federal MC SWM Dev Alloc	External MC SWM Dev Alloc	DF GRP	DF Target SWM	DF MC SWM Dev Alloc	Delegacion MC SWM Dev Alloc	WTP HH tips	WTP Entities Fincas	Beneficiary Contrn Dev Alloc	Total	Accumulated Balance
					(US$, mil)		(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)
	1997				402,500	8,567,135												
	1998	0.0%	4.0%	4.00%	418,600	8,617,681				93,000	93.0	7.6	4.4			0.32		
1	1999	0.0%	4.0%	0.59%	435,344	8,668,525				96,720	96.7	7.42	4.27			0.33	7.7	7.7
2	2000	0.0%	4.0%	0.59%	452,758	8,719,670				100,589	100.6	7.25	4.15			0.34	7.6	15.3
3	2001	0.0%	4.0%	0.59%	470,868	8,771,116				104,612	104.6	7.08	4.03			0.35	7.4	22.8
4	2002	0.0%	4.0%	0.59%	489,703	8,822,865				108,797	108.8	6.91	3.91			0.36	7.3	30.0
5	2003	0.0%	4.0%	0.59%	509,291	8,874,920				113,149	113.1	6.75	3.79			0.37	7.1	37.1
6	2004	0.0%	4.0%	0.59%	529,663	8,927,282				117,675	117.7	6.59	3.68			0.38	7.0	44.1
7	2005	0.0%	4.0%	0.59%	550,849	8,979,953				122,382	122.4	6.44	3.58			0.39	6.8	50.9
8	2006	0.0%	4.0%	0.59%	572,883	9,032,935				127,277	127.3	6.28	3.47			0.40	6.7	57.6
9	2007	0.0%	4.0%	0.59%	595,798	9,086,229				132,368	132.4	6.14	3.37			0.42	6.6	64.2
10	2008	0.0%	4.0%	0.59%	619,630	9,139,838				137,663	137.7	5.99	3.27			0.43	6.4	70.6
11	2009	0.0%	4.0%	0.59%	644,415	9,193,763				143,169	143.2	5.85	3.17			0.44	6.3	76.9
12	2010	0.0%	4.0%	0.59%	670,192	9,248,006				148,896	148.9	5.71	3.08			0.45	6.2	83.1
Total 1999 - 2010			83.1	US$ million				0.00	0.00		1,453.3	78.4	43.8	0.0	0.0	4.66	83.07	
Present Value, 1998			39	US$ million														
Annualized Fund			4.8	US$ million														

Table E-19: Model Configuration and Assumptive Parameters (2)

Key Parameters

Policy Target (Bdgt Allocation for the Solid Waste Subsector)		
MC SWM Alloc (Fm Fed)	0.05%	of Investment Outlay
MC SWM Alloc (Fm DF)	0.1%	of GRP
External Assistance	0.0%	of the total public investment outlays
Real GDP Growth	4.0%	per annum
Population Growth	0.59%	per annum
FX Quotation	9.1	P/US$
Devaluation	0.0% in FY2002	0.0% in FY2015
Share of Devt Bdgt	10.0%	of DGSU SWM Budget
Share of non-committal funds	70.0%	of DGSU SWM Development Budget
Household Ratio	70%	of the total population
# of Entities	330,000	in MCity 1998
WTP (for Solid Waste service)	0.5%	of income
Beneficiary Contrn	2.9	P. million/yr, 1998 (PAHO Report)
Annual Real Increase in BenContn	3.0%	per annum
Ben Contn (Agg.HH *tip*, '98)	323.52	US$ million
Ben Contn (Agg.*Fincas*, '98)	1,035.71	US$ million
Ben Contn (Agg.Current, '98)	2.9	P. million/yr, 1998
Social Discount Rate	6.6%	
Inflation *vide infra*	0%	per annum
Nominal case	12%	per annum
Nominal GR of DF Bdgt 95-98	28.7%	
Av Inflation 95-97	31.6%	
Real GR of DF Bdgt, SWM	-2.9%	
Buffer Coeficient	0.8	

Key Economic Indicators

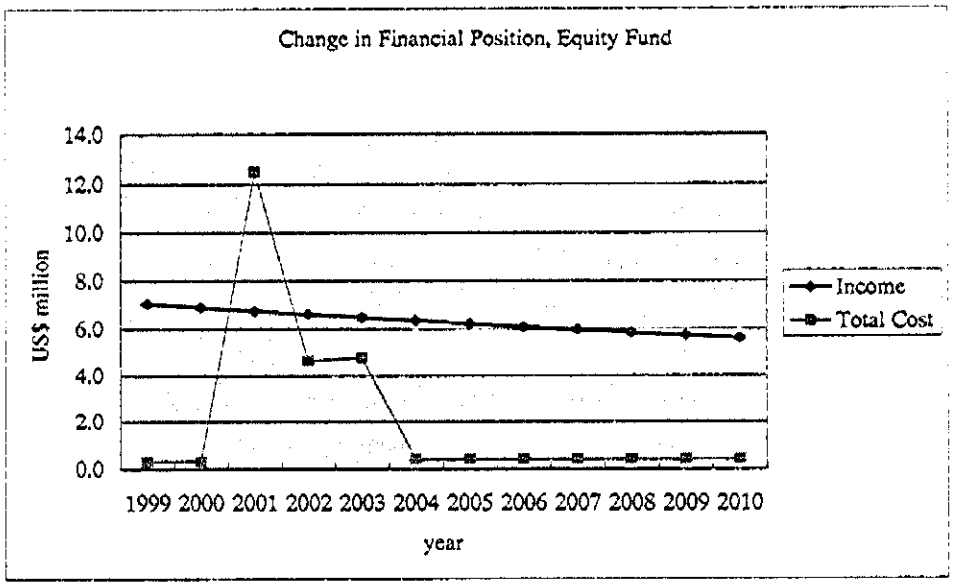
	$ million	P. million	
GDP ('97)	402,500	3,260,250	(Ref:WB)
GNP ('97)			
Gov Rev ('97)	90,173	730,400	(Ref:BdeMexico)
Gov Exp ('97)	92,840	752,000	(Ref:BdeMexico)
DF GKP ('93)	22,938	71,465	(Ref:Censo Industrial, Comercial y servicio, 94, INEGI)
DF GRP (est.,'98)	93,000	846,300	
DF Secretariat Exps ('98)	2,833	25,784	(Ref:Official Gaceta)
DF Expenses ('98)	4,678	42,574	(Ref:Official Gaceta)
Del Budget ('98)	818	6,630	(Ref:Official Gaceta)
DF SWM Bdgt ('98)	109	987.9	(Ref:DGSU)
Del SWM Bdgt ('98)	63	572.5	(Ref:DGSU)
Av Earning/pc/yr (Mexico,'96)	3,392	25,776	(Ref:Ingreso y Gasto, 97,p.29)
Av Earning/yr (MCity,'96)	30	0.00118	
Av Earng/yr (Mexico,'98)	3,712	33,777	
Min Wage/day,MCity,'98	3.32	30.2	National Average - P.27.99/day
GDP p.c (Mexico,$,1997)	4,091	33,137	Ref:Mexican Bulletins of Statistical Information
GRP p.c (DF,est.,1997)	12,149	98,407	
XR (P/$) 1998	9.1		
XR (P/$) 1997	8.1		
XR (P/$) 1996	7.6		
Inflation ('93-'95)	8.0%		
Inflation 1998	12.0%		
Inflation 1997	17.0%		
Population, mil, 1998	8.6		
Interest Rate (*cetes*, '97)	23.6%		
Fed Inv Plan for SWM		NA	
DF Inv Plan for SWM		NA	
DF Debt, agg (as of '98)	109,373	12,019	(Ref:Official Gaceta)
DF Ecological Preservation('98)	23,323	2,563	(Ref:Official Gaceta)

Alternative 2: With Private Resources Mobilized in Formal Sector (Tips, Fincas included in the LR)

#	Year	Inflation per annum	Real GDP Growth	Population Growth	GDP	Population	Federal Target Transfer	Federal MC SWM Dev Alloc	External MC SWM Dev Alloc	DF GRP	DF Target SWM	DF MC SWM Dev Alloc	Delegacion MC SWM Dev Alloc	WTP HH *Tips*	WTP Entities *Fincas*	Beneficiary Contrn Dev Alloc	Total	Accumulated Balance
P. million/yr, 1998 (PAHO Report)					(US$, mil)		(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)	(US$, mil)
	1997				402,500	8,567,135								30				
	1998	0.0%	4.0%	0.59%	418,600	8,617,681	0			93,000	93.00	7.6	4.4	22.6	72.5	0.32		
1	1999	0.0%	4.0%	0.59%	435,344	8,668,525				96,720	96.7	7.4	4.3	23.3	74.7	0.33	105.7	105.7
2	2000	0.0%	4.0%	0.59%	452,758	8,719,670				100,589	100.6	7.2	4.2	24.0	76.9	0.34	108.5	214.3
3	2001	0.0%	4.0%	0.59%	470,868	8,771,116				104,612	104.6	7.1	4.1	24.7	79.2	0.35	111.4	325.7
4	2002	0.0%	4.0%	0.59%	489,703	8,822,865				108,797	108.8	6.9	4.0	25.5	81.6	0.36	114.4	440.0
5	2003	0.0%	4.0%	0.59%	509,291	8,874,920				113,149	113.1	6.7	3.9	26.3	84.0	0.37	117.4	557.4
6	2004	0.0%	4.0%	0.59%	529,663	8,927,282				117,675	117.7	6.6	3.8	27.0	86.6	0.38	120.6	678.0
7	2005	0.0%	4.0%	0.59%	550,849	8,979,953				122,382	122.4	6.4	3.7	27.9	89.2	0.39	123.8	801.9
8	2006	0.0%	4.0%	0.59%	572,883	9,032,935				127,277	127.3	6.3	3.6	28.7	91.8	0.40	127.2	929.1
9	2007	0.0%	4.0%	0.59%	595,798	9,086,229				132,368	132.4	6.1	3.6	29.5	94.6	0.42	130.7	1,059.8
10	2008	0.0%	4.0%	0.59%	619,630	9,139,838				137,663	137.7	6.0	3.5	30.4	97.4	0.43	134.3	1,194.1
11	2009	0.0%	4.0%	0.59%	644,415	9,193,763				143,169	143.2	5.9	3.4	31.3	100.4	0.44	138.0	1,332.1
12	2010	0.0%	4.0%	0.59%	670,192	9,248,006				148,896	148.9	5.7	3.3	32.3	103.4	0.45	141.8	1,473.9
Total 1999 - 2010			1,473.9	US$ million				0.00			1,453.3	78.4	45.4	331.0	1,059.8	4.66	1473.90	
AF Present Value, 1998			688.4	US$ million														
Annualized Fund			84.6	US$ million														

Table E-20: Summary Income Statement for DGSU investment Project in SWM (Equity Fund)

	Income	Capital Investment	O/M Cost	Total Cost	Net Income	Accumulated Inc
1999	7.1	0.3	0.0	0.3	6.7	6.7
2000	6.9	0.3	0.0	0.3	6.6	13.6
2001	6.8	12.5	0.0	12.5	-5.7	20.4
2002	6.6	4.5	0.1	4.6	2.0	27.0
2003	6.5	4.5	0.3	4.8	1.7	33.5
2004	6.3		0.4	0.4	5.9	39.8
2005	6.2		0.4	0.4	5.8	46.0
2006	6.1		0.4	0.4	5.7	52.1
2007	6.0		0.4	0.4	5.6	58.1
2008	5.8		0.4	0.4	5.4	63.9
2009	5.7		0.4	0.4	5.3	69.7
2010	5.6		0.4	0.4	5.2	75.3
Total	75.6	22.1	3.2	25.4	50.2	



Case I: Own Fund	7.1 US$ million Max			
Case II: Own Fund+Loan	28.2 US$ million Max	(Loan Max	21.2 US$ million)	
Case III: Own Fund+Loan +Grant	42.3 US$ million Max	(Grant Max	14.1 US$ million)	
Loan Equity Mix Coefficient	0.25 Equity	Loan Equity Grant Mix Coefficient		0.4 Equity
	0.75 Loan			0.4 Loan
				0.2 Grant
SEDESOL Grant Coeffcient				
MC SWM Alloc (Fm Fed)	0.05%			
Share of Devt Bdgt	10.0%			
Share of non-committal funds	70.0%			
GDP 1997	402,500 US$ million			
Possible Amount of Grant	14.1 US$ million			

Table E-21: Summary Income Statement, Loan -Equity Mix, 1998 Price

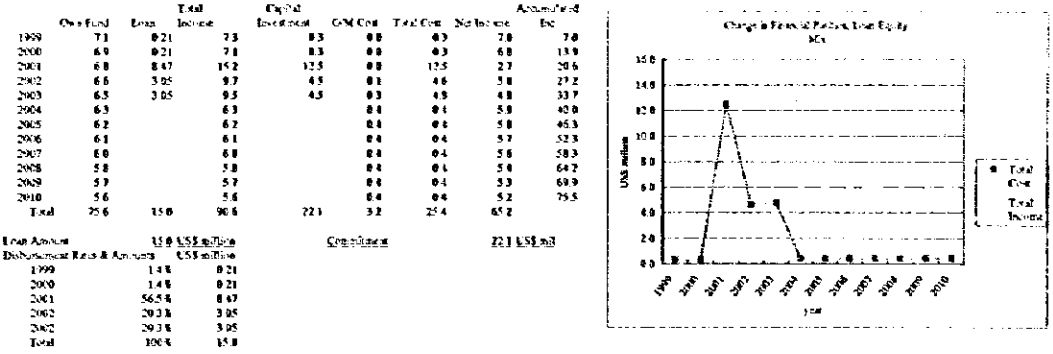
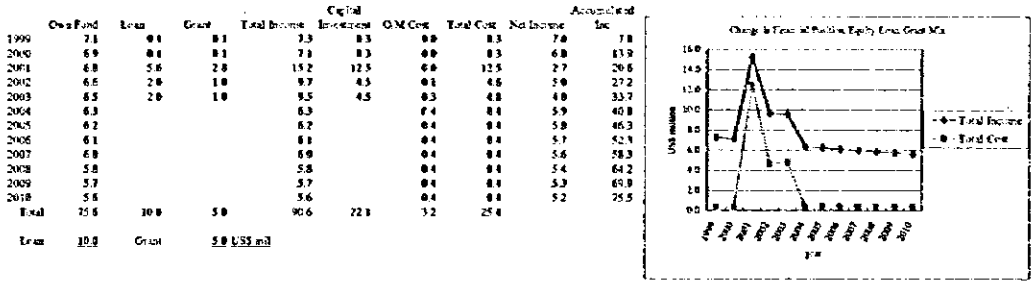


Table E-22: Summary Income Statement, Loan - Equity - Grant Mix, 1998 Price



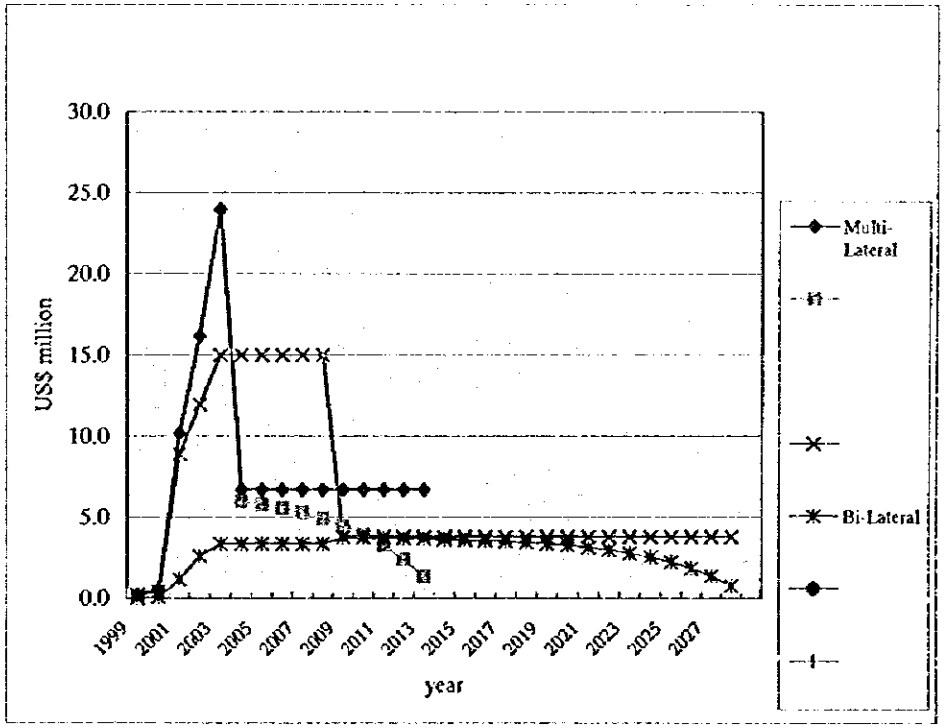


Figure E-8: Finance and Repayment Patterns by Finance Source

Annex F

Particulars to be Considered in the Master Plan Formulation

Contents

List of Tables

F Particulars to be Considered in the Master Plan Formulation

The municipal SWM in the DF, providing services to about 8.7 million people and dealing about 11,000 tons of generated wastes daily, complies with fundamental prerequisites such as keeping the city clean and implementing the sanitary landfill with impermeable liner in order not to pollute the environment. In other words, the GDF has achieved a considerable integration in its municipal SWM, in spite of the difficulties brought by its enormous coverage of the SWM. Today, a firm and large-scale system for SWM has already established in order to keep maintaining this integration. Therefore, in formulating the M/P, special attentions shall be paid to the following:

1. Respecting the established management in the existing system, improvement measures should be formulated in the M/P.
2. The municipal SWM system in the M/P should, aiming at the promotion of resource conservation, be put in force to reduce the final disposal amounts.
3. The systems in the M/P should be cost-effective.

F.1 Technical Particulars to be Considered

F.1.1 Discharge and Storage System

a. Separation Items

At present, source separation is not realized in the DF. The M/P has the target in the sub-system of:

- introducing source separation in 2000; and
- achieving 100% source separation in 2004.

Meanwhile, it has another target in the delegation collection system of:

- introducing the source separation in 2002; and
- achieving 50% source separation in 2010.

The success in shifting the generators' behavior from mixed waste discharge to source separation largely depends on morals and devotion of themselves. Namely, **the fewer** the separation items are, **the higher** possibility of success they may have in the source separation.

From 1996, the DGSU is being carried out a pilot program of three items source separation in some public institutions and housing units, in which totally about 8,500 people are cooperated. 92% source separation was achieved on average in 1998.

In view of this result, the source separation items in the sub-system is proposed to be **three items** (organic, recyclable, and others).

The above pilot project might possibly have gained a good devotion of rules observance from generators, since they were public institutions and housing units where the collective cooperation were easily expected, and in turn unanimously responded to the project.

On the other hand, the collection services by the delegations are provided for individual generators, whose laborious commitments in source separation are difficult to seek. Since it is anticipated that the same three items source separation (as the pilot project) can not be easily achieved by generators in the delegation services, it is proposed to employ the simplest separation items (i.e., two categories (recyclable, and others)) for the source separation in the delegation services.

Table F-1: Source Separation Item

System	Separation type	Waste category
Sub-system	3 items separation	organic, recyclable, and others
Delegation	2 items separation	recyclable, and others

Actual compositions in respective item-categories (i.e., organic, recyclable, and others) are set out as shown in Table F-2, with referring to the definitions applied in the waste amount and composition survey[1] realized by the DGSU in 1996.

Table F-2: Definition of Item Categories to be Separated

For Sub-system	For Delegation	Category	Composition
Organic	Others	Organic	Vegetable fiber
			Bone
			Food waste
			Garden waste
Recyclable	Recyclable	Recyclable	Cardboard
			Synthetic fiber
			Vinyl
			Cans
			Metal
			Nonferrous metal
			Paper
			Newspaper
			Plastic film
			Hard plastic
			Color glass
			Transparent glass
Others	Others	Others	Absorbent cotton
			Cotton
			Leather
			Paper container
			Gauze
			Disposable syringe
			Ceramics
			Wood
			Construction waste

[1] ESTUDIO DE ACTUALIZACION DE LOS INDICADORES CUALITAIVOS Y CUANTITVOS DE LOS RESIDOUS SOLIDOS GENERADOS EN DOMICILIO, EN LA CIUDAD MEXICO, 1996, DGSU/DTDS

For Sub-system	For Delegation	Category	Composition
Others	Others	Others	Toilet paper
			Disposable diaper
			Radiation treatment goods
			Polyurethane
			Foamed polyurethane
			Sanitary napkin
			Rags
			Bandage
			Fine fraction
			Others

F.1.2 Collection and Haulage System

a. Separate Collection Methods

Collection methods for separately discharged wastes comprise such as:

- **Normal vehicle collection**: Collection vehicles of single loading space are employed in this collection. Respective collection for each item is performed on different days of a week. (i.e., a vehicle, assigned in a fixed route, collects one "source separate" item on (a) specific day(s) of a week, and another item on another (other) day(s) of a week). Generators should: separate wastes into the defined items; hand in only one item on a day of a week; and rest items should be stored in his/her place until the collection of that item takes place on another day of a week.
- **Point collection**: Plural containers are installed (one container for one "separate" item) at a designated collection point. Generators should: separate wastes into the defined items; carry them to the collection point and dispose them of respectively into the assigned container.
- **Special vehicle collection**: A special collection vehicle with plural loading spaces is employed in the collection. The vehicle can collect plural items at the same time. Generators should only separate wastes into the defined items, and can hand them in to the service on every collection day.

Normal vehicle collection: It only requires service providers to arrange their present vehicles to the same collection routes and to schedule the collection of respective items for specific days of a week. For the collection crew, it is also easy to simply unload the wastes at the transfer station. However, the generator should follow the rules of on what day what items should be handed in to the collection services.

Point collection: Item-wise containers should be located at the collection point. Generators should dispose the wastes into containers item by item. On the other hand, the **point collection** containers may easily invite many informal waste-pickers as they wish to recover materials by themselves. Therefore, locations that co-use container to be installed at should be carefully selected.

Special vehicle collection: Procurement of the special vehicles (with plural loading spaces) is necessary. Unloading (of plural items) at the transfer station will become complicated. On the other hand, there is no need to change the present collection schedule, and generators (although they should separate wastes into defined items)

can hand all separate items to the collector on any day (unlike in the case of normal collection methods).

In view of an advantage of utilizing the existing collection system (i.e., maximum use of current resources and cost saving), **normal vehicle collection** appears to be most recommended as a separate collection method in the M/P. Meanwhile, as for the separate collection for markets, in which limited in number of major generators are put together, **point collection** could be recommended, if the collection point can be managed as part of market facilities.

b. Haulage System

b.1 Transfer Station

Currently waste visual inspections are carried out at the transfer stations, in order to determine the optimum waste destination (S/P or final disposal site) for respective incoming wastes. Therefore, even in a case where separate collection is implemented in the future, it is judged that present system of transfer stations can cope with the change.

b.2 Transportation

Separate transport by which wastes are transported: from station to S/P, from station to final disposal, and from S/P to final disposal. Therefore, it is judged that present system can be adapted to the future transportation system in which mixed waste and separate waste are to be transported independently.

F.1.3 Intermediate Treatment System

a. Recycling Facility

Three manual sorting S/Ps are currently operated in the GDF's municipal SWM system. Manual sorting in general is the optimum solution for the selection plants (S/Ps), where abundant cheap labor force is available. Manual sorting methods have an advantage over mechanical sorting methods in selection preciseness.

Therefore, it is judged that the M/P basically should examine options for efficient utilization of existing S/Ps, and will not propose options of new facilities.

b. Volume Reduction Facility

Alternatives aimed at final disposal volume reduction will include: incineration; sorting; and composting. Incineration can significantly contribute to volume reduction, but requires considerably huge investment, operation and maintenance costs. Furthermore, it necessitates a set of technical and technological integrity in facilities' operation and maintenance.

The above should be considered as key elements of justifying volume reduction facilities in the M/P formulation.

As the GDF is operating three S/Ps, the examination of volume reduction facilities, in formulating the M/P, will be limited to incineration and composting.

b.1 Composting

The delegation Gustavo A. Madera had owned a municipal SW composting plant operated until 1993. The facility was shut down and dismantled mainly because mixed municipal wastes input to the facility deteriorated compost quality. It is required that, in order to prevent this failure, a composting facility should be fed with selected organic wastes.

Composting facilities in principle consist of:

- mechanical composting facilities (represented by DANO drum).
- open area composting facilities (namely, windrow composting).

The mechanical composting facilities, although its requirement for narrow space is a merit, incorporate a set of mechanical installations. Therefore, an initial investment costs and O&M costs will become substantial.

On the other hand, the windrow composting, although it requires a much wider area, is operable with very limited machinery. Therefore, its investment and O&M costs are reasonably small. Furthermore, the DGSU is currently operating a small-scale windrow composting facility, which treats selected organic wastes of pruned branches and grasses from public park maintenance by the DGSU. Their technical capability of windrow composting is judged to be sufficiently high.

In view of the above, if a composting facility is to be planned in the M/P formulation, the windrow system should be recommended.

b.2 Incineration

The GDF operated the 100 ton/day capacity incineration plant as a pilot project from 1990 to 1992. The plant operation has been suspended due to a set of problems ranging from a poor functional design to high O&M costs of the plant. What was learnt from the pilot operation was that municipal wastes in the DF are generally such wastes that can technically be incinerated with least auxiliary fuel by a modern incinerator. However, such a modern incinerator, which could comply with the updated emission norms, will be incredibly expensive, even though its volume reduction effect is highly appreciated. Therefore, incineration facilities can not be recommended in the M/P.

F.1.4 Final Disposal System

The Bordo Poniente Etapa IV final disposal site, employing an impermeable liner in its bottom, is performing sanitary landfill operations. Its management is judged to be very satisfactory, except for the management of leachate treatment. Therefore, it is considered that an additional improvement of leachate management to the current final disposal system will satisfy the technical norms imposed in Mexico.

F.2 Particulars of Social Aspect

Human, family, professional, ex-scavengers groups union, institutional attitudes and relations between participants in the solid waste management system are deeply influenced by culture, values and perceptions of all the different components of the

urban society. Consequently, any technical or operative proposal should include the social and cultural factor within the context where it wants to be applied.

For the DF case, the new proposals of the M/P for solid waste management should respond the following social criteria:

1. **Identification of local specific characteristics**

   Identification of the DF's diversity and specific characteristics, leaving room for local solutions. Classic or rigid models which are applicable or already applied to other cities should not necessarily be imposed.

2. **Harmonization**

   An open attitude among the participants of the SWM system which can lead to negotiation, consensus and social harmonization as the main strategy to advance on new innovative proposals.

3. **Education**

   An educational component which can make service recipients (who receive the service) and the GDF come together with the purpose of improving their communication. It will also try to improve the attitude of "just throw away" to "responsible to his/her waste". This will be done by means of introducing a will to separate and reduce the solid waste generated; and encouraging more responsibility toward the health and environment, it should initiate in the short term.

4. **Worker Promotion**

   The Socio-economic improvement of informal workers should be aimed at. For this study, this previous statement implies that the informal personnel (volunteers) which work in sweeping and collecting waste should be incorporated to the formal sector. This action will lead to an improvement of their socio-economical conditions. This criteria does not mean that the GDF will take care of this personnel, but new and modern proposals should be concerted to achieve formality for majority of this personnel by the year 2010.

5. **Training**

   More training should be provided for persons in charge and workers in general within the GDF cleansing services and private contractors which participate on SWM in the short and medium term.

6. **Participation and Sustainability**

   More participation from the civil society in planning new functional and operative proposals; in addition, and social and community sustainability for such proposals should be promoted. It should be initiated in the short term.

7. **Cost for Society**

   These proposals should not mean a higher cost for the society in the DF.

8. Supervision and Control

Supervision and control (for the fulfillment of legal arrangements or contracts which would protect the interest of population in general, GDF, and workers) should be strict and transparent.

Consequently, the social factor is related in a complex manner with the other components of the Master Plan. Education is indispensable and can not be neglected for cleansing and hygiene to achieve a situation where residents or solid waste generators cooperate with the GDF authorities.

F.3 Institutional Particulars to be Considered

F.3.1 Legal Bases for Institutionalization

F.3.1.1 Legal basis and Regulatory Instruments

The institutional structure would be based on the according legislation and its rules:

- Government Statute of the Federal District.
- Internal Code of Public Administration for the Federal District.
- Organic Law for Public Administration for the Federal District.
- Environmental Law of the Federal District.
- Financial Code for the Federal District.
- Income and Budget Expense Law for the DF (annual).

The codes to be followed by the citizens and by those entities contracted out, with concession or authorized to carry out the SWM services would arise from the instruments mentioned above, as well as the tariff scheme and the corresponding tariff and collection fixing by the GDF or their concessionaires or authorized entities.

The Secretariat of Works and Services (SOS)/DGSU would be in charge of the elaboration of the SWM Code - applicable to the private or public entities that render the service- which has to be submitted for the approval of the GDF. This code would include the following issues:

a. classification of wastes and services and the modality for the execution of these services.
b. norms for the conditioning, storage and delivery of the wastes to the collector.
c. criteria and restrictions to fix the prices for the services.
d. commitment towards the society.
e. operational information system for the granting authority/contractor/authorizer.
f. parameters to monitor and evaluate the quality of the services.
g. infringement and sanctions.

A code should also be issued for citizens, which includes the aforementioned contents and additionally at least the following topics in its second volume:

h. system of information and complains to the authority.
i. procedures to minimize wastes: use, reuse, recycling, composting, separation of recyclable and dangerous wastes.

j. requirements of domicile constructions regarding the internal collection and storage.
k. procedures to preserve streets and public places neat.
l. infringement and sanctions.

F.3.1.2 Basic Juridical Concepts

Basic juridical concepts such as

i. DF's Parastatal Public Administration
ii. Cooperatives
iii. Social Solidarity Associations (SSA)
iv. Concessions
v. Administrative Permissions (Permissions)
vi. Public Service when rendered by Private Entities

are presented and explained herewith, in order to examine optimum institutional options for respective components of SWM by the GDF.

i. DF's Parastatal Public Administration

The Government Statute of the Federal District that was issued in the Official Gazette of the Federation on July 26, 1994 and amended in the years of 1995, 1996 and 1997. Its Art. 97 through 103, and Art. 33 through 67, Title No. 3 of the Organic Law for Public Administration for the Federal District, issued in the Official Gazette of the Federation on December 12, 1994 and amended in the years of 1996 and 1997, provide and regulate three parastatal entity types:

- decentralized body (DB).
- enterprise with a majority state participation (EE).
- public trust (trust).

The federal legislation, which is also applicable to the DF in those items not encompassed by the articles mentioned before, is consolidated in the Federal Law of Parastatal Entities (Official Gazette of the Federation, 14/05/1986 and modifications in 1992, 1996, 1998) and in its Code (Official Gazette of the Federation, 26/01/1990 and modification in 07/04/1995).

The *main objectives* of DBs and EEs are the following (Statute, Art. 99):

I. The execution of priority activities.
II. The provision of priority public, social or highly-specialized services for the functioning of the city.
III. Operative assistance for the execution of technological or technical functions of the Governor of the DF.

The Government Statute of the Federal District states in Art. 34 "in regard to this law, *priority activities* are those related to the *economic development and employment...*"

Trusts would be entities aiming at "assisting the Governor of the DF to carry out the functions legally under his charge" (Statute Art. 36).

On the other hand, the Federal Law Code (Art. 31) establishes that "*institutional service entities* are those that meet a clear social function, through rendering public services..."; whereas "*public enterprises* are those with economic purposes mainly, due to the type of goods or services they provide, and they will be subject to financial profitability criteria".

Article 33 of the Organic Law establishes that DBs are those entities with juridical status and with their *own asset,* whichever the legal structure they adopt; they can be created by a decree from the Governor of the DF or by the Assembly of Representatives of the DF, under proposition from the president of the Republic or the governor of the DF. These entities must have a precise objective, their fund source to integrate their patrimony, integration of their government body... (Statute, Art. 100).

The *administration* of DBs will be in charge of a government body, such as a committee or an equivalent, and a general manager (Federal Law, Art. 17). Said government body will be integrated by 5 to 15 nominal members and their corresponding assistants, a head for the *sector coordinator* or the person he may appoint. The general manager will be appointed by the Governor of the DF or by the government body, under instructions of the former (Organic Law, Art. 43 and 46).

Parastatal entities will be under the *surveillance* of a body integrated by a nominal public commissioner and his assistant, appointed by the General Controllership of the DF and who will evaluate the general performance of these enterprises and their functions. *Internal control bodies* will be part of the entity's structure and will follow the codes and guidelines set forth by the Controllership (Art. 65 and 67).

The Organic Law establishes the following *non-delegable powers* of the government body of a parastatal company (Art. 63): to approve the programs and *budgets*, as well as their modifications ... following the guidelines ...; to approve the *prices* or adjustments of goods and services produced or rendered ... following the guidelines established by the Finance Department; to approve the granting of *loans* to finance the entity, with domestic and external credits, following the guidelines and laws...; to approve the policies, bases and general programs that *regulate* the agreements, contracts or requests entered by the entity...; to approve the *basic structure* of the entity's organization and its modifications; to approve the *organic statute* in the case of a DB; to appoint and remove, under proposal of the general manager, those *servants* in the two immediate lower hierarchies to his position; and to approve *wages* and *fringe benefits*...

Article 64 of this law establishes the obligations of the general manager, such as: to enter, if the case requires so, the collective and individual contracts that regulate the *labor relations* between the entity and its workers.

Parastatal entities will be subject to the DF's General Development Program, to the sector and institutional programs derived from it and to the authorized expenditure and financing allocations; under these documents, they will formulate their short, medium and long terms *institutional programs*; from their annual programs they will formulate their *budgets*; they will *handle and use their own resources* through their administrative bodies, and in regard to subsidies and transfers, they will receive such from the Finance Department under the terms set forth in the DF's annual expenditure

budget, and will be subject to the corresponding controls and reports of the applicable legislation (Organic Law, Art. 60, 61, 62).

ii. Cooperatives Societies (Cooperatives)

The General Law on Cooperatives (Official Gazette of the Federation, 03/08/1994) states the following (Art. 2): "A cooperative is a social organization formed by particulars based on common interests and in accordance with solidarity, own effort and mutual assistance principles, in order to meet individual and collective needs through the execution of economic production activities, distribution and consumption of goods and services".

There exist two *types* of cooperatives (Art. 21): "consumers of goods and/or services" and "producers of goods and/or services" and two *categories* (Art. 30): "ordinary" and "state share". For such purpose, the State will be able to grant the concession or administration of goods or services to these cooperatives, under the terms set forth by the corresponding laws.

Cooperatives will be able to adopt the regimes of limited liability or supplementary responsibility of the partners. They will have a *variable capital* constituted by the contributions of the partners, with occasional contributions for risky capital during a certain period of time and with the yields agreed by the General Assembly to increase such capital. The partner will have the option to *transfer* his *property rights* to the beneficiary appointed by him in case of death (Art. 11, 14, 49, 50, 63).

These cooperatives will have the *essential equivalence of rights and obligations among the partners* and fair conditions for women; there will be a *single vote per partner*, regardless of his contributions; the work provided by the partners will either be *physical, intellectual or both*; *annual yielding* will be distributed *according to the contribution in work* per partner during a year, taking into consideration that such work can be evaluated from the following factors: quality, time, technical and scholar level. If technological complexity requires, the cooperative will form a Technical Commission among the partners, whose functions will be defined in the constitutive bases; and they will be able to have *payroll staff only in those cases specified* by the law (Art. 11, 28, 29, 64, 65).

Cooperative education and solidarity economy will be compulsory; the following *social funds* can be created: reserve fund, pension fund, and cooperative education fund (Art. 47, 53).

The General Assembly, the Board of Directors, the Surveillance Committee and other commissions will be in charge of the cooperative's direction, administration and internal surveillance as set forth by this Law and by the general Assembly; cooperatives will also be subject to an external monitoring (Art. 20, 34).

Cooperatives will be able to *group* freely in federations, unions or any other legal associative figures aiming at the design and commissioning of strategies of integration of their activities and productive processes, in order to have an access to the economy of scale, cut down expenses, structure production and trading links, and so on (Art. 74, 86).

Federal, state and municipal governments will *support* the development of cooperatives. All the activities related to the constitution and registration of

cooperatives will be *free of taxes and fees*; the Federal Government will create a *guaranty fund* to cover the risk of investment projects of these cooperatives, and it will also grant *discounts* to those *credit institutions* that assist the cooperatives (Art. 91, 93, 94).

iii. Social Solidarity Associations (SSA)

The SSAs are ruled by the Law on Social Solidarity Associations (Official Gazette of the Federation, 27/05/1976), and their partners will be individuals "with the right to work, that will allocate a portion of their work to a social solidarity fund and that will be able to conduct commercial activities", apart from peasants, common land owners (ejidatarios),... (Art. 1).

The *objective* of SSAs is the following: to create jobs, and to produce, industrialize and commercialize the goods and services that may be necessary, ... and their functioning requires the *authorization* from the Secretariat of Work and Social Prevision, where the bases and the articles of incorporation will be registered apart from the previous authorization (Art. 2, 7, 8).

The *social assets* begin with the contributions of partners and donations; the partners commit to provide their personal work and will have the right to receive a *fair share* of the benefits for their participation in the association's productive process; the SSAs will not *use payroll workers* but *specialized* and temporary professional services for those tasks that cannot be attended by the partners (Art. 6, 10, 11, 14, 30).

The General Assembly, the Executive Committee and the commissions set forth in the articles of incorporation or assigned by the Assembly will be in charge of the *direction* and *administration* of the SSA, mainly the Financial and Surveillance Committee and the Education Commission (Art. 16, 24, 27).

The *Social Solidarity Fund* is only applicable to the creation of new or more jobs, training, construction of rooms, medical and educational services, payment of retirement funds and temporary or permanent disability (Art. 32,33).

The Federal Executive branch will be able *to exempt* the SSAs from the obligation of social security regime; federal bodies *will freely advise* the SSAs, which will also be subject to a *preferential credit*; the SSAs will also be able to organize into state federations...(Art. 35, 36, 37, 42).

iv. Concessions

The Law on Property Regime and Public Services of the DF (Official Gazette of the Federation) in chapter II establishes the concepts and regulate the concessions in the DF: The following article is remarkable:

Art. 76. For the purposes of this Law, a concession is the administrative act by virtue of which the Administration grants an individual or enterprise the use or exploitation of *goods* of public domain of the Federal District; in this case, rendering *public service*, which will be subject to the provisions of this Law or others, as well as the declaration of the purpose and the corresponding *concession title*.

The concessions will be granted by the Governor of the DF, reason why it is called a *granting authority*. The dependencies that assist such authority according to their jurisprudence are known as *assistant dependencies* and are in charge of the process to

award a concession, for the regulation, supervision and surveillance of this concession. This concession is through a public bid, which will dispense with the case "*when giving concession can lead to the possibility of monopolies...*".

The *basis* and *specifications* of the *bids* for granting concessions will contain the following at least: ...

V. The minimum technical features required for the service...
VI. A complete description of the technical project...and the minimum specifications (of the services)...
VII. A tariff proposal to render the service and the considerations related to the concession of a good;
VIII. Proposal for the term of the concession (Art. 79).

The granting authority and the assistant dependencies will be empowered to the following:

I. To monitor the concessions and, if the case, to modify them in the most convenient manner;
II. To regulate their performance...;
V. To establish the mechanisms to set, and modify the corresponding prices, tariffs and considerations;
VII. To supervise the works...;
VIII. To establish the modalities required for the most appropriate rendering of public services;
IX. To revoke the concessions (Art. 86).

The concessions... will be granted for a determined period only. The *validity term ... will be fixed*...in such a way that during that time the concessionaire can be able to *financially amortize the total investments that he is to carry out, which can be extended in those previous concessions (Art. 88).*

The *concession title* should contain ...

II. Purpose of the concession ...b) in the case of concessions for rendering public services, determination of the manner and conditions under which said services will be carried out;
III. The mechanisms to set and modify the tariffs...;
VI. Duration of the concession;
VII. Delivery conditions to the compelling authority of the goods and services subject to concession;
VIII. Reasons for revocation and expiration of the concession.

The title will show the dependency that will function as an assistance body, according to the competency set forth by the Organic Law for Public Administration for the Federal District (Art. 89 and 94).

The *modalities* for the concession of *goods* may be as follows: the obligation from the concessionaire to provide maintenance to the good granted, to expand or repair it or to use it for the rendering of a public service. The *modalities* for the concession of public services can be the following: direct investment from the concessionaire,

GDF/concessionaire, the execution of works in goods of the DF or those provided by the concessionaire, or both (Art. 90 and 91).

The rights and obligations derived from the concessions will only be partially or totally transferred to the previous and expedite authorization of the granting authority, when such fact has been set forth in the concession basis. Whenever any of the reasons to terminate the concessions take place, the authority will immediately take possession of the good or public service granted, according to the case (Art. 98 and 103).

v. Administrative Permits (Permits)

The Law on Property Regime and Public Services of the DF (Official Gazette of the Federation) in chapters III and IV establishes the concepts and regulate the permits in the DF; the following articles are remarkable:

Art. 105 and 106. A Temporary Revocable Administrative Permit is the administrative act by means of which the Administration grants an individual or enterprise the *use of real state* from the DF, either being it from public or private domain. These permits can be granted gratuitously or based on valuable consideration. The *validity* of the permit will last for from one to ten years and it can be prolonged.

Articles 109 and 110 establish the causes for the termination of a permit, detailing the causes for revocation.

vi. Public Service when rendered by Private Entities

The Law on Property Regime and Public Services of the DF (Official Gazette of the Federation) in Book No. II deals with this issue: The following articles are remarkable:

Articles 127. The rendering of public services in the DF correspond to the Local Public Administration, without prejudice to commission them, through a limited and temporary concession title, under the cases foreseen by the laws and granted to those who meet the following requirements.

Art. 128 For the purposes of this Law, a public service is the organized activity carried out in accordance with the valid laws in the DF, in order to meet general needs in an obligatory, regular and continuous manner, uniformly and under the same conditions.

Art. 130. In order to allow an *individual* to render a public service, it will be necessary that ... the Governor of the DF grants him a *concession*...

Art. 132. The individual *users* affected by the rendering of granted public services can complain before the General Controllership of the Federal District, so as to begin an investigation and, if the bases are correct ... to compensate the affectation to the users...

Articles 133 and 134. Those who exploit or use a public or private domain good without having obtained the corresponding previous authorization or entered a contact with the compelling authority will be sanctioned, as well as those that do not return it

to the corresponding authority within the term established when the permission or authorization has expired...

F.3.2 Institutional Particulars to be Considered

a. Introduction

The current situation of SWM and the expected one in year 2010 are generally summarized in the following table.

Table F-3: Current status and Expected Future for the SWMS

Components	Status Quo (Dec. 1998)	Desired Status (Dec. 2010)
Source of Wastes	• Separation: not carried out	• Segregation: recyclable/organic/others (100% in the sub-system; recyclable/others (50% in the delegation system)
Specialized Sub-system	• Bids for contracting out	• Granted: collection, processing and sale of recyclable products; collection and composting or organic matter; collection or rejected ones; transfer and transportation. • Authorized: collection, processing and sale or disposal of construction wastes, non-hazardous industrial wastes; collection, treatment and final disposal of medical wastes.
Ordinary Domestic Collection	• Managed by the delegations, strong presence of Section 1 • Charge-free according to the law, paid as tips and *fincas* • Sweepers also carry out this service • A great number of "volunteers" • Scavenging on streets and in-route • Poor sanitary conditions	• Collection granted to enterprises and/or collectors organized into skilled institutions (OW). • A service with laws and direct payments to the concessionaire • Scavenging prohibited, as well as "volunteers"
Street Sweeping	• DGSU: inter-delegational roads; illegal dumping sites • Delegations: everything other than by DGSU • Sweepers also carry out domestic collection	• Delegations carry out all the service • Sweepers employed for sweeping
Collection of Recyclable Products	• Aleatory, by the private sector and pepenadores	• Granted to an enterprise and/or current workers organized in OW

Components	Status Quo (Dec. 1998)	Desired Status (Dec. 2010)
Separation Plants (S/P)	• Operation and maintenance by DGSU • Administration by DGSU, with interference from unions • Exploitation and sale by the unions and their leaders • "Informal" workers	• Granted or permitted to workers and leaders, organized in skilled institutions • Evolution to Processing Plants to add value to the product • Shared charges and costs
Transfer Stations and Final Transportation	• Operation and maintenance by DGSU and its contractors • Administration by DGSU, with interference by the delegation, Section 1 and unions • Short-term contracts	• Granted to a private or parastatal enterprise • Long-term contracts, whenever necessary
Composting Plant	• There exists equipment that has not been operated since the beginning of the 90's in a unit of the DGSU	• Granted to a private or parastatal enterprise if nobody seems to be interested in it • Obligatory acquisition of the production by GDF • Controlled quality
Sanitary Landfill (SL)	• B. Poniente SL: DGSU in charge of the whole • Santa Catarina SL: operation and maintenance by DGSU, administered and exploited by the union • A historical and latent conflict	• B. Poniente SL only • Granted to a parastatal enterprise • Optionally, direct administration by DGSU, contracting long-term services
DGSU	• It rules, supervises and executes the SWMS	• It rules and supervises the SWMS; occasionally, it executes

The following points must be remembered for the current situation:

1. Sanitary Landfill are managed by the DGSU and operated by the contracted parties.
2. TS are administered by the DGSU but with the participation of the delegation where they are located and with Section 1 and they are operated by the parties contracted by the DGSU. Transportation from the TS is somehow controlled by the interests of the Ex-scavengers Groups that use the S/P.
3. The equipment of S/P is managed, operated and controlled by the DGSU and its contracted parties, whereas the production and commercialization of recyclable products is managed by the Ex-scavengers Groups and their leaders.
4. Domestic collection and street sweeping are managed by the delegations, which provide the equipment and maintenance with the participation of Section 1; they are operated by the syndicated employees and their "volunteers" and temporary workers.
5. Private collection does not require an official authorization and is restricted to medical, non-hazardous industrial and construction wastes.
6. Waste generators pay spontaneous tips and *fincas* to the collectors (sweepers included) for the service rendered, whereas the Cleansing Code establishes that the collection of wastes from generators of up to 200 kg/day is charge-free.
7. Labor legislation applicable to the public service favors and strengthens syndicated workers and weakens temporary ones.
8. The legislation to contract services brings as a consequence short-term, restrictive and anti-economic contracts.

The diversity in institutional and informal factors found in some components of SWM suggests the *concession* as an economically feasible and non-shocking solution in political terms. In other components of the SWM, the concession appears again as a good solution, yet inevitably shocking.

The transition from the current status towards the future would be made progressively, integrating into the SWMS informal personnel and entities that are currently accepted and that work efficiently. The specialized sub-system that will kick off in January 1999 will foster regulation and monitoring actions, and at the same time will test and upgrade the proposals of the Master Plan.

F.3.3 Discussion on Stakeholders in "Recyclable" Materials

The following components integrated are considered for the discussion:

- management of the wastes at the source.
- collection.
- separation of recyclable products.
- processing of recyclable products.
- sale of recyclable products.

The **management at the source** would be guided by a Code (which would also inform the citizen on all the stages of SWM) and would be implemented gradually with a help of pilot programs. These programs would be planned and monitored by the SOS/DGSU.

The **collection** and transportation to the middle and/or final destiny would be divided into the Delegation System and the Specialized Sub-system, in accordance with the agreement signed between the GDF and Section 1 of the Unique Syndicate of Workers of the Federal District.

The institutionalization plans that the Sub-system will start and to be concluded in the medium term. On the other hand, the Delegation System will be started institutionalizing in the long term, oriented and stimulated by the results of the Sub-system.

The pre-established objective is to minimize the wastes to be transported to the final disposal, through the utilization of recyclable and compostable products, and the separation at the source. For that purpose, five specialized flows in the sub-system would be implemented, the domestic waste flow being the main one.

The separation plant (S/P) is part of a whole system that requires further analysis, which is shown next.

A S/P and its evolved form as a **processing plant (P/P)** for recyclable products could be productive units of an attractive industry but that depends excessively on the purchasing market -which is in turn conditioned to the prices (generally low) of raw materials and energy, as well as to the fiscal levying system.

This dependency increases with the difficulty of: storing recyclable products (dirty and bulky ones); the numerous labor (that requires payments without any delay, including the social charges); and the low profitability that does not justify a high working capital.

As a general rule, an industrial activity in which the social interest is more important than the economic one, requires investments without any return and operational subsidy -unless the social and tax burdens corresponding the labor should not be paid and at the same time its productivity must be kept at a high level.

The two last conditions suggest that SP should be operated by **organizations of workers (OW)**, which are foreseen in Art. 25 of the federal Constitution as *cooperative associations or social solidarity associations*. However, it should be mentioned that establishment of cooperatives has not succeeded historically in Mexico.

The dirtiness, the low market value and the difficulty to store the recyclable products separated in a plant that receives *mixed wastes* furthermore, the high costs for more than 90% of the mass received to discharge, reload and transport it to the landfill-suggest the validity of the separation of wastes at the source, followed by a differentiated collection, classification and reduction in volume of recyclable products.

When this activity develops, the S/P would require changes to evolve to PP, which would process the clean recyclable products with more appropriate technologies every time to add values on these secondary raw materials.

The flow of recyclable products separated at the source would like to go through **gathering centers** and **processing plants**, so that they can reach the market with value to maintain the flow and obtain some profits. The feasibility of this purpose

depends on the institutionalization of the labor and the flow as a consequence, and the manner to achieve it.

Current S/Ps should like to be integrated into this flow, until the end of their useful span, gradually turning into PP. In this manner, the staff who already have experience in the management of wastes would be used and then the facilities would be utilized efficiently.

The gathering system required for the recyclable product flow must be compatible with the vehicle that transports them.

To utilize the existing conventional collection vehicles is proposed in this Master Plan for the collection of recyclable materials.

Two factors present in the market should not be forgotten:

- recyclable product traders that keep their own gathering centers, are drawing the attention of pepenadores, sweepers and collectors to buy "their" recyclable products.
- tax laws, which grant tax exemptions to the trade of recyclable products, require conditions that are difficult to be fulfilled by the small seller.

The traders mentioned above would not be bothered by the GDF, yet they would be affected by the organized collection system being proposed - as well as the big buyers and their associations, which would cause an increase in the prices, *in a basic and superficial evaluation, without taking into account the advantages of a regular market assisted by the government and of clean recyclable products, maybe previously processed.*

As regard to the tax levying, the GDF should stimulate in real terms the activities that lead to recycling, as well as requesting the same thing to other governmental bodies. A basic and realistic stimulation is to grant a zero rate to the taxes of such activities, which would bring as a result of positive effects in the sales and the information on the market.

F.3.4 Discussion on Improvement of Informal and Voluntary People

Another component for the discussion is the *informal waste collection system*, known herewith as the Delegation System.

Due to the competency shown throughout the years in the domestic collection and street sweeping and the **culture of direct payment for the service rendered**, the workers in charge of this service should have the priority in the **concession** of the ordinary domestic collection service.

The **concession** would be the juridical instrument chosen due to the productivity and the greater political independence of private entities in comparison with public entities, and specially for two basic reasons:

- the existing culture of the *direct payment for the service rendered* presupposes the popular acceptance and success of the payment to the *concessionaire*, rather than any form of payment to the *Public Power*.

- the features mentioned for the collection and pre-processing of recyclable products recommend the *autonomous* work, thus granted, for these activities.

F.3.5 Analysis of the Institutional Alternatives

The analysis of the institutional alternatives will be conducted for each component group in the following order, in response to the strategies on institutionalization (from the downstream components):

- Sanitary Landfill.
- Composting Plant.
- Transfer Stations and Transport.
- Selection Plant.
- Delegation Collection (Sub-system).
- Delegation Collection (By Section 1).
- Inter-Delegation Collection.

F.3.5.1 The Sanitary Landfill

Final disposal would be made at the sanitary landfill (SL) of Bordo Poniente "Etapa IV", alternating with "Etapa V" when each stage has been implemented.

The situation to locate the SL in the lake Texcoco area is sensitive and is subject to restrictions and audits by federal entities and by the GDF, and occasionally by authorities from the state of Mexico. The use of the land owned by the National Water Commission (CNA) was authorized under the commitment of the GDF to carry out work, monitoring and maintenance tasks in the long term. The alternation in the uses of areas IV and V would be a technical decision made according to the features of the soil.

For such reason, the DGSU will have a continuous presence at the site, reason why it would not be very interested to give concession of the construction of infrastructure, operation and maintenance of SL to a private enterprise, and contracting out such services would be convenient.

On the other hand, these conditions suggest that the concessions are similarly attractive as the referred contracts to private enterprises.

The institutional alternatives induce the analysis of two options:

- **SL.1** - To keep the direct administration by the GDF through the SOS/DGSU and **to operate SL through long-term contracts.**
- **SL.2** - To create a **parastatal entity** linked to the SOS to manage and operate the SL; either directly or not.

The advantages and disadvantages of a parastatal entity directly managing the SL are obtained from the legal precepts. In the current case of the SL, it could be said that the superiority of a parastatal entity is not that much in the case of the management of a SL, where there exists no commercial or industrial activity, and the high, intrinsic indirect costs are not diluted in such a small body.

Meanwhile, this superiority would become unquestionable in case that same parastatal entity -as a decentralized body- is granted the SL and the compost plant.

F.3.5.2 The Composting Plant

The composting plant is a production unit of a scarcely attractive industry, due to the difficulty to sell the product or until the potential consumers are correctly oriented and convinced of the need for compost.

As long as it is industry, the CP is part of a waste flow, therefore it is characterized as an "institutional service entity" (Federal Law of Parastatal Companies, Art. 31), and it is also clear that it is not a simple urban cleaning activity.

There is a lack of financial and administrative autonomy for a direct public administration entity to manage and direct a self-sustainable industrial enterprise; therefore, the following alternatives should be studied:

- **CP.1** - Concession of the manufacturing and sale of compost to a private entity.
- **CP.2** - Establishment of a parastatal entity associated to the SOS for that purpose.
- **CP.3** - Establishment of a mixed public and private capital company.

The **first option** would be favorable for the development of the technology of production and use of compost, since the commercialization of the product would determine the survival of this enterprise, which at the same time would not require public investment.

To make this enterprise more appealing, the GDF would guarantee the consumption of a considerable amount of the product, as well as the optional joint concession of the collection of products to be composted in the sub-system.

In view of a possibility that private entities do not show interest in the composting plant, the **second alternative** would appear to be better than the *direct administration* by the GDF from the industrial aspect of this enterprise for the following reasons:

- capacity to set its own entrepreneurial policy and the prices for the private market.
- free management of the revenues generated by its economic activity.
- own property which would be allowed for financial transactions.
- administrative authority and the obligatory internal control and auditing, which leads to a correct assessment of its performance.
- its own identity and minor political interference.
- competition to fix the salaries and fringe benefits, as well as to enter collective and individual contracts that will regulate the labor relations of the entity with its workers (Art. 63 and 64 of the Organic Law).

The autonomy degree of a parastatal entity in the Federal District has improved considerably due to the Organic Law for Public Administration for the Federal District, particularly in regard to the administration of staff and salaries, which are very sensitive items that are mentioned in this Study.

Another critical item is the acquisition of goods and the contracting of services. In this regard, the same code for the direct administration is kept, but the existence of internal control and external surveillance, as well as their higher ranked than a Direction allow the parastatal entities to manage this critical topic with more autonomy.

The intrinsic cost of a parastatal administration is high, due to the fact that its autonomy requires internal and external surveillance bodies, a board of directors, accounting systems, juridical consulting and management of human, financial and material resources similar to those in a Secretariat (which dilutes its costs among several bodies). However, costs can be cut down with greater productivity of the resources applied due to its autonomy and the minor political interference. Therefore, the advantages of a parastatal entity increase proportionally with the resources involved, the commercial relations and its productive activities.

The appropriate parastatal modality would be a **decentralized body (DC)**, since the land would be owned by the GDF only and the main purpose for it would be to render a public service instead of making profits. The trust, which would be a supporting or temporary body of the government would not be an appropriate modality and it would like to be discarded.

The **third option** would make a private entrepreneur trust to begin such enterprise, specially as regards to the consumption of the product. The GDF would integrate its portion of capital with equipment it already has and the land for the facility, thus reducing the investment in currency. The most difficult thing would be to accept a minority participation, either the GDF or a private entrepreneur, which turns this alternative as unfeasible. A *parastatal entity* would be created if a **majority state participation entity** were formed, yet its entrepreneurial activities would be restricted as a DC, and there would be certain commitments with the private partner.

F.3.5.3 Transfer Stations and Transportation

Transfer stations (TS) represent the middle destiny of the wastes collected and constitute a single body along with the transportation to the final destination. This fact justifies the single administration of the transfer station with the transportation in each delegation.

On the other hand, S/Ps receive half of the wastes collected and also constitute a single body along with the transportation to the final destiny, however, joint administration for them would not be feasible due to the particularities that is discussed in the next section.

If it is considered that the features of a TS and transportation by truck as regards to equipment and materials, as well as to the technologies and professional training are considerably opposite, the option to manage separately the TS and transportation can then be chosen. Both services will have to be supported with direct payments by the collecting entities, since they constitute the final part of the collection service.

The institutional forms selected for the analysis were the following:

- **TS.1** - Direct administration by the SOS/DGSU.
- **TS.2** - Indirect administration by a parastatal entity.

- **TS.3** - Private administration under a concession.

The **direct administration** would not certainly eliminate the costs and inconvenient administrative processes of the simultaneous performance of the DGSU: the delegation and the syndicates in the TS, apart from the interference of Ex-scavengers Groups in the transportation. It would be very difficult to set fair prices to receive the wastes brought by the collecting concessionaires, with the risk of politically influenced prices. As a positive aspect, it can be pointed out that the SOS/DGSU already have the operative facilities and the required elements for their maintenance.

The **parastatal administration** would provide new and stronger personality to TS, with the capacity to mitigate the inconveniences mentioned before. The 13 TS would represent a considerable economy of scale to cut down the indirect costs of the entity. Transfer of the assets to the entity would be very easy, and their main positive and negative aspects as an institution were mentioned in the two previous sections.

The parastatal entity, instituted as a DC, would be granted the **concession** by the GDF to render the public service and with the obligation to maintain, renew and expand the facilities and acquire equipment whenever required. The options of integrating both the TS and transportation as one component would depend on the economic study to calculate the investment and costs, even more than operational resources, which could be contracted out to private enterprises during long periods.

The **private administration** could result in lower costs, and also an advantage for the user under the conditions set forth for the **concession** as the modality suggested above. The GDF would be released from a massive investment when the renovation of the fleet were necessary, as well as from financial burdens and from the multiple administrative interference in TS and in the final transportation.

F.3.5.4 Recyclable Product Separation Plants (S/P)

The exploitation of S/P *themselves* could be granted by the GDF as a **temporary revocable administrative permission** or as a **concession**, according to the legislation. In both instances, all operation/maintenance costs would be born by the beneficiary and extensions of such instruments could be allowed if what constructed become as the GDF property.

The beneficiary entity would have to be legally empowered to exercise the inherent industrial and commercial activities of a S/P, which would require the appropriate institutionalization of the workers and Ex-scavengers Groups, since they would be the obvious candidates for the concession.

The *permission* authorizes the use of the good for any lawful purpose, whereas the *concession* allows the use of it to render a *public service.*

Consequently, the concession could be the *unique* and more appropriate instrument to grant, for example, the *joint* exploitation of a S/P and of collection of recyclable products.

F.3.5.5 Delegation Collection (Sub-system by Private Sector)

a. Collection of Markets and Central de Abasto Wastes

Being restricted business and with permanent governmental presence, and due to the necessity to separate the organic wastes to carry them to the composting plant, a concession has more advantages than the *authorization*, since there does not exist demand for several offerers whose competition in prices would certainly decrease the quality of the services.

The concession would set the conditions and the terms for it -which would have to be compatible with the useful span of equipment to be employed (between 5 and 7 years approximately).

F.3.5.6 Delegation Collection (By Section 1)

a. Collection of Domestic Recyclable Products

Due to the reasons discussed in the section F.3.3, this flow could be operated under a concession by integrating the *collection* with *Gathering Centers* (GC). *Gathering Points* (GP) would be included in specific *Collection Zones for Recyclable Products* (CZRP), which would use the labor intensive alternative.

Each delegation would have its GC, preferably located in the land for the TS and providing service to one or more CZRP, according to their potential for recyclable products. The concession for a CZRP would be granted to a cooperative, and recyclable products would be stored in the GC.

GPs would be supporting units for non-motorized pickers of that cooperative and would be included in the same concession -granted by the Governor of the DF-, the delegation being a *Supporting Body.*

Meanwhile, the GC would be granted to the cooperative(s) associated to the same delegation, yet the *Supporting Body* would be the SOS/DGSU, since the GC would be part of a group that would end with the sale of recyclable products and could be integrated in commercial terms with SP/PP (besides, the GC would be preferably located in the TS, which are administered by the SOS/DGSU).

The GC would allow the autonomy of collectors, since they would negotiate the sale of the materials or the integration with SP/PP.

b. Collection of Ordinary Domestic Solid Wastes

As discussed in the section F.3.3, the concession could be the means to be awarded with the collection of these wastes under the following *modalities*:

- equipment supplied by the concessionaire;.
- equipment supplied by the concessionaire and the GDF.

or

- equipment supplied by the GDF only.

The first modality would be utilized for bids among *enterprises*, whereas the other two would be to favor *cooperatives* and/or another institution in which the current collectors would be organized.

In the concessions, the delegations would act as *Supporting Bodies.*

c. Collection of Public Solid Wastes

If it is considered that there exists a great number of sweepers employed and syndicated, who could not be re-allocated in other sectors of the GDF or dismissed, an unfeasible option would be to continue the *street cleaning service* by means of a **direct administration**, represented by the **delegations.**

The *removal* of public wastes, including those from *illegal dumping sites* and from *main roads*, would also be carried out by the delegations -which would become in this manner totally responsible of the local cleaning. This proposal might imply the appropriate modification of the Cleaning Code.

Regardless of any assumption, these operations could be **contracted out** to diverse enterprises, with/without furnishing the equipment.

F.3.5.7 Inter-Delegation Collection

a. Collection of Medical Wastes and Similar Ones

A private collection-treatment-transportation system of pathological and biological-infectious wastes (PBIW) to the sanitary landfill has been already implemented, which was fostered by an agreement reached between the GDF and the Health Service Institute of the DF and the contracting of this service by the hospital network from the GDF, ISSSTE (Institute of Security and Social Service for State Workers) and PEMEX (Mexican Oil Company).

In order to expand the proper management of the diverse types of medical wastes and similar ones to all the generators (hospitals, laboratories, and so forth), the market should be stimulated by applying the concerned laws and by granting a corresponding **authorization title** to those enterprises legally and technically authorized.

This management is characterized as an *inter-delegation specialized activity*, reason why it would be supervised by the central administration of the SOS/DGSU, which would establish the conditions for the authorization and the term for the required periodical renovation of it.

The classification and technical management of medical wastes has a federal code, and the GDF is responsible for regulating the obligations of generators and those who render the service.

b. Collection of Industrial Non-Hazardous Wastes

As in the previous section and with the same objective, the *inter-delegation specialized activity* for the collection-processing-disposal of this type of wastes would be regulated, being carried out by private enterprises authorized by the SOS/DGSU.

The **authorization title** would set the conditions and the required renewal period. There are two important requirements for environmental sanitation: (a) wastes could be carried to an authorized processing plant, where rejected products would go to the sanitary landfill, yet they could not be discharged -previously or later- at a transfer station, due to safety reasons; (b) the control would be conducted through the

responsibility or **declaration** by the generator that there are no hazardous wastes in the load to be delivered. Hazardous wastes are under the federal jurisdiction.

It should be pointed out that the *monitored authorization* allows the market open to stimulate investment and technological contributions, which would be more useful for the generating-paying industry than a concession regime, which requires control in prices and the presence of the government, sometimes with political interference.

c. Collection of Wastes from Civil Constructions

This type of industrial waste does not require the aforementioned *declaration* and can be carried to a TS from the moment at which the separation of its hazardous contents is carried out at the source, commonly in demolition sites.

This flow, including a processing plant if possible, would be also an *inter-delegation specialized private activity*, **authorized** through a **title** granted by the SOS/DGSU to those enterprises empowered and under the conditions and the renovation term accorded. The processing of these wastes tends to be an attractive economic activity, as construction material for public and private use is produced.

F.3.6 Hypothetical Case Studies

Next, some hypothesis for the application of concepts discussed above are shown, yet it is pointed out that the effective ways to be followed would be achieved through meetings with the workers involved and negotiations with the Ex-scavengers Groups and Section 1, and possibly with other entities.

Due to the importance of these negotiations, it would be wise that the SOS/DGSU choose a small study group with engineers and lawyers experienced in the local affairs, so as to get to know the ways to be followed and consult during the negotiations in the appropriate time.

In total eight flows from origin to final destination are presented herewith as hypothetical case studies, in order to view and examine:

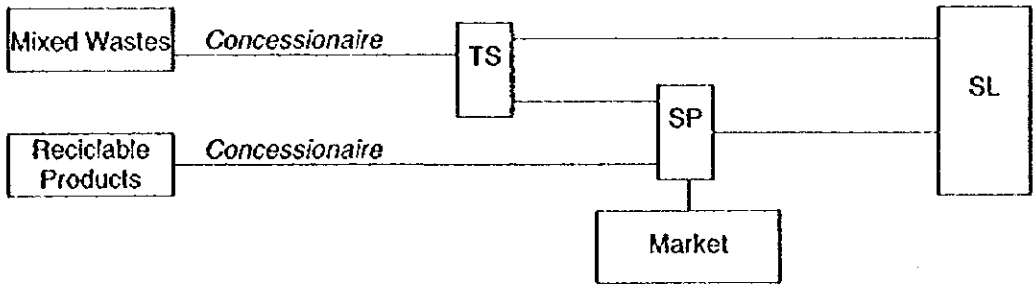
- pros and cons of institutionalization options for respective components in SWM for each case.
- possible benefits and disbenefits of all respective stakeholders in the SWM for each case.

The total eight flows of the hypothetical case studies comprises:

- three cases for the delegational collection (currently by Section 1).
- five cases for the sub-system.

F.3.6.1 Case Studies for Delegational Collection (currently by Section 1)

a. Case Study Flow 1



Conditions

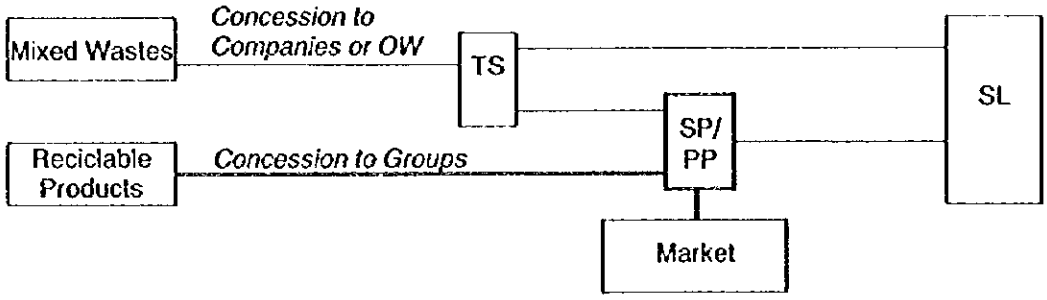
1. Concession to private entities.
2. The user pays for the collection of mixed and recyclable products.
3. S/P are utilized by the Ex-scavengers Groups.

Primary Evaluation according to the Current Situation

ITEMS	POSITIVE	NEGATIVE
Cost for the user	--	Extremely high
Cost for the GDF	Lower	--
Unemployment	--	very high
Separation at the source	--	No interests for the user
Ex-scavengers Groups	--	Stronger economically and having a political voice No interest in changes
Section 1	--	Total loss reaction can not be ignored
GDF	Complete institutionalization of collection Easy administration. No further collection investment.	Insignificant reduction of wastes that go to the SL. Huge reaction by syndicate and politicians. No expense reduction with S/P (*)

Note: (*) First, an agreement with Ex-scavengers Groups to institutionalize them is required to grant permissions for the use or concessions, by establishing their obligations as regards to the operation and maintenance before delivering separated recyclable products.

b. Case Study Flow 2



Conditions

1. Concession to companies or OW (of current workers) of the collection of mixed wastes.
2. Concession of the collection, processing and sale of recyclable products to the Ex-scavengers Groups, which would absorb the costs of SP/PP.
3. A charge-free collection of recyclable products, subsidized by the GDF.

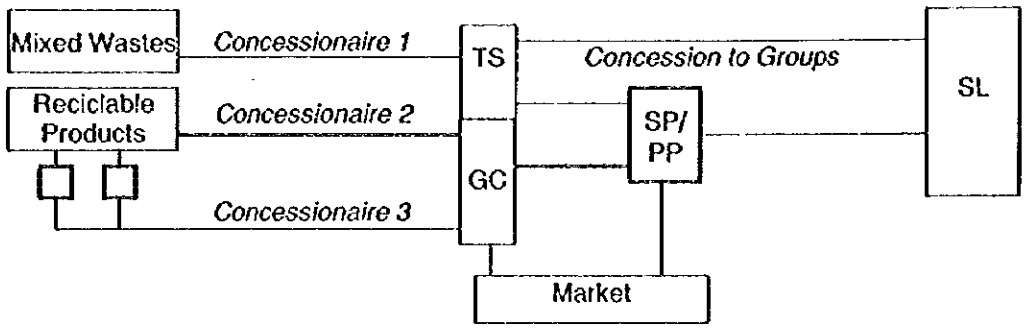
Primary Evaluation according to the Current Situation

ITEMS	POSITIVE	NEGATIVE
Cost for the user	Lower	--
Cost for the GDF	Very low	--
Unemployment	Legalization of employees	very high
Separation at the source	High interest	--
Ex-scavengers Groups	Conveniently institutionalized	Reaction of leaders Reaction of politicians
Section 1	--	Total loss Huge reaction (*)
GDF	Complete institutionalization of collection and S/P Easy administration, small structure.. No new collection investment. Slight reduction for SL.	Huge reaction by syndicate and politicians (*). Subsidy necessary for collection of recyclable products. Investment to evolve from a S/P to a PP(**)

Note (*) First, an agreement with Section 1 to organize their associates into OW skilled to compete for the concession of collection systems is needed.

(**) Negotiation with the purchasers of recyclable products on a portion of the investments is needed.

c. Case Study Flow 3



Conditions

1. Concession 1 to enterprises or OW (current collectors of Section 1).
2. Concession 2 to OW (current "voluntary" collectors).
3. Concession 3 to OW (current "voluntary" collectors).
4. The squares represent GP in the figure
5. Concession to Ex-scavengers Groups and the costs absorbed by them, investments by the GDF for PP.
6. Negotiations between OW and Ex-scavengers Groups with the alternative of direct sale to the market.
7. Collection of recyclable products is charge-free for the users.

Primary Evaluation according to the Current Situation

ITEMS	POSITIVE	NEGATIVE
Cost for the user	Lower	--
Cost for the GDF	Very low	--
Unemployment	Does not exist, the workers are the owners of OW	--
Separation at the source	High interest	--
Ex-scavengers Groups	Conveniently institutionalized	Reaction of leaders Reaction of politicians
Section 1	Conveniently institutionalized	Reaction of leaders Reaction of politicians
GDF	Complete institutionalization of collection and S/P No collection investment. Slight reduction for SL. Huge reduction in the number of employees	Subsidy or facilities required for recovery of recyclable products Investment to evolve from a S/P to a PP(*) Intensive assistance required by the OW.

Note (*) Negotiation on the investments with the purchasers of recyclable products is needed.

F.3.6.2 Case Studies for Flows of Delegational Collection (Sub-system)

As a result of the agreement signed between the GDF and Section 1 of the Unique Syndicate of Workers of the DF in August 1998, a ***Specialized Sub-system for SWM*** that involves the general coverage services in the city and technically specialized is proposed to be institutionalized.

The delegation of services would be done under **concession** and **authorization**.

The first one would be applied as long as the direct collection of the service is feasible, there is an economic activity involved and the plurality of service entities is anti-economic or may hinder the public action. It should be applied for the collection, transfer and processing of wastes.

The second one would be applicable as long as the direct collection of the service is feasible, there is a predominant economic activity involved, the public action required is nothing but a simple regulation and the technical and legal skills of the service offerers are proved.

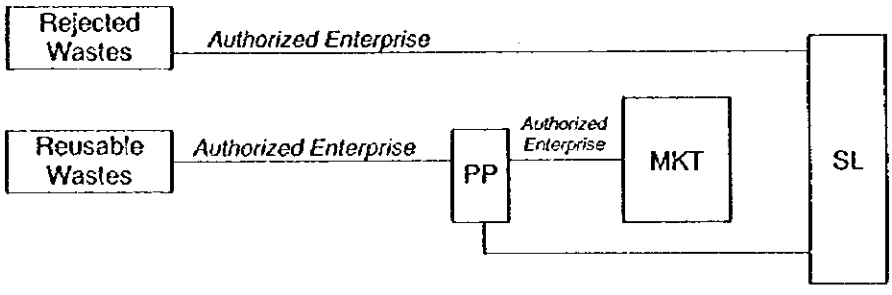
The specialized services would still follow the current practices unless the charge-free domestic collection were eliminated, the SMW codes for those who render the service and the users were issued, and also the **contracting** instrument were adopted before the concession.

The Specialized System encompasses the following flows and with a clearly defined origin:

- the flow of non-hazardous industrial wastes.
- the flow of civil construction wastes.
- the flow of market and Central de Abasto wastes.
- the flow of school wastes an other institutions.
- the flow of low-rent housing complex wastes.

d. Case Study Flow 4

The Flow of Non-Hazardous Industrial Wastes



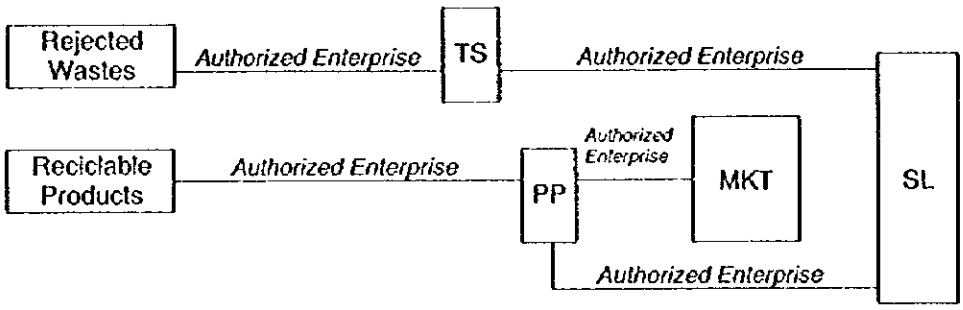
Conditions

1. Laws and renovation term set forth in the Authorization Title.
2. Reusable wastes could be carried to a Processing Plant (PP).

3. The use of **TS** would not be allowed for safety reasons. The generators sign a declaration stating that there are no hazardous wastes in the load delivered to the collector.

e. Case Study Flow 5

The Flow of Civil Construction Wastes

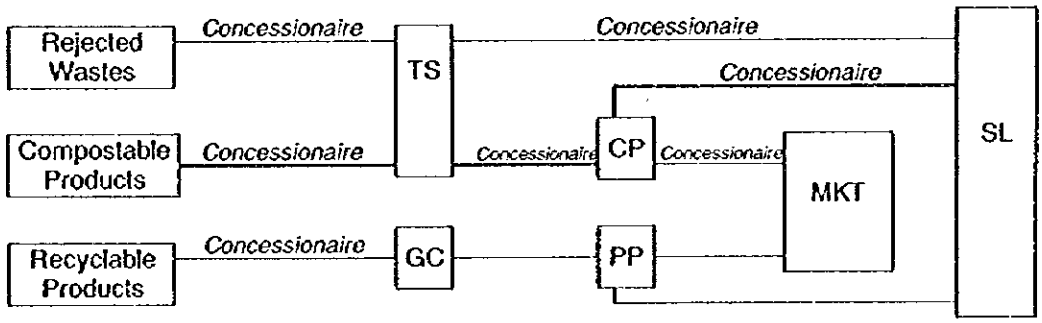


Conditions

1. Laws and renovation term set forth in the Authorization Title.
2. Reusable wastes could be carried to a Processing Plant (PP).
3. The use of TS would be allowed.

f. Case Study Flow 6

The Flow of Wastes from Markets and Central De Abasto

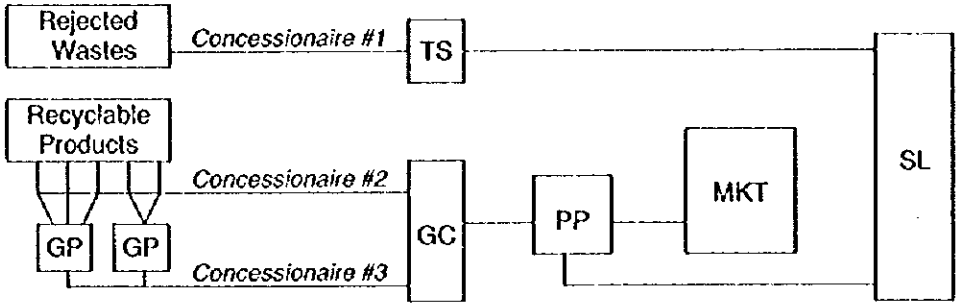


Conditions

1. The Composting Plant (CP) and the sale of the product would be granted to a private enterprise or to a DB linked with the SOS.
2. The collection of compostable products could also be granted to the same concessionaire.
3. (Free) collection of recyclable products could be granted to an OW, which could use a Gathering Center (GC) or deliver them directly to a SP/PP.
4. Collection of rejected wastes could be granted to a collector of ordinary wastes.
5. The total collection could be granted to the same concessionaire.

g. Case Study Flow 7

The Flow of Wastes from Schools and other Institutions



Conditions

1. (Free) collection of recyclable products could be granted to an **OW**, which could use a Gathering Center **(GC)** or deliver directly the wastes to a **SP/PP.**
2. Collection of recyclable products in non-motorized vehicles could be shared with the **OW**, which would be allowed to use Gathering Points **(GP).**
3. The collection of rejected wastes would be granted to private entities or the **OW** constituted by current collectors.

h. Case Study Flow 8

The Flow of Low-rent Housing Complex Wastes

It would be exactly the same as the previously mentioned, as well as the conditions for it. Additional factors would be the possibility of some dwellers of the complex that use the service to participate in the **OW** along with workers of the domestic collection.

F.3.7 Synthesis of the Institutional Consideration Proposed

	Phase 1 (1999-2001)	Phase 2 (2002-2004)	Phase 3 (2005-2010)
Source	Code, rules Educational program with Environmental and Education Departments; separation of wastes Evaluation of sub-system	Educational program with Environmental and Education Departments; separation of wastes	Educational program with Environmental and Education Departments; separation of wastes
Sub-system	Code, rules Contracting out collection services	Code, rules, revision, complete Audit and supervise services Organize DGSU and services, train staff Promote private interests for industrial and construction wastes Grant collection service of waste from markets and Central de Abasto, institutions and housing complexes	Audit authorized services Audit and supervise granted services
Collection of recycl. Products	Code, rules Alternative study for granting services, possible effects, strategies for harmonization Survey of acceptable institutional Modalities for Ex-scavengers Groups and collectors	Organize and operate consultation to institutionalize workers Develop harmonization with recognized and emerging leaders, looking forward to allowing workers for future concessions	Begin concessions Audit and supervise granted services Keep consulting for institutionalization of workers
Ordinary collection	Code, rules Alternative study for granting the services, possible effects, strategies for harmonization Survey of acceptable institutional Modalities for Section 1, collectors and volunteers	Organize and operate consultation to institutionalize workers Develop harmonization with recognized and emerging leaders, looking forward to allowing workers for future concessions	Begin concessions Audit and supervise granted services
SP/PP	Alternative study for granting the services, permissions for SP and related services, possible effects, strategies for harmonization Survey of acceptable institutional Modalities for Ex-scavengers Groups	Organize and operate consultation to institutionalize workers Develop harmonization with recognized and emerging leaders, looking forward to allowing Ex-scavengers Groups for future concessions or permissions	Begin concessions Audit and supervise services
TS and Final Trans.	To choose the best option TS2 or TS3 Prepare the corresponding laws and codes	Implementation, according to the option TS2: constitution, securing resources, organization, staff,	Functioning TS2: contracts, investments

	Phase 1 (1999-2001)	Phase 2 (2002-2004)	Phase 3 (2005-2010)
		functioning, prices, contracts for services, investments TS3: regulate, bid, functioning, monitoring	TS3: monitoring
Compost Plant	Choose the best option: CP1 or CP2 CP1: legislate, bid, construct, implement CP2: constitution, securing resources, organization, staff, investment, construction, implementation	Implementation, according to the option: CP1: monitoring, purchase the compost CP2: functioning	CP1: monitoring, purchase the compost CP2: functioning
SL	Choose best option: SL1 or SL2 SL1: contract out long term services SL2: constitute, securing resources, organization, personnel SL1 or SL2. Operation of Etapa IV, construction of Etapa V	SL1 1or SL2: to operate Etapa V	SL1 or SL2: operation of Etapa IV and V, alternatively

Annex G

The Master Plan

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G.1 Outline of the Mater Plan

G.1.1 Discharge and Storage System

At present, source separation is not realized in the DF. Taking account of the future consequence of SWM in the DF, however, source separation is indispensable. The following is the plan for source separation proposed by the M/P.

a. Time Schedule

Separate discharge is to be introduced step by step into the sub-system aiming at 100% separation rate in 2004 in the M/P.

On the other hand, a "source separation" program is to be introduced in later years to the generators whose waste collection services are currently provided by the delegations more gradually with due attention by making use of experience gained in the sub-system aiming at a 50% separation rate by 2010.

The separate discharge and collection program in the M/P is presented in Figure G-1.

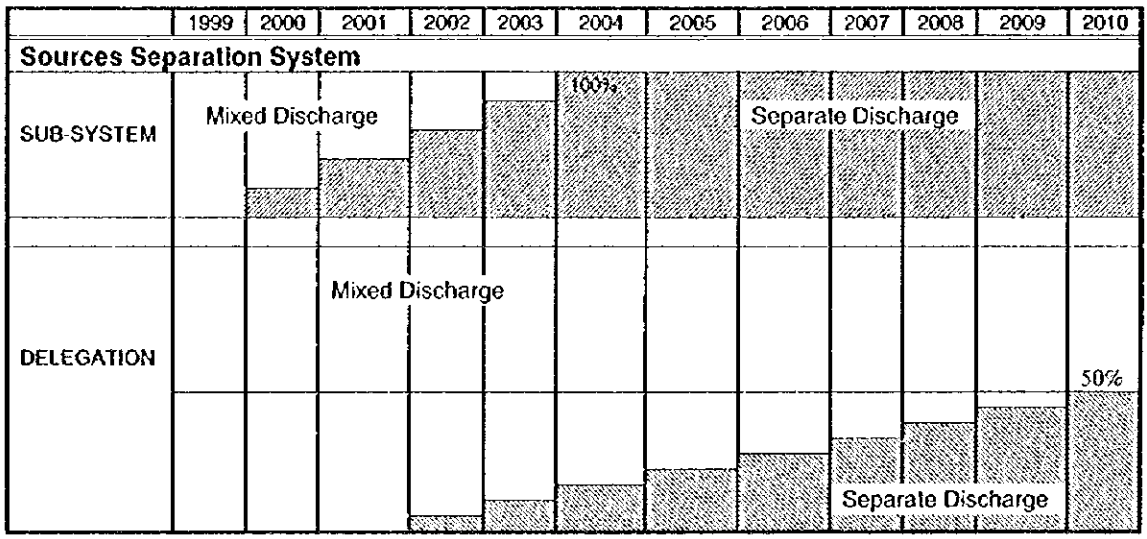


Figure G-1: Separate Discharge and Collection Program

b. Separation Categories

The success in shifting the generators' behavior from mixed waste discharge to source separation largely depends on morals and devotion of themselves. Namely, **the fewer** the separation categories are, **the higher** possibility of **success** they may have in the source separation.

Since 1996, the DGSU has been carried out a pilot program of three categories source separation in some public institutions and housing units, in which totally about 8,500 people are cooperating. 92% source separation was achieved on average in 1998.

In view of this result, the source separation categories in the sub-system are proposed to be **three** (organic, recyclable, and others).

The above pilot project might possibly have gained a good devotion of rules observance from the generators, since they were public institutions and housing units where the collective cooperation were easily expected, and in turn unanimously responded to the project.

On the other hand, the collection services by the delegations are provided for individual generators, whose laborious commitments in source separation are difficult to seek. Since it is anticipated that the same three categories source separation (as the pilot project) can not be easily achieved by generators in the delegation services, it is proposed to employ the simplest separation categories (i.e., **two categories** (recyclable, and others)) for the source separation in the delegation services.

Table G-1: Source Separation Item

System	Separation type	Waste category
Sub-system	3 categories separation	organic, recyclable, and others
Delegation	2 categories separation	recyclable, and others

G.1.2 Collection and Haulage System

a. Collection Methods

Collection methods for separately discharged wastes comprise such as:

- **Normal vehicle collection**
- **Point collection**
- **Special vehicle collection**

In view of an advantage of utilizing the existing collection system (i.e., maximum use of current resources and cost saving), **normal vehicle collection** appears to be most recommended as the separate collection method in the M/P. Meanwhile, as for the separate collection for markets, in which limited in number of major generators are put together, **point collection** could be recommended, if the collection point can be managed as part of market facilities.

b. Haulage System

b.1 Transfer Station

Currently visual waste inspections are carried out at the transfer stations, in order to determine the optimum waste destination (S/P or final disposal site) for respective incoming wastes. Therefore, even in a case where separate collection is implemented in the future, it is judged that the present system of transfer stations can cope with the change.

b.2 Transportation

Separate transport routes by which wastes are transported are: from station to S/P, from station to final disposal, and from S/P to final disposal. Therefore, it is judged

that present system can be adapted to the future transportation system in which mixed waste and separate waste are to be transported independently.

G.1.3 Intermediate Treatment System

The objectives of the intermediate treatment system are the minimization of waste volume to be disposed of and material recycling. There are three selection plants in the DF, but their material recovery ratio is not high enough.

In the M/P, the efficiency upgrading of these S/Ps and the installation of a new compost facility are planned. The compost facility will be fed with organic waste from the sub-system and its capacity is expanded as the source separation program proceeds.

In Phase 3, the latter half of the M/P (2005-2010), when and if the shortage of the final disposal site is anticipated to emerge, possibility of the introduction of an incinerator should be examined.

G.1.4 Final Disposal System

The standard of the final disposal method employed by the GDF at present is high and the minor improvement of the leachate treatment system should be enough to operate the Bordo Poniente final disposal site technically satisfactorily.

However efficiently the Bordo Poniente final disposal site is used, it is certain that the GDF needs another new final disposal site around 2013 in addition to Etapa V. Under the present land use condition in the DF, however, obtaining a new land for the final disposal within the DF is very likely to encounter serious difficulty.

As it is anticipated that substantially long time of discussion will be required before its implementation, the coordination with municipalities outside of DF for the future landfill (to be used after the year 2013) should be started at latest in the year 2007 or around by the GDF and other entities.

G.1.5 Outline of the Master Plan

Table G-2 shows outline of the master plan.

Table G-2: Outline of the Master Plan

			Data of 1997	Phase 1 (1999 - 2001)	Phase 2 (2002 - 2004)	Phase 3 (2005 - 2010)
Population			8,610,000	8,654,000-8,747,000	8,796,000-8,896,000	8,946,000-9,206,000
Waste generation amount (ton/year)						
	Household		1,926,000	1,946,000-1,965,000	1,976,000-1,998,000	2,009,000-2,072,000
	Commercial		1,210,000	1,217,000-1,223,000	1,229,000-1,236,000	1,244,000-1,267,000
	Service		636,000	642,000-649,000	652,000-657,000	659,000-669,000
	Special		130,000	131,000-134,000	134,000-136,000	136,000-140,000
	Others		267,000	268,000-270,000	271,000-275,000	276,000-282,000
	Total		4,169,000	4,204,000-4,241,000	4,262,000-4,302,000	4,324,000-4,430,000
Discharge/Storage						
	Sub System		-	Introduction of source separation	Introduction of source separation	Maintaining source separation
	Delegation		Mixed	Mixed	Introduction of source separation	Introduction of source separation
Collection						
Amount (ton/year)	Sub System		-	853,000-858,000	861,000-867,000	870,000-884,000
	Delegation		4,169,000	3,293,000-3,325,000	3,342,000-3,376,000	3,395,000-3,485,000
Method	Sub System		-	Introduction of separate collection	Introduction of separate collection	Maintaining separate collection
	Delegation		Mixed	Mixed	Introduction of separate collection	Introduction of separate collection
Transfer Station and Transport						
Transfer Station and Transport				• Installation of weighbridges for every station. • Utilization of a single common format for data compilation	• Utilization of the transport monitoring and control system (for 5 flows[1]) based on the accurate incoming/outgoing weight measuring • Efficient transport allocation by the monitoring and control system	
Transfer amount (ton/year)			3,123,000	3,725,000-3,757,000	3,776,000-3,812,000	3,830,000-3,922,000
O&M cost(U$/year)			43,547,000	51,941,000-52,387,000	52,652,000-53,154,000	53,405,000-54,688,000
Intermediate Treatment						
Selection plant				• Experiment of operation modification to incorporate an objective of quantity oriented picking. • Experiment of "storage system" for recovered materials to cope with market prices fluctuation.	• Implementation of operation control with 2 objectives of: - revenue oriented picking; -quantitative picking, • Establishment of "storage system" for recovered materials to cope with market prices fluctuation, in view of experiment results.	• Implementation of operation control with the major objective of "quantity oriented picking". • Utilization of the optimum "storage system" for recovered materials to cope with market prices fluctuation.
Input amount (ton/year)	Mixed		1,794,000	1,650,000-1,546,000	1,288,000- 725,000	567,000 - 0
	Recyclable		-	0 - 98,000	210,000-438,000	504,000-844,000
Recycle amount(t/y)			182,000	166,000-224,000	277,000-380,000	409,000-591,000
Recovery rate (%)			10.0	10.0-13.6	18.5-32.7	38.2-70.0
O&M cost (US$ 1,000)			11,232	10,565 - 10,537	9,857 - 8,296	7,867 - 6,809
Composting plant			-	Design and construction	Starting operation	Operation and maintenance
Input amount (ton/year)			-	-	253,000 - 424,000	425,000 - 431,000

[1] 5 flows refer to current waste flows (from the transfer stations to the S/Ps, from the transfer stations to the final disposal sites, and from the S/Ps to the final disposal site) and additional flows from the transfer stations to the NIT and the NIT to the final disposal site.

		Data of 1997	Phase 1 (1999 - 2001)	Phase 2 (2002 - 2004)	Phase 3 (2005 - 2010)
Compost production amount (ton/year)		-	-	34,000 - 57,000	57,000 - 58,000
Investment (U$D)		-	3,959,000	1,345,000	1,334,000
O&M cost(US$/year)		-	0 - 33,000	1,185,000 - 1,343,000	1,343,000 - 1,343,000
Final Disposal					
Final Disposal Site		BP "Etapa IV" Santa Catarina	BP "Etapa IV" vertical expansion Design & construction of BP "Etapa V"	Operation of BP "Etapa V"	Operation of BP "Etapa IV" & "Etapa V"
Disposal amount (ton/year)	GDF	3,489,000	3,619,000 - 3,592,000	3,325,000 - 3,101,000	3,089,000 - 2,994,000
	Edo. Mexico	262,000	284,000	284,000	284,000
	Total	3,751,000	3,903,000-3,876,000	3,609,000-3,385,000	3,373,000-3,278,000
Investment (US$)		-	12,708,000	-	-
O&M cost (US$/year)	Bordo Poniente	9,925,694	8,570,000 (2001)	9,400,000 (2003)	4,072,000 (2005)
	Santa Catarina	?	-	-	-
Others					
Street sweeping	Length (km/day)	1,273.4	1,285-1,296	1,303-1,316	1,323-1,357
	O&M cost (US$/y)	3,293,000	3,323,000-3,352,000	3,369,000-3,403,000	3,421,000-3,509,000

Note: US$ 1 = 9.1 pesos.

G.2 Description of the Master Plan

G.2.1 Projection until 2010

a. Population

Table G-3 presents the population data and forecast from 1997 to 2010, which are officially approved by DGSU.

Table G-3: Population Forecast

Delegation \ Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Alvaro Obregon	688,923	691,954	694,999	698,057	701,338	704,634	707,946	711,273	714,616	717,975	721,349	724,739	728,145	731,600
Azcapotzalco	439,188	440,286	441,387	442,490	443,729	444,971	446,217	447,466	448,719	449,975	451,235	452,498	453,765	455,100
Benito Juarez	376,576	377,517	378,461	379,407	380,469	381,534	382,602	383,673	384,747	385,824	386,904	387,987	389,073	390,200
Coyoacan	703,086	706,250	709,428	712,620	716,753	720,910	725,091	729,297	733,527	737,781	742,060	746,364	750,693	755,100
Cuajimalpa	147,340	149,874	152,452	155,074	157,788	160,549	163,359	166,218	169,127	172,087	175,099	178,163	181,281	184,500
Cuauhtemoc	538,315	539,930	541,550	543,175	544,967	546,765	548,569	550,379	552,195	554,017	555,845	557,679	559,519	561,400
Gustavo A.Madero	1,214,625	1,215,840	1,217,056	1,218,273	1,219,857	1,221,443	1,223,031	1,224,621	1,226,213	1,227,807	1,229,403	1,231,001	1,232,601	1,234,300
Iztacalco	414,048	414,172	414,296	414,420	416,119	417,825	419,538	421,258	422,985	424,719	426,460	428,208	429,964	431,800
Iztapalapa	1,717,259	1,726,360	1,735,510	1,744,708	1,756,572	1,768,517	1,780,543	1,792,651	1,804,841	1,817,114	1,829,470	1,841,910	1,854,435	1,867,100
M.Contreras	221,463	224,295	227,169	230,077	231,480	232,892	234,313	235,742	237,180	238,627	240,083	241,548	243,021	244,600
Miguel Hidalgo	367,495	368,597	369,703	370,812	372,036	373,264	374,496	375,732	376,972	378,216	379,464	380,716	381,972	383,300
Milpa Alta	75,856	76,921	77,990	79,074	80,205	81,352	82,515	83,695	84,892	86,106	87,337	88,586	89,853	91,200
Tlahuac	264,349	268,050	271,803	275,608	280,321	285,114	289,989	294,948	299,992	305,122	310,340	315,647	321,045	326,600
Tlalpan	600,700	606,590	612,535	618,538	624,785	631,095	637,469	643,907	650,410	656,979	663,614	670,317	677,087	684,000
V.Carranza	471,241	472,466	473,694	474,926	476,303	477,684	479,069	480,458	481,851	483,248	484,649	486,054	487,464	488,900
Xochimilco	326,658	331,231	335,868	340,570	343,942	347,347	350,786	354,259	357,766	361,308	364,885	368,497	372,145	375,900
DF Total	8,567,135	8,610,336	8,653,901	8,697,829	8,746,664	8,795,896	8,845,533	8,895,577	8,946,033	8,996,905	9,048,197	9,099,914	9,152,063	9,205,600

b. Waste Generation Amount and Composition

b.1 Waste Generation Amount

b.1.1 Waste Generation Ratio

The waste generation ratio of OECD member countries ranges from 800 to 1,900g/person/day, and its average is about **1,370g/person/day**[2].

On the other hand, the waste generation amount in DF is calculated as 11,422 ton/day and its population is forecast at 8,567,135. The waste generation ratio derived from these figures is **1,333g/person/day**, which is as high as the average of the OECD member countries.

Table G-4: Example of Waste Generation Ratio in OECD Countries

Country	Generation Ratio (kg/person/year)	Generation Ratio (g/person/day)
Japan	408	1,118
USA	710	1,945
France	328	899
Denmark	475	1,301
Portugal	259	710
Spain	322	882
OECD	500	1,370

source : Environmental Indicators OECD 1994

The waste generation ratio ranges widely depending on the cultural practices, economical situations, and consumption trends in respective societies, among which economical situation will mainly determine the magnitude of the waste generation ratio. People in economically developing countries, in which the living standards are low, generate less waste and reuse and recycle more, therefore, their waste

[2] Environmental Indicators, OECD 1994

generation ratios are in a low range (Table G-5). Therefore, in order to estimate future waste amount especially in developing countries, it is important to consider the indicators such as economic growth rate for estimating the future waste generation ratio.

Table G-5: Example of Waste Generation Ration in Developing Countries

Country/City	Year	Generation Amount (ton/day)	Population	Generation Ratio (g/person/day)
Paraguay/ Asuncion	1994	793	1,163,598	682
Tanzania/ Dar es Salaam	1996	1,771	2,030,000	872
Honduras/ Tegucigalpa	1997	480.7	848,859	566

source : results of JICA study

On the other hand, the economy level of DF is already higher than the average of middle income countries and its waste generation ratio is at the same standard as other industrialized countries. It is expected that the municipal SWM by DF in the future will focus on waste minimization programs. Therefore, the future trends of waste generation ratio in DF will be toward a little increase or a little decrease from that of today. Consequently in this M/P, the future waste generation ratio is set up at the present waste generation ratio.

The generation ratio at each source surveyed by the DGSU is shown in Table G-6.

Table G-6: Waste Generation Ratio

Type of Source Generation	Classification	Generation Ratio	
Domestic	Household	0.616	kg/Person/Day
Commercial	Commercial Establishment		
	- Auto Service Shop	637.000	kg/Establishment/Day
	- Department Store	368.000	kg/Establishment/Day
	- Commercial Place	6.650	kg/Establishment/Day
	Market		
	- Meat Market	4.430	kg/Stall/Day
	- Vegetable Market	7.920	kg/Stall/Day
	- Grocery store	1.025	kg/Stall/Day
	- Food Preparation	14.960	kg/Stall/Day
	- Various	0.803	kg/Stall/Day
	- Shifting Market (Tianguis)	575.800	kg/Tianguis/Day
Service	Restaurant and Bar	25.442	kg/Establishment/Day
	Amusement and Sports Center		
	- Amusement Center	1.230	kg/Employee/Day
	- Sports Center	2.620	kg/Employee/Day
	- Cultural Center	0.330	kg/Employee/Day
	Public Service		
	- Services Office	3.460	kg/Establishment/Day
	- Repair and Maintenance Service	1.940	kg/Establishment/Day
	- Gas station	53.120	kg/Establishment/Day
	Hotel		
	- Five-star hotel	1,016.900	kg/Establishment/Day
	- Four-star hotel	218.500	kg/Establishment/Day
	- Three-star hotel	16.810	kg/Establishment/Day
	Education Center		
	- Kindergarten	0.040	kg/student/Day
	- Elementary School	0.055	kg/student/Day
	- Job Training Center	0.060	kg/student/Day

Type of Source Generation	Classification	Generation Ratio	
	- Junior High School	0.065	kg/student/Day
	- Technical School	0.060	kg/student/Day
	- Senior High School	0.060	kg/student/Day
	- University	0.070	kg/student/Day
	Public Office	0.413	kg/Employee/Day
Special	Medical Institution		
	- 1st. Level	1.279	kg/Consultation Room/Day
	- 2nd. Level	4.730	kg/Bed/Day
	- 3rd. Level	5.390	kg/Bed/Day
	Laboratory	6.340	kg/Laboratory/Day
	Veterinary	1.700	kg/Employee/Day
	Bus Terminal	2,103.000	kg/Terminal/Day
	Airport	28,887.000	kg/Airport/Day
	Road Sweeping	125.530	kg/km/Day
	Social Rehabilitation Center	0.540	kg/Person/Day
Others	Green Area	0.00993	kg/m^2/Day
	Bulky Waste	28.850	kg/Ton-Solid Waste/Day
	Demolition Waste and Small Repair	20.850	kg/Ton-Solid waste/Day

b.1.2 Waste Generation Amount

The future waste amount is forecast by multiplying the waste generation ratios listed in Table G-6 by factors such as population, employees and number of shops listed in Table G-7. The factors such as employees and number of shops are estimated to increase in proportion to the population. However, as for the large-scale public facilities such as airports and bus terminals, the factor (the future quantity) is estimated to be the same as present.

Meanwhile, future wastes brought from the 10 municipalities in the Mexico State are assumed to be the same as present (i.e., 284,000 ton/year) based on the DGSU's estimation.

Table G-7: Factors for Waste Generation

Year	Commercial			Market						Service			
	Auto service shop	Department store	Commercial place	Meat	Vegetable	Grocery	Food preparation	Various	Shifting market (tianguis)	Restaurant & Bar	Amusement center	Sports center	Cultural center
	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Employee	Employee	Employee	Employee
1999	759	350	168,063	6,469	21,979	8,451	9,093	26,413	1,217	29,470	25,950	13,009	481
2000	761	352	168,795	6,493	22,058	8,487	9,131	26,511	1,225	29,581	26,060	13,080	487
2001	764	352	169,572	6,516	22,143	8,524	9,169	26,610	1,230	29,695	26,175	13,155	491
2002	769	354	170,449	6,548	22,231	8,566	9,213	26,730	1,238	29,831	26,307	13,235	494
2003	772	357	171,258	6,574	22,317	8,605	9,253	26,830	1,246	29,955	26,427	13,308	498
2004	773	359	172,066	6,602	22,404	8,645	9,293	26,935	1,251	30,081	26,540	13,380	503
2005	778	359	172,957	6,630	22,500	8,684	9,340	27,056	1,260	30,218	26,673	13,465	507
2006	781	362	173,763	6,651	22,578	8,726	9,377	27,157	1,267	30,341	26,794	13,540	512
2007	783	361	174,613	6,684	22,668	8,767	9,420	27,271	1,272	30,469	26,924	13,620	515
2008	787	367	175,483	6,712	22,759	8,806	9,458	27,379	1,280	30,600	27,047	13,697	522
2009	790	368	176,329	6,738	22,847	8,848	9,503	27,489	1,290	30,729	27,169	13,776	525
2010	797	369	177,229	6,769	22,940	8,890	9,546	27,608	1,294	30,868	27,303	13,858	529

Year	Public Service			Hotel				Education						
	Service office	Repair & maintenance service	Gas station	Five stars	Four stars	Three stars	Public office	Kindergarten	Elementary school	Job training center	Junior high school	Technical school	Senior high school	University
	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Employee	Students	Students	Students	Students	Students	Students	Students
1999	31,034	26,045	237	32	46	489	1,354,903	291,292	1,094,532	91,270	518,767	63,580	327,285	277,959
2000	31,153	26,152	237	32	46	490	1,360,399	292,755	1,100,008	91,577	521,287	63,886	328,599	279,304
2001	31,277	26,267	239	32	46	491	1,366,164	294,295	1,105,845	91,917	523,970	64,204	329,954	280,635
2002	31,423	26,399	239	32	47	493	1,372,823	296,004	1,112,316	92,325	526,964	64,555	331,541	282,167
2003	31,555	26,521	240	32	47	494	1,378,904	297,618	1,118,411	92,690	529,777	64,887	332,995	283,663
2004	31,683	26,640	242	32	47	496	1,384,972	299,221	1,124,475	93,050	532,578	65,216	334,432	285,144
2005	31,830	26,774	243	32	47	498	1,391,743	300,966	1,131,075	93,468	535,641	65,579	336,050	286,702
2006	31,964	26,894	246	32	47	501	1,397,781	302,605	1,137,261	93,832	538,494	65,915	337,516	288,203
2007	32,102	27,019	249	33	47	503	1,404,173	304,266	1,143,536	94,218	541,388	66,258	339,004	289,688
2008	32,241	27,149	250	33	47	504	1,410,645	306,007	1,150,131	94,599	544,427	66,611	340,559	291,348
2009	32,376	27,277	250	33	47	506	1,417,009	307,711	1,156,585	94,978	547,408	66,957	342,106	292,894
2010	32,525	27,412	251	33	47	509	1,423,780	309,479	1,163,255	95,392	550,497	67,325	343,700	294,441

Year	Medical Institution			Laboratory	Veterinary	Bus Terminal	Airport	Road Sweep	Social Rehabilitation Center	Green Area
	Level 1	Level 2	Level 3	Nos.	Employee	Nos.	Nos.	km	Center	m^2
	Consultation room	Bed	Bed							
1999	6,853	10,668	17,349	627	947	6	1	1,285	11,676	21,453,000
2000	6,899	10,701	17,421	632	954	6	1	1,290	11,742	21,539,000
2001	6,945	10,746	17,493	635	957	6	1	1,296	11,808	21,629,000
2002	6,986	10,796	17,575	637	961	6	1	1,303	11,878	21,740,000
2003	7,034	10,838	17,655	638	969	6	1	1,310	11,946	21,831,000
2004	7,074	10,879	17,733	643	973	6	1	1,316	12,012	21,925,000
2005	7,119	10,930	17,816	645	976	6	1	1,323	12,083	22,037,000
2006	7,162	10,976	17,892	647	981	6	1	1,330	12,151	22,132,000
2007	7,212	11,021	17,976	650	987	6	1	1,336	12,219	22,233,000
2008	7,257	11,072	18,052	651	993	6	1	1,343	12,292	22,332,000
2009	7,299	11,115	18,132	656	998	6	1	1,350	12,363	22,433,000
2010	7,346	11,164	18,218	657	1,004	6	1	1,357	12,434	22,542,000

Table G-8: Forecast of Waste Generation Amount in DF

unit : ton/year

Year	Total	Household	Commercial	Market	Restaurant & Bar	Sports & Amusement center	Public service	Hotels	Public office	Education center	Hospital	Laboratory	Veterinary	Bus terminal	Airport	Road sweeping	Social rehabilitation center	Green Area	Bulky waste	Demolition waste
1999	4,204,000	1,945,000	630,000	587,000	273,000	26,000	63,000	19,000	204,000	57,000	54,000	1,000	0	6,000	11,000	56,000	3,000	77,000	111,000	80,000
2000	4,222,000	1,953,000	632,000	588,000	275,000	26,000	63,000	19,000	206,000	58,000	55,000	1,000	0	6,000	11,000	56,000	3,000	77,000	112,000	81,000
2001	4,241,000	1,965,000	633,000	590,000	276,000	26,000	63,000	19,000	207,000	58,000	55,000	1,000	0	6,000	11,000	58,000	3,000	77,000	112,000	81,000
2002	4,262,000	1,976,000	638,000	591,000	278,000	26,000	63,000	19,000	210,000	58,000	55,000	1,000	0	6,000	11,000	58,000	3,000	78,000	112,000	81,000
2003	4,283,000	1,989,000	642,000	592,000	278,000	26,000	63,000	19,000	210,000	58,000	56,000	1,000	0	6,000	11,000	58,000	3,000	78,000	112,000	81,000
2004	4,302,000	1,998,000	643,000	593,000	280,000	26,000	63,000	19,000	210,000	59,000	56,000	1,000	0	6,000	11,000	59,000	3,000	79,000	115,000	81,000
2005	4,324,000	2,009,000	650,000	594,000	281,000	26,000	63,000	19,000	211,000	59,000	56,000	1,000	0	6,000	11,000	59,000	3,000	79,000	115,000	82,000
2006	4,344,000	2,021,000	652,000	595,000	282,000	26,000	63,000	19,000	211,000	60,000	57,000	1,000	0	6,000	11,000	60,000	3,000	79,000	115,000	82,000
2007	4,365,000	2,033,000	656,000	597,000	283,000	26,000	63,000	19,000	212,000	60,000	57,000	1,000	0	6,000	11,000	61,000	3,000	80,000	115,000	82,000
2008	4,386,000	2,046,000	658,000	597,000	285,000	26,000	65,000	19,000	212,000	60,000	57,000	1,000	0	6,000	11,000	62,000	3,000	81,000	115,000	82,000
2009	4,408,000	2,060,000	661,000	600,000	285,000	26,000	65,000	19,000	212,000	60,000	57,000	1,000	0	6,000	11,000	62,000	3,000	81,000	116,000	83,000
2010	4,430,000	2,072,000	667,000	600,000	286,000	26,000	65,000	19,000	213,000	61,000	57,000	1,000	0	6,000	11,000	62,000	3,000	81,000	117,000	84,000

b.2 Waste Composition

The waste composition, as well as waste generation ratio, varies widely with the cultural practices, economical situations, and consumption trends in respective societies. Table G-9 shows examples of waste composition in OECD countries and Table G-10 shows waste composition at source in the DF.

Table G-9: Example of Waste Composition in OECD Countries

Composition / Country	Paper and paperboard (%)	Plastics (%)	Glass (%)	Metal (%)	Food & garden waste, etc. (%)	Other (%)
Japan	38	11	7	6	32	7
USA	38	8	7	8	25	15
France	31	10	12	6	25	17
Denmark	22	4	5	3	55	9
Portugal	25	9	4	3	NA	59
Spain	20	7	8	4	49	10

source : OECD Environmental Data 1993, OECD

Table G-10: Waste Composition of DF

Composition / Area	Paper and paperboard (%)	Plastics (%)	Glass (%)	Metal (%)	Food & garden waste, etc. (%)	Other (%)
DF	24	12	7	4	43	10

source : DGSU

Comparing the above two tables, the waste composition at source in the DF are similar to those in European countries. The waste composition in the DF, as well as the waste generation ratio, turns out to be in the level of industrialized economies. Therefore, it can be estimated that the future waste composition remains same as that of today even taking the future economic growth into the consideration. Consequently in this M/P, the future waste composition is set at the present one.

Table G-11: Waste Composition

unit : %

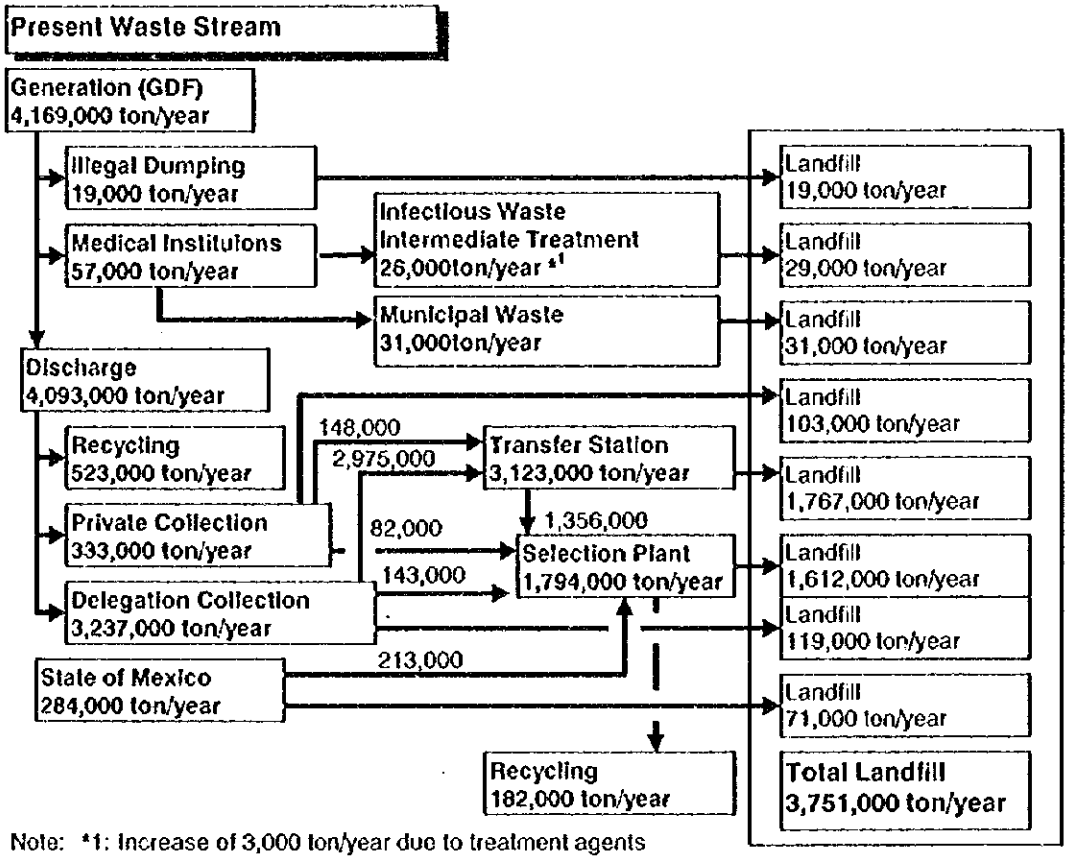
Generation sources / Composition	Domestic	Commercial		Service						Special							Others			Total
	Household	Commercial	Market	Restaurant	Sports and amusement center	Public service	Hotel	Public service office	Education center	Hospital	Laboratory	Veterinary	Bus terminal	Airport	Road	Social rehabilitation center	Green area	Bulky waste	Demolition waste	
Spatula										1.970										0.030
Cotton	2.150	0.070	0.830			0.380	0.030	2.990	0.170	1.970	10.380	5.570								1.300
Cardboard	5.360	11.510	5.290	5.970	11.040	23.180	3.770	11.200	8.980	8.300	8.010	2.560	4.340	5.310	3.660	5.060	4.000			6.680
Leather	0.110			0.020		3.690			0.040											0.110
Paper container	1.960	1.970	2.220	1.430	5.180	1.980	0.760		6.050	1.070		0.690	0.550		6.530	0.520	3.120			1.910
Vegetable fiber	0.060	1.790	2.630			1.130	0.080	0.010	0.780	0.200										0.690
Synthetic fiber	1.430	0.290	0.890	0.040			0.010	0.240		0.270	3.100				0.100					0.850
Gauze										3.770	5.740	5.940								0.050
Bone	0.080	0.440	1.110			0.210			0.670	0.070		0.380								0.270
Vinyl	0.200	1.070	0.160			0.360	0.180	0.830	1.330	2.070										0.370
Disposable syringe										2.800	1.310	1.380								0.040
Cans	1.580	0.310	1.470	0.250	1.230	3.100	0.520	0.280	4.890	1.730		2.310	4.530	3.170	4.770					1.240
Ceramics	0.370	0.120	0.090	0.450	0.290		0.180	0.080	2.010										2.090	0.300
Wood	0.100	1.200	1.170	0.670		6.720		0.010	3.920	0.430		4.820	0.290				5.120	20.000	1.530	1.240
Construction waste	0.630			0.520	0.090		2.890						1.240						95.270	2.140
Metal	1.390	2.590	0.070	0.920	5.650	0.710	1.790	0.150	0.400	1.900		0.690			0.410		2.860	50.000		2.560
Nonferrous metal	0.060	0.510				1.300		6.540		0.070	1.180	1.310					2.290			0.490
Paper	1.190	5.310	1.870	1.540	3.570	18.750	9.210	37.610	14.330	6.570	17.230	9.880	9.100	6.410	5.410	3.110	6.820		0.970	4.410
News paper	4.610	5.950	4.540	0.950	3.170	15.500	5.240	11.910	6.990	4.370	11.970	20.640	6.070	15.340	9.710	7.730	2.220			4.960
Toilet paper	8.780	1.940	4.270	3.400	9.590	4.200	8.160	1.990	10.720	11.000	9.620	7.380	15.200	8.920	9.520	4.650				5.890
Disposable diaper	3.370	0.140		0.080	0.090	0.320	0.890		0.300	1.430			1.940							1.620
X-ray film										0.300										0.000
Plastic film	6.240	5.380	1.500	3.080	7.130	2.140	3.580	0.160	1.950	3.270		0.440	5.340	3.910	5.380	2.000	9.290		0.140	4.530
Hard plastic	4.330	3.940	2.960	1.260	15.340	1.390	1.690	0.880	2.690	0.970	8.640	1.630	3.080	5.460	6.620	1.260	4.000			3.490
Polyurethane	0.160	0.110	0.080	0.030		2.700			0.670	0.760	2.170	2.560								0.160
Foamed polyurethane	0.780	0.120	0.460	0.350	0.720	1.850	0.160	0.110	0.460	1.700	2.270	1.060	1.100	1.180	1.220		1.230			0.580
Food waste	34.660	38.730	63.080	74.430	16.170	5.710	43.230	21.220	16.020	26.960	1.740	3.310	30.440	16.320	7.670	42.490				37.700
Garden waste	5.120	0.150	0.050	0.080	0.420	0.590	3.660	0.300	6.320	1.300	1.890	0.560		1.530	11.460	7.460	25.360			3.180
Sanitary napkin		0.170						0.040	0.630		1.610		0.010			2.000				0.040
Rags	0.640	0.200	0.300	0.120	1.140		1.720	0.310	1.020	0.500	1.840			4.880		3.000		30.000		1.220
Bandage										0.360					0.020					0.010
Color glass	4.000	1.770	0.300	1.530	4.670	2.810	3.090	0.260	2.440	6.700	4.860	2.000	3.450	8.070	8.640	0.420				2.620
Transparent glass	6.770	5.180	0.440	2.820	11.760	1.280	8.520	0.760	4.660	5.630	3.050	0.940	7.790	7.140	8.370	0.950	0.850			4.610
Fine fraction	1.210	0.070	3.970	0.030	2.750		0.260	0.010	0.730	0.430	0.030			3.610	4.020		26.300			1.710
Others	2.660	8.960	0.250	0.030			0.380	2.110	0.830	1.130	3.350	23.950	5.520	8.750	6.500	19.380	6.540			3.000
Total	100.000	99.990	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	99.990	100.000	99.990	100.000	100.010	100.030	100.000	100.000	100.000	100.000

G.2.2 Technical System

a. Optimum Waste Stream

Figure G-2 illustrates the present waste stream and Table G-12 presents the current annual operation and maintenance cost of transportation from transfer stations to final disposal facilities management of which is under the responsibility of the DGSU.

unit: ton/year



Note: *1: Increase of 3,000 ton/year due to treatment agents

Figure G-2: Present Waste Stream

Table G-12: Present Annual Operation and Maintenance Cost

	Transfer	Selection Plant	Final Disposal	Total
Waste amount (ton/year)	3,123,000	1,794,000	3,751,000	-
*O&M cost (pesos)	411,690,240	107,718,026	105,647,918	625,056,184
Unit cost (pesos/ton)	131.8	60.0	28.2	-
**Unit cost (U$/ton)	14.5	6.6	3.1	-

*O&M cost: Cost of Urban Services, 1997 DGSU, **Unit cost: 9.1 pesos per dollar

Although O&M of the selection plants (S/Ps) costs about 108 million pesos/year, the amount of materials recovered by the selection plants remains only 182,000 ton/year. If the selection plants are closed, although the final disposal amount will be increased by 182,000 ton/year, the GDF can save the operation and maintenance cost of the S/Ps as much as about 102 million pesos (as shown in Table G-13).

On the other hand, this will encounter other problems such as below:

- Social problems of unemployed S/Ps workers.
- No material conservation.

Therefore, neither the status quo nor the closure of the S/Ps is acceptable in the M/P. Consequently, the M/P should seek to make the best of the S/Ps.

Table G-13: Annual Operation and Maintenance Cost in Case of S/Ps Closure

	Transfer	Selection Plant	Final Disposal	Total
Waste amount (ton/year)	3,123,000	0	3,933,000	-
*O&M cost (pesos)	411,690,240	0	110,910,600	522,600,840

*O&M cost: Cost of Urban Services, 1997 DGSU

The problem of the very low material recovery rate of the S/Ps is due to the excessive feeding of mixed municipal wastes. Hence, if wastes are previously sorted and input amount to the selection plants is decreased, working condition on sorting lines will be improved and material recovery efficiency will be raised.

Therefore, waste separation at source is proposed in the M/P through which recyclable waste is separately collected and fed to the S/Ps. The feeding level can be adjusted to its optimum as the rest of wastes is not fed to the plants. As a result, the material recovery ratio will be improved to such an extent that final disposal waste amount is much reduced in spite of the lowered feeding level. However, in order to keep the material recovery ratio constantly high, in addition to the physical improvement of input composition and feeding level of the S/Ps, it is necessary to establish the mechanism of controlling the flow of recovered materials to the market and maintaining the stable selling prices of recyclable materials. Obviously, collection system should be instrumented to guarantee that separate materials are delivered to S/Ps.

Therefore, it is necessary (i.) to build recovered materials storage facilities so that the materials can be stored and sold in view of the market trends, (ii.) to establish a management system to determine appropriate timing of selling the recyclable materials, (iii.) to foster industries that re-use the recovered materials and/or process them into certain new products, and (iv.) to promote usage/consumption of recycled products.

The proposal of waste separation at source is also justified by the large amount of organic waste generated at the Central de Abasto (about 231,000 ton in 1997), which is to be collected in the sub-system. Composting treatment is strongly recommended for such homogeneous organic wastes because of two main benefits. First, composting treatment can contribute to the waste volume reduction, and second, it converts waste to usable resources, if the compost product attains such quality that can be used as the soil conditioner.

Until 1993 a composting facility was operated by a delegation. Since the facility was receiving the mixed wastes for composting, however, compost product delivered had an inferior quality to be used as soil conditioner, its demand was limited and the

facility was finally shut down. Separate collection should be able to avoid this former failure and make the compost production viable.

As can be seen from the above, in planning the future municipal SWM by the GDF, it is judged that the source separation and the separated collection are indispensable. The M/P raises the target of separate collection: for the sub-system to be achieved 100% in the year 2004; and for the other part to be 50% in the year 2010.

The number of separation items for the sub-system and the other part, as presented in Table G-14, should be reasonably acceptable, in view of the considerations expressed above. Table G-15 defines item categories to be separated in both systems.

Table G-14: Source Separation Item

System	Separation type	Waste category
Sub-system	3 categories separation	organic, recyclable, and others
Delegation	2 categories separation	recyclable, and others

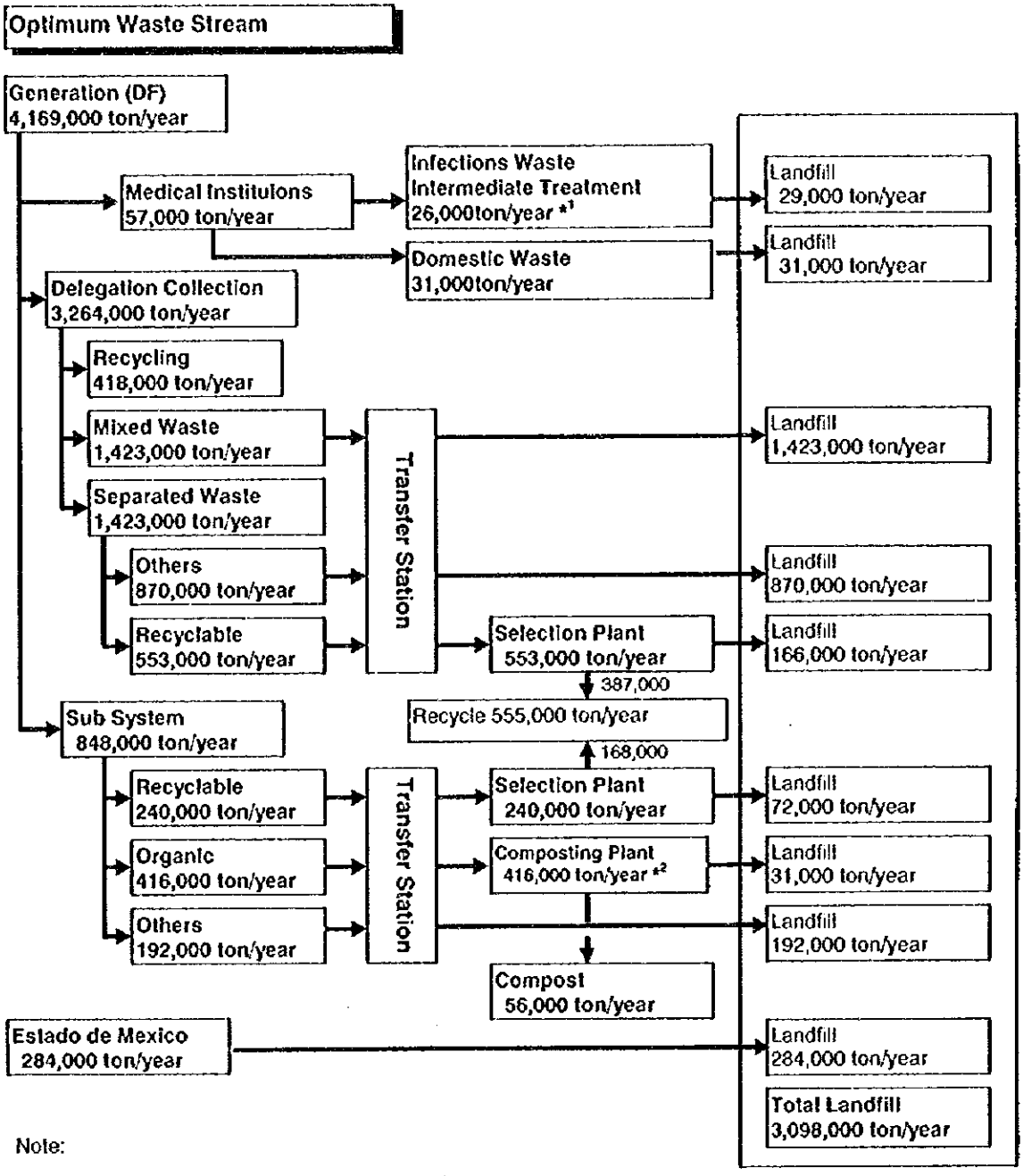
Table G-15: Definition of Item Categories to be Separated

For Sub-system	For Delegation	Category	Composition
Organic	Others	Organic	Vegetable fiber
			Bone
			Food waste
			Garden waste
Recyclable	Recyclable	Recyclable	Cardboard
			Synthetic fiber
			Vinyl
			Cans
			Metal
			Nonferrous metal
			Paper
			News paper
			Plastic film
			Hard plastic
			Color glass
			Transparent glass
Others	Others	Others	Spatula
			Cotton
			Leather
			Paper container
			Gauze
			Disposable syringe
			Ceramics
			Wood
			Construction waste
			Toilet paper
			Disposable diaper
			X-ray film
			Polyurethane
			Foamed polyurethane
			Sanitary napkin
			Rags
			Bandage
			Fine fraction
			Others

In view of the above examination, the optimum waste stream estimated for the GDF, on the bases of the waste amount in 1997, is illustrated in Figure G-3.

By converting the present waste stream into this optimum waste stream, the material recovery ratio at S/Ps will be improved from 10% (present) to 70% (optimum stream), and about 653,000 ton/year of final disposal amount will be reduced.

unit: ton/year



Note:

*1: increase of 3,000 ton/year due to treatment agents
*2: reduction of 329,000 ton/year due to the evaporation and gas generation through decomposition

Figure G-3: Optimum Waste Stream