PART IV. A COMPREHENSIVE PLAN FOR THE INTEGRATED MANAGEMENT OF NEW YORK CITY'S SOLID WASTES.

CHAPTER 15. The Planning Process.

As in any well-turned novel, the elemental components of a comprehensive solid-waste-management plan (not characters, events, and themes, but waste quantities and composition, generators, collection systems, processing networks, marketing arrangements, disposal facilities) are assembled in shifting patterns and examined from a variety of perspectives as the logic of needs and objectives propels them to a conceptual resolution: an implementable vision of a strategically designed solution. And as the trajectory cut by the conclusion of any novel that rises above the mediocre is not fixed -- that is, the arc of characters' future lives is subject to a range of eventual possibilities -- so too is any plan that attempts to encompass vistas beyond present possibilities and to anticipate the likelihoods of the long-term future.

The logic of the planning process unfolds. First (Part I), we find out where we are. Next (Part II), we establish our needs and desires. Then (Part III) we evaluate the universe of alternatives to establish those that are feasible, and to assemble the information that we will need to arrange these building-block <u>components</u> into alternative <u>systems</u>. This evaluation includes all of the criteria that we as a late-twentieth-century society have established in our pantheon of legally-encoded value judgments, to wit: environmental, economic, and social impacts. This brings us up to the present (Part IV), where we shall imagine integrated possibilities (we shall call them "<u>scenarios</u>"), compare them on the basis of the criteria established in Chapters 5 and 6, and successively narrow the range of options, elaborating and refining them until only the most desirable choices remain (these choices will be referred to as "<u>systems</u>" to distinguish them from the more abstract early-stage scenarios). Because of the unpredictability of implementing a massive public/private behavioral/infrastructural system encompassing every resident and business in the city over a 20-year time period, these choices will represent the boundaries demarking the likely limits of the City's intended course. Over the next 20 years, some elements of the sytems will be put into place, but the City is not now committing to adopt fully any of the systems. Rather, these systems provide guidance for the development of a "near-term implementation plan" which sets forth the programs and facilities that, at the conclusion of this planning process, the City has actually scheduled for implementation. Unlike the full-scale "systems," the near-term implementation plan represents the course of action chosen by the City, and includes only those facilities which the City is prepared to develop within the next five years, plus two additional composting facilities which are proposed for development by the end of the decade. The only incinerators planned to be renovated or built in the near-term implementation plan are the Southwest Brooklyn and the Brooklyn Navy Yard facilities.

New York's MSW -- in terms of sheer tonnage, its heterogeneity, and the complexity of the options for set-out, collection, processing, and marketing -- is the waste-stream that poses the most difficult analytical problems for a planned solution. For that reason, as well as because parallel but precedent planning efforts have already been initiated for sewage sludge and medical wastes, the analysis of alternatives for the management of MSW is the subject of this chapter. These analyses, conducted in three successively refined stages, dealt with deeper and deeper "layers" of MSW: residential wastes only were considered in the first phase; institutional wastes were added to the intermediate phase; and commercial wastes were added to the final phase. The other waste streams will be similarly "layered" onto the basic "alternative-MSW-management templates" -- when the planning work conducted by the Department of Environmental Protection and the Health and Hospitals Corporation and Department of Health comes together with the planning analyses developed by the Department of Sanitation -- in the presentation of environmental impacts and costs in Chapters 17.1, 17.2, and 17.3.

15.1 Constructing the Initial-Phase Scenarios.

The building-block alternatives that were examined in **Part** III were considered within a New York City context, but not in an <u>integrated</u> fashion. In order to integrate these components, we shall need to establish some <u>system parameters</u>.

15.1.1 Waste-Stream Parameters.

<u>The number of "sorts."</u> Into how many categories should householders be asked to sort their refuse? In answering this question, **two competing objectives need to be balanced. One objective** is maximizing ease of participation, so that the maximum amount of material can be diverted for recycling and composting (waste-management techniques that are "higher on the hierarchy" than are waste-to-energy and landfilling). **The other objective** is keeping discrete materials in as "pure" form as possible to maximize the ease of processing and the marketability of the recovered materials, so that the maximum amount of material is actually re-used.

The more categories requested, the more difficult the sorting task will be for waste generators. The fewer categories requested, the more difficult the processing and marketing task will be for waste managers.

The feasible range of sorts assumed for New York City's (generally high-density) citywide conditions was from one (i.e., no separation, householders simply putting all refuse into one bag or container) to four.

The category definitions. What waste components should go into the one, two, three, or four containers?

- Refuse. If there is only one container in the system, what goes into it is "refuse," i.e., everything. If there is more than one container in the system, one of those containers will be "refuse," i.e., everything else.

- Wet/Dry. If there are only two containers in the system, the distinction could be primarily on the basis of moisture content, i.e., between "wet," compostable materials (primarily "kitchen" waste: food and food-contaminated papers) and "dry" materials, which would include potentially recyclable paper, metals, glass, plastic, and textiles. If there are more than two containers in the system, the "refuse" category could be bifurcated into wet/dry (as shown in Table 15.1.1-1).

- High Quality. If there are only three containers in the system, two could encompass the materials that are most likely to be recyclable, and treat them in a way that would maximize their quality. The proposed definition of "high-quality" materials includes 25 of the 46 components sorted in the waste-composition study -- a much more expansive list than the six materials that the City currently designates for residential recycling.

  These include all of the materials for which an adequate market is likely within the 20-year planning period. If all glass, metal, and plastics are put into one container, and all paper and textiles are put into the other, problems due to the potential contamination of paper with shards of broken glass, and of textiles with food or liquids, would be avoided.

- Organics. If there are four categories, the last could include only organic kitchen wastes (primarily food scraps and soiled paper, as shown in Table 15.1.1-1), which would represent the MSW materials most suitable for in-vessel composting.

Table 15.1.1-1: MSW Waste Component Category Options

	% of Total*	Wet/Dry	High Quality	Organics
Corrugated/Kraft	5.6 %	D	X	
Newsprint	8.9 %	D	X	
Office/Computer	1.0 %	D	X	
Magazines/Glossy	3.8 %	D	X	
Books/Phonebooks	1.8 %	D		
Non-Corrugated Cardboard	2.5 %	D		X
Mixed Paper	9.9 %	W	X**	X**
Clear HDPE Containers	1.1 %	D	X	
Colored HDPE Containers	1.1 %	D	X	
LDPE	0.2 %	D	X	
Films & Bags	5.5 %	D	X	
Green PET Containers	0.1 %	D	X	
Clear PET Containers	0.8 %	D	X	
PVC	0.4 %	D	X	
Polypropylene	0.3 %	D	X	
Miscellaneous Plastics	0.8 %	D	X	
Grass/Leaves	3.0 %	W		X
Diapers	2.5 %	W		X
Food Waste	10.9 %	W		X
Miscellaneous Organics	7.3 %	W		X
Glass Containers-Clear	1.9 %	D	X	
Glass Containers-Green	0.7 %	D	X	
Glass Containers-Brown	0.6 %	D	X	
Miscellaneous Glass	0.2 %	D		
Food Containers/Foil	0.5 %	D	X	
Aluminum Beverage Cans	0.5 %	D	X	
Miscellaneous Aluminum	0.1 %	D	X	
Food Containers	1.6 %	D	X	
Miscellaneous Ferrous	2.0 %	D		
Bi-Metal Cans	0.02 %	D	X	
Ceramics	0.1 %	D		
Miscellaneous Inorganics	1.8 %	D		
Pesticides	0.01 %	D		
Non-Pesticide Poisons	0.02 %	D		
Paint/Solvents/Fuel	0.2 %	D		
Dry Cell Batteries	0.02 %	D	X	
Car Batteries	0.04 %	D		
Medical Waste	0.02 %	D		
Miscellaneous HHW	0.1 %	D		
Textiles	4.4 %	D	X	
Rubber	1.9 %	D		
Fines	2.2 %	W		
Brush/Stumps	0.7 %	W		X
Lumber	2.1 %	D		
Polystyrene	0.8 %	D	X	
Bulk	10.0 %	D		
Total	100.02%		45.6%	31.85%

* Projected composition in the year 2000 after 7.5% is "prevented."

** 50% of mixed paper is assumed to be "high quality."

The type of container. The choices are rigid bins (such as the blue plastic bins currently used in the City's curbside recycling program), bags (plastic or paper), and larger containers for automated or semi-automated dumping.

15.1.2 Collection System Parameters.

The number of collection trucks to service each waste generator. The range established is from one (the minimum) to three (the current NYC system, which imposes costs that already severely strain the City's budget). (An additional truck, not included in the one-to-three range, would be required for collecting bulky/oversized waste).

The types of collection trucks. Only compacting trucks are feasible for New York City: non-compacting trucks, which have been tested extensively by the Sanitation Department, are unduly inefficient and expensive. Compactor trucks that are feasible for New York City can have one or two compartments: compactor trucks with more than two compartments (which have also been tested here) were determined to be too unworkable.

Collection frequency. The range established was one, two, or three times a week, depending on population density and the type of material being collected.

15.1.3 Processing System Parameters.

The analysis of waste-management alternatives presented in the preceding chapters suggests -- in conformity with the State's waste-management hierarchy -- that all four generic types of waste-management facility types (recycling, composting, waste-to-energy, and landfilling) might be necessary for the management of various waste types in the most cost-effective and environmentally benign way. Nonetheless, waste-to-energy systems are considered by many New Yorkers to represent the least desirable type of facility. Therefore, the basic distinction between options for integrated processing systems is between those that include all four facility types, and those that do not include waste-to-energy facilities.

The types of facilities for all waste streams (including wastes other than MSW) that were determined to be feasible for New York City within the timeframe of this plan, along with representative feasible sizes, are presented in Table 15.1.3-1. (These "reference facilities" are described in detail in Appendix Volume 5; their capital and operating costs, air emissions, water usage and discharge requirements, water pollutant discharges, and acreage and siting requirements are summarized in Chapter 17.)

Table 15.1.3-1: List of Reference Facilities

		REFERENCE FACILITIES	TPD
TRANSFER	1	Truck Transfer Station	1500
	2	Marine Transfer Station	2000
	3	Rail Transfer Station	1500
	4	Materials Drop-Off	10
	5	Materials Buy Back	50
	6	Household Hazardous Waste Drop-Off	2
	7	Waste Oil Facility (gal/day)	1500
COMPOSTING	8	In-Vessel Compost	1500
	9	Mixed Waste In-Vessel Compost	1500
	10	Leaf & Yard Waste Compost	60
	11	Sludge Compost	250
	12	Sludge Pelletizer	500
	13	Sludge Chemical Stabilization	500
PROCESSING	14	Materials Recovery Facility	500
	15	Mixed Waste Processing	1500
	16	Dry Bag Processing	1500
	17	Commercial Paper Processing	250
	18	Commercial Waste Processing	1500
	19	Construction & Demolition Processing	500
	20	Medical: On-Site Chop & Bleach	2.1
	21	Medical: On-Site Autoclave	2.5
	22	Medical: Regional Autoclave	110
	23	Harbor Debris Processing	150
	24	Dredge Spoils Dewatering	147
	25	Waste Tire Processing	100
INCINERATION	26	Mass-Burn Waste-to-Energy	2250
	27	RDF Waste-to-Energy	2250
	28	Modular Waste-to-Energy	360
	29	Sludge Incinerator	250
	30	Medical: Regional Pathological Incinerator	7.4
	31	Medical: On-Site Incinerator	5.4
	32	Medical: Regional Incinerator	330
LANDFILL	33	Ash Landfill	1000
	34	MSW Landfill	5000

All of these types of facilities were deemed feasible from an engineering point of view; differences in costs and environmental impacts did not disqualify any from further consideration (in large part because the facilities are for different types of wastes, or different combinations of wastes, and because no one type of facility would necessarily be most suited to handling an entire waste stream.)

15.1.4 Construction of Initial-Phase Scenarios.

Combinations of these waste-stream, collection, and processing parameters produced the universe of first-phase scenarios in Table 15.1.4-1.

Table 15.1.4-1: First-Phase Scenarios

WASTE STREAM DIVISIONS	COLLECTION SYSTEM	PROCESSING SYSTEM*	SCENARIO NAME
Paper & OCC/Metals, Glass, Plastic/Refuse	3 Trucks	Paper Dealers/MRF/Incin/LFL	PROJECTED BASELINE
No Division (Refuse)	1 Truck	WTE/Lfl	Maximum WTE
Wet/Dry	1 Truck w/ 1 Compartment	Dry Bag/In-Ves/WTE/Lfl	Wet/Dry: 1 Truck, 1 Compartment (w/WTE)
		Dry Bag/In-Ves/Lfl	Wet/Dry: 1 Truck, 1 Compartment
	1 Truck w/ 2 Compartments	Dry Bag/In-Ves/WTE/Lfl	Wet/Dry: 1 Truck, 2 Compartments (w/WTE)
		Dry Bag/In-Ves/Lfl	Wet/Dry: 1 Truck, 2 Compartments
	2 Trucks	Dry Bag/In-Ves/WTE/Lfl	Wet/Dry: 2 Trucks (w/WTE)
		Dry Bag/In-Ves/Lfl	Wet/Dry: 2 Trucks
High Quality/Refuse	2 Trucks (a 2-compartment & a 1-compartment)	MRF/WTE/Lfl	High Quality/Refuse (w/WTE)
		MRF/MWProc-In-Ves/Lfl	High Quality/Refuse
High Quality/Wet/Dry	2 Trucks (both 2-compartment)	MRF/Dry Bag/In-Ves/WTE/Lfl	High Quality/Wet/Dry (w/WTE)
		MRF/Dry Bag/In-Ves/Lfl	High Quality/Wet/Dry
High Quality/Organics/Refuse	3 Trucks (a 2-compartment and two 1-compartments)	MRF/In-Ves/WTE/Lfl	High Quality/Organics/Refuse (w/WTE)
		MRF/In-Ves/MWP/Lfl	High Quality/Organics/Refuse

* In addition to the basic collection systems and facility types included here, each system includes collection of bulk wastes and their processing for the recovery of recyclables.

MRF: materials recovery facility; Incin: incinerator; LFL: landfill; WTE: waste-to-energy; Dry Bag: dry bag processing facility (a specialized form of "MRF" that is designed to receive and process all materials that would be included in the "dry bag" category); In-Ves: in-vessel composting facility (which is virtually the same facility whether it receives source-separated organics or "wet bags"); MWProc-In-Ves: Mixed-waste-processing/in-vessel composting facility (an in-vessel facility equipped with front-end equipment designed to recover recyclables from mixed refuse).

15.1.5 Scenario-Evaluation Assumptions.

These scenarios were "modelled" with the computer program developed for this purpose, "NYC WastePlan." The model "inputs" are described below; the model "outputs" were used in the evaluation of environmental impacts -- i.e., were used as "inputs" in parallel phases of environmental modelling and analysis. The successive phases of environmental analyses are described in Chapter 17, in a presentation that parallels the phases of NYC WastePlan analysis; the remainder of the present chapter deals with the direct logistical quantifications calculated by NYC WastePlan (i.e., numbers of tons, trucks, shifts, acres, facilities, dollars, etc.). (See Appendix 7.1, "Scenario Analysis Results," for details on all input data and assumptions.)

Cost Information.

Collection data (collection efficiencies, and costs) were largely derived from the Sanitation Department's existing operations in the "baseline" year, 1990.[1]

Facility cost data for this modelling were derived from the reference facilities database.

Participation/Diversion Rates.

Recycling diversion rates (i.e., the amount of targeted material actually collected in source-separation recycling programs, which is a function of the number of people who participate and the fraction of the targeted materials that they capture) were assumed to be higher than those already achieved in the City's current curbside program, but within the range of rates achieved elsewhere. In 1990, depending on the District, diversion rates ranged from 26 to 43 percent. Since diversion is a function of these two variables, assumptions need to be made for both. To achieve diversion rates of 26 to 43 percent, perhaps 35 to 55 percent of a neighborhood's residents participated in the program, and set out perhaps 75 to 85 percent of their recyclables. Diversion rates elsewhere are reported in the range of 40 percent (Seattle), with reported participation rates in the range of 60 percent.

With an effective public-education program and an easier-to-participate-in set-out system, it was assumed for mid-range modelling purposes that participation rates may average 55 percent in high- and medium-density areas, and ~~75~~ 65 percent in low-density areas, with capture rates ranging between 75 and 85 percent, depending on the specific material.

Sectors Included.

In this first phase of analysis, only residential wastes were included, and they were disaggregated into only four density categories, which corresponded to the sectors that were sampled in the waste-composition analysis: low, medium, high, and high-rise apartment complexes that have waste collected in dumpster-type containers.[2]

Waste Prevention.

A citywide waste-prevention program (described in Chapter 16) was assumed to produce an overall reduction of the waste stream of between seven and eight percent.

Technology.

Dual-compacting trucks; bag-breaking equipment. Two components assumed for these scenarios -- dual-compartment compacting trucks, and bag-breaking equipment for processing bagged recyclables -- stretch the limits of technology, since they have only been demonstrated on a pilot scale. However, there are several manufacturers of these types of equipment. Based on a preliminary evaluation of these "emerging" technologies, there is a high degree of probability that both will be reliably available by the time this plan is implemented. The planning period includes time for testing, further development, and implementation of these systems.

Composting/mixed-waste processing. The operating experience with MSW composting technology in this country on this scale has been chequered. However, for the purposes of these scenario analyses, this technology was assumed to function reliably. (Compost markets, based on the market studies presented in Chapter 9, are considered adequate, but no net revenues from the sale of compost were assumed.) Mixed-waste processing in conjunction with composting facilities -- a system in which as much recyclable material is recovered as possible -- has not been demonstrated in this country on this scale, but for purposes of evaluating certain scenarios, this variation on source-separated compost technology was assumed to be available.

Materials revenues for recyclables. Detailed revenue assumptions on a material- and program-specific basis are presented in Appendix Volume 7.1, along with detailed factors for all other quantitative assumptions.

Baseline Evaluation.

Baseline operations for 1990 were also modelled with NYC WastePlan, in order to "calibrate" the model, and to provide a benchmark against which to compare plan alternatives. A second benchmark was the "projected baseline" for the year 2000, against which the other alternatives could be compared. In this projected year 2000 baseline (roughly analagous to the "no-action alternative"), the Sanitation Department's current operations were assumed to continue through the year 2000, with no changes from the existing system except for a phased implementation schedule for source-separated collection of six materials citywide. No increase in participation rates over 1990 levels was assumed.

15.1.6 Sensitivity Analyses.

In addition to the "standard" model runs, several sensitivity analyses were conducted. One sensitivity analysis tested a best- and worst-case scenario for each of the 12 alternative systems. The variables used in these best- and worst-case runs were those that have both the greatest degree of uncertainty and the most significant impact. These included participation and capture rates in both the high-quality and organics source-separation programs, collection efficiency, market revenues, processing efficiency, residue rates, and landfill costs.[3] The primary purpose of these analyses was to determine if the overall cost ranking of the 12 scenarios would change significantly under more or less optimistic assumptions; the answer in every case was negative: that is, the relative cost ranking of the alternative scenarios was not affected appreciably by uniform changes in these variables.

In addition to the general best- and worst-case sensitivity analyses, several sensitivity tests were conducted on single variables to determine how changes in any one variable would affect the ordering of scenarios. These sensitivity tests were run on the following variables:

1. Participation and Capture Rates: This tested the impact of increasing or decreasing participation and capture rates on overall system costs per ton.

2. Source-Separation Collection Costs: This sensitivity analysis tested the impact of changing the cost of the source-separation collection programs used in each scenario.

3. Processing Efficiency: This tested the impact on overall scenario cost of recovering more or less material from each type of processing facility.

4. Ash-Disposal Costs: This tested the impact on overall scenario costs of varying the price of ash disposal. The costs of each of the scenarios that included waste-to-energy facilities were compared against the least-expensive non-incineration alternative. This sensitivity test was conducted to determine the point at which ash disposal costs would make scenarios that included waste-to-energy systems more expensive than the non-incineration scenarios.

5. Landfill/Export Costs: This tested the impact of changing the cost per ton of landfilling residue from recycling and

composting facilities, unprocessed solid waste, and ash.

6. Igloo, Drop-Off and Household Hazardous Waste Collection Programs: This tested the impact of adding each of these programs (individually and then collectively) to the five least-costly alternative scenarios. The major goal of each of these sensitivity analyses was to determine if and/or at what value changes in the variable under consideration might change the relative ordering of the alternative scenarios.

15.1.7 Conclusions of Initial-Phase Analysis.

The outcome of these runs is summarized in Tables 15.1.7-1 and 15.1.7-2.

Among the general conclusions from this first phase of analysis are the following:

- The least costly system involves separate collection of source-separated recyclables and refuse in two trucks (using a dual-compartment truck to keep paper separate from other recyclables).

- Co-collection of source-separated "wet" and "dry" bags in a single truck is the least costly collection program, but requires an unproven and significantly more costly processing system.

- Systems without waste-to-energy processing are generally more costly, require more land area for facilities, and consume far greater amounts of landfill capacity.

- Continuing the current waste-management system into the future in its present basic form is by far the most costly of the alternatives examined. This equivalent of the "no-action alternative" would cost $90 per ton more than the most economical waste-to-energy-and-recycling system ($300 million per year) (or $120 per ton more than a waste-to-energy-only system). It is assumed to include: expanding the current recycling program citywide with the currently designated materials (newspaper, magazines, corrugated, glass, metals, plastic), in a three-truck collection system, using "blue recycling bins," at anticipated participation rates (which achieves an overall recycling rate of 15 percent of the residential waste stream); leaf-and-yard-waste composting (one percent of the waste stream), the existing three municipal incinerators, upgraded (to incinerate 27 percent of the residential waste stream), and landfilling 63 percent of the overall waste stream (including ash residue) at Fresh Kills.

Table 15.1.7-1: First-Phase Scenarios Ranked By Cost (Mid-Range Assumptions for Residential Waste Only*)

COLLECTION SYSTEM SCENARIO	SYSTEM COST/TON#	COLLECTION COST/TON	FACILITIES COST/TON	TOTAL SYSTEM COST ($000s)	% RECYCLED	% COMPOSTED	% WASTE-TO-ENERGY	% LANDFILLED	FACILITY ACREAGE**
"Projected Baseline"	$290	$156	$134	$1,000,000	15%	1%	27%	63%	129 acres
Maximum WTE (1 Truck)	$170	$100	$70	$579,000	3%	0%	90%	20%	
1. High Quality/Refuse: 2 Trucks (w/WTE)	$204	$136	$73	$699,000	22%	0%	67%	16%	111 acres
2. Wet/Dry: 1 Truck, 1 Compartment (w/WTE)	$211	$103	$117	$727,000	15%	25%	38%	22%	162 acres
3. High Quality/Organics/ Refuse: 3 Trucks (w/WTE)	$221	$156	$71	$760,000	22%	13%	54%	16%	122 acres
4. Wet/Dry: 1 Truck, 1 Compartment	$232	$103	$139	$796,000	15%	25%	0%	52%	131 acres
5. High Quality/Refuse: 2 Trucks (w/MWP***)	$236	$136	$108	$810,000	31%	32%	0%	29%	163 acres
6. Wet/Dry: 1 Truck, 2 Compartments (w/WTE)	$239	$139	$108	$820,000	20%	25%	38%	17%	158 acres
7. High Quality/Organics/ Refuse: 3 Trucks	$245	$156	$96	$840,000	22%	13%	0%	58%	78 acres
8. High Quality/Wet/Dry: 2 Trucks (w/WTE)	$253	$162	$98	$869,000	30%	23%	29%	17%	156 acres
9. Wet/Dry: 2 Trucks (w/WTE)	$255	$155	$108	$875,000	20%	25%	38%	17%	158 acres
10. Wet/Dry: 1 Truck, 2 Compartments	$260	$139	$132	$894,000	20%	25%	0%	48%	127 acres
11. High Quality/Wet/Dry: 2 Trucks	$269	$162	$116	$924,000	30%	23%	0%	40%	131 acres
12. Wet/Dry: 2 Trucks	$276	$155	$132	$949,000	20%	25%	0%	48%	127 acres

* Citywide residential waste only, using standardized mid-range assumptions for the year 2000. All scenarios (except "Projected" Baseline) assume that 7.5% of the City's residential wastes are "prevented," and thus diverted from entering the collection, processing and disposal system. (See Appendix Volume 7.2 for a detailed description of the assumptions.)

** Total acreage for all facilities except landfill.

*** Mixed-waste processing (instead of waste-to-energy).

\# "System Costs Per Ton" are not simply collection costs per ton plus facilities costs for ton. "Facility cost per ton" is an average cost for all tons processed by all facilities. Since some materials are handled in more than one facility (e.g., transfer stations, or MRF processing residue and WTE ash that are landfilled), many tons are "double-counted," and this varies from system to system. System costs also include the cost attributed to prevention programs, which are not reflected in the per-ton collection or facilities costs.

Table 15.1.7-2: Outcome of Initial-Phase Analysis

SCENARIO NAME	OUTCOME OF INITIAL ANALYSES	BASIC SCENARIOS TO BE CONSIDERED IN REFINED FORM IN SUBSEQUENT STAGES OF ANALYSIS
Projected Baseline	Most expensive, does not conform to NYS hierarchy, great landfill capacity requirements.	Projected Baseline
Maximum WTE	Does not conform to NYS hierarchy or LL19.	Maximum-Burn (FOR BENCHMARK PURPOSES ONLY)
Wet/Dry: 1 Truck, 1 Compartment (w/WTE)	Does not maximize recycling, heavy acreage requirements, costly and unproven processing system, and marketing risks.	
Wet/Dry: 1 Truck, 1 Compartment	More costly, and far more landfill capacity than WTE version.	
Wet/Dry: 1 Truck, 2 Compartments (w/WTE)	Relatively expensive, heavy acreage requirements, costly and unproven processing system, and marketing risks.	
Wet/Dry: 1 Truck, 2 Compartments	More costly, and far more landfill capacity than WTE version.	
Wet/Dry: 2 Trucks (w/WTE)	Relatively expensive, heavy acreage requirements, costly and unproven processing system, and marketing risks.	
Wet/Dry: 2 Trucks	More costly, and far more landfill capacity than WTE version.	
High Quality/Refuse (w/WTE)	Least costly alternative that addresses NYS hierarchy.	High Quality/Refuse (w/WTE)
High Quality/Refuse	More costly, more facility acreage required, far more landfill capacity than WTE version, and relies on unproven processing system that poses significant materials-marketing risks.	High Quality/Refuse (FOR BENCHMARK PURPOSES ONLY)
High Quality/Wet/Dry (w/WTE)	Relatively expensive, heavy acreage requirements, costly and unproven processing system, and marketing risks.	
High Quality/Wet/Dry	More costly, far more landfill capacity than WTE version.	
High Quality/Organics/ Refuse (w/WTE)	Achieves balance of cost, conformance to hierarchy, acreage and landfill requirements.	High Quality/Organics/Refuse (w/WTE)
High Quality/Organics/ Refuse	More costly, far more landfill capacity than WTE version.	

- A system that relied entirely on waste-to-energy (without any recycling or composting) would be the least expensive (by $30 per ton, or $120 million per year), because it would have the lowest collection costs. Such a system, however, would not conform with the New York State waste-management hierarchy, and would produce more ash residue.

- Net pollutant loadings to the environment, as well as maximum pollutant concentrations, are not substantially different between the 12 alternative scenarios, even though some of the alternatives include waste-to-energy facilities and some do not. (See Chapter 17 for more details on the environmental analysis.)

- Landfilling is the most costly type of waste-management facility, as well as the only type of facility that will be impossible to replace within the City's boundaries.

- Minimizing transport distances between collection routes and dumping points is key to minimizing overall system costs.

In addition to these conclusions drawn from the scenario-modelling exercises, some general observations concerning the existing system were used to guide the development of more refined alternatives. It is important to note that the recommended changes would represent a fundamental shift in the way recycling is conducted in New York City. Among these are:

- Collection of recyclables in specially-designated, recyclable plastic bags would be better suited to NYC than the use of rigid bins. Bags are likely to enhance public participation (by making the storage and set-out of recyclables more convenient, reducing the costs of theft and breakage of bins, and reducing spillage). Bags would also eliminate the cost to the City of providing bins, improve collection efficiency, allow the collection of mixed paper and textiles, and protect the recyclable materials from sun, wind, and rain.

- A uniform citywide system would greatly facilitate public-information requirements, and accordingly, enhance public participation and enforcement efforts.

- The designation of recyclable materials should be as expansive as practicable, so that changes in secondary materials markets do not have to entail changes in citizen behavior or collection systems, but can instead be dealt with more flexibly on the processing end by increasing or decreasing the degree of sorting, the materials recovered, and the end-markets to which they are shipped.

- Pre-processing of the remaining refuse stream with "front-end" equipment at waste-to-energy or composting facilities might increase the recycling rate by several percent system-wide by removing additional recyclable glass and metals, and the cost of this pre-processing does not appreciably increase the overall costs of waste-to-energy or composting facilities.

- Collection costs might be further reduced with increased use of a flexible semi-automated/manual rear-loading system, as is standard practice for NYC's private-carter fleets.

The product of these conclusions and observations was the hypothesis that a "high quality"/refuse division of the citywide residential and institutional waste streams will be most cost-effective and produce the least adverse environmental impacts.

This hypothesis was tested in the succeeding phase of scenario analysis, along with a version of the other most promising scenario from the first phase of analysis -- the variation of the high quality scenario that also included source-separated organics. The projected baseline, the maximum-burn, and the "no-burn" scenarios were also carried along in the analysis for benchmark purposes.

15.2 Intermediate-Phase Scenario-Analyses.

In the next phase of scenario analysis, these findings from the generalized, citywide scenarios were used to guide the development of more refined scenarios.

15.2.1 Methodology for Analysis.

The first phase of analysis, as described above, was conducted in a relatively streamlined, simplified, generalized way: overall citywide tonnages and compositions (for residential waste only) were used, but without reference to New York City geography. Citywide tonnages were "sent" to imaginary facilities, and the number of facilities required -- which were calculated as fractions of reference-facility-sized units -- were outputs of the model's calculations. The major conceptual difference between the initial phase of analysis and the next, more-refined, phase, was that these calculations were brought down from a level of abstraction onto a map of New York City -- much as Hannibal once rode his elephants down from the mountains and onto the plains of Italy.

Data disaggregation/addition of institutional waste. Waste-generation and -composition data were disaggregated to the

Community-District level (for residential waste). They were also collected at the District level, and routed to specific facilities at specific (hypothetical) locations by District. In order to encompass all of the wastes that are collected by the City, institutional wastes were added to this layer of analysis; the generation, compostion, collection, and routing of this waste was done on the basis of six groups of institutional sectors (e.g., schools, hospitals, City agencies), by borough.

Wastesheds/hypothetical facility locations. The waste generated by specific Districts and institutional groups was "routed" to specific hypothetically located facilities of specific sizes. These aggregations constitute wastesheds. The establishment of "working" wastesheds required satisfaction of the following condition: are there locations within the specific wastesheds that might be suitable for facilities of the proposed types at the proposed sizes? These determinations were made on the basis of an assessment of these regions in terms of the siting criteria described in Chapter 13, which, in turn, were based on technology requirements and preliminary environmental assessments.

In addition, certain technical refinements were made to the modelling inputs (e.g., more accurate facility cost factors), which reflected further refinements in the parallel technical analyses.

Together, all of these changes between layers of scenario analysis created changes in the magnitude of the "absolute" numerical model outputs (as reflected in the tables in the preceding and succeeding pages), but did not significantly affect the relative numerical rankings between scenarios.

15.2.2 Creating the Template for Intermediate-Phase Analyses: Testing Variations of the Hypothesized "Best" Scenarios (and Comparing Them to the Baseline and the "Benchmarks").

In this stage of analysis, the alternatives suggested by the first, screening-level phase of analysis were subjected to a series of variables designed to answer specific questions for optimizing the operation of the overall system. These scenarios are described in Table 15.2.2-1. The results of modelling these nine iterative alternatives are reflected in Table 15.2.2-2.

The City's existing or currently proposed system was taken as a given in the first round of these analyses, with the goal of testing variations and alternatives that would make the overall system come closer to achieving the objectives of this planning process. That is, the proposed Staten Island materials recovery facility (MRF) was assumed to exist, along with the three existing incinerators, the proposed Brooklyn Navy Yard waste-to-energy facility, the Fresh Kills landfill, and the City's network of seven marine transfer stations (MTSs). (The eighth existing MTS, in the South Bronx, is in a state of advanced deterioration.) A fundamental reason for beginning this round of scenario analysis with the existing and currently proposed facilities in place is that facilities of particular sizes in particular locations exert a gravitational pull on wastes generated in surrounding vicinities, creating significant constraints in the establishment of one of the most basic waste-management-planning components: <u>wastesheds</u>. To resist these forces of geographical gravity increases collection and transport costs, because the longer a truck has to travel to its dump site, the less time it has available on its collection route. This, in turn, can substantially increase overall system costs.

The sizes of additional facilities beyond those currently existing or proposed were shaped by technology-specific factors affecting economies of scale and environmental impacts, by the general impetus to minimize transport distances, and by the demographic features, transportation networks, and geographic characteristics specific to New York City that have a direct bearing on the size and shape of feasible and practical wastesheds.

A major finding of this stage of analysis is that there are a very limited number of areas in New York City that might be suitable for the development of large-scale waste-processing facilities. Short of re-opening closed landfills at such sites as Ferry Point in the Bronx or Pennsylvania Avenue in Brooklyn -- all of which are now designated City or federal parkland -- there are no locations in the City that would be suitable for establishing a municipal-solid-waste landfill of any practicable size. With the possible exception of the undeveloped "neck" of the former Edgemere landfill, there are no suitable locations for an ashfill other than the currently proposed site within the Fresh Kills landfill. Transfer stations and materials-recovery facilities could be appropriately sited in a relatively large number of potential locations, but there is a small universe of only about a dozen areas in the City that would be potentially suitable for either a new waste-to-energy or a mixed-waste in-vessel composting facility.

The basic facility/wasteshed template for this second-phase series of scenario analysis was further shaped by the goal of developing a "utility-type" system in which individual facilities in the network could "share the load" of refuse in "surge" times (i.e., in the event of unscheduled facility downtime, seasonal fluctuations in refuse volume and characteristics, or problems

Table 15.2.2-1: Scenarios for Intermediate-Phase Analysis (Residential and Institutional Refuse Only)

BASIC SCENARIOS TO BE CONSIDERED IN THE INTERMEDIATE PHASE OF ANALYSIS	CHANGES/REFINEMENTS MADE DURING INTERMEDIATE ANALYSIS AND VARIABLES TESTED*	REFINED SCENARIOS TO BE CONSIDERED IN THE FINAL-PHASE ANALYSIS
PROJECTED BASELINE	(None)	PROJECTED BASELINE
MAXIMUM-BURN	(None)	MAXIMUM-BURN SYSTEM
HIGH QUALITY/REFUSE (W/WTE)	**Scenario #1** (6 new MRFs, 3 existing incinerators, BNY, 2 new WTE)	
	Scenario #2: Same as #1, except with pre-processing (RDF) at all new WTE facilities (except at BNY)	
	Scenario #3: Same as #2, except w/ energy recovery at 3 existing incinerators	
	Scenario #4: Same as #3, except w/ private-standard staffing levels at existing incinerators	
	Scenario #5: Same as #4, except w/out BNY (which is replaced by 2 larger and 1 additional WTE)	
	Scenario #6: Same as #5, except w/out existing incinerators and w/ BNY	
	Scenario #7: Same as #4, except w/ composting of institutional organics (2 in-vessel facilities), i.e.: 6 NEW MRFS, 3 EXISTING INCINERATORS, BNY, 2 NEW WTE, 2 IN-VESSEL	"SYSTEM A"
HIGH QUALITY/REFUSE: NO WTE	**Scenario #8** (6 new MRFs and 6 large mixed-waste processing/composting facilities)	"NO-BURN SYSTEM"
HIGH QUALITY/ORGANICS/REFUSE	**Scenario #9**: Same as #7, except w/ composting of source-separated residential organics (3 in-vessel) and reduced WTE capacity, i.e., 6 NEW MRFS, 2 EXISTING INCINERATORS (1 would be closed), BNY, 2 NEW WTE (sized smaller than in #7), 3 IN-VESSEL	"SYSTEM B"

* Not included in this column are changes uniformly made to all scenarios, which are described in the preceding paragraphs.

related to a particular type of transportation system). The goal was to design enough facility capacity to process as much of the city's refuse as possible (minimizing the amount of "by-pass" waste that must be landfilled), while also minimizing the amount of capacity required. Since it is easier to "micro-control" daily shipments of waste via barge than by truck, at less cost, and with minimum transport distances involved, this goal can be best achieved by taking advantage of the City's existing system of marine transfer stations in conjunction with one or more barge-fed facilities. Truck-fed waste-to-energy or compost facilities then could be matched to waste sheds that presume nearly 100 percent facility availability, with by-pass waste diverted as necessary to the nearest marine transfer station. The barge-fed facilities, as an ensemble, then would be sized to handle most of the overflow requirements of the overall system.

The system developed for the first in this second series of modelling analyses (Scenario #1 in Table 15.2.2-1), then, consisted of the following elements:

- A basic citywide "high quality"/refuse collection system, in which bagged paper and textiles are put into one side of two-compartment truck, and bagged metals, glass, and plastic are put in the other, to be transported to six 500-tpd high-level-sorting MRFs;[4]

- The incineration of refuse collected by a second truck in: the three existing incinerators; the proposed 3000 tpd Brooklyn Navy Yard waste-to-energy facility; a 1000-tpd facility to service the Bronx; and a 2250-tpd truck-and-barge-fed facility in Staten Island.

The next scenario-modelling step (Scenario #2) was to test the effect of <u>adding pre-processing</u> capacity at all new waste-to-energy facilities (with the exception of the Brooklyn Navy Yard, where site-size constraints preclude the addition of equipment to remove glass and metals). This processing increases the amount of recycling by about two percent system-wide, reduces the amount of ash residue for landfilling, and slightly reduces overall landfilling requirements, at the cost of just $1 per ton ($3 million system-wide per year).

Since the three existing incinerators, largely because they do not recover energy, cost a third more on a per-ton basis than would a newly constructed 1000-tpd facility with energy recovery, a desirable variation on this system is to model the effects of <u>equipping these existing facilities with energy recovery</u> capability. This scenario (Scenario #3) reduces the overall system's per-ton cost by $7 per ton, without affecting any other system variables. The economics of this system could be further

Table 15.2.2-2: Second-Phase Scenarios in Chronological Order: Cost Comparison Summary. (Residential and Institutional Waste, Mid-Range Assumptions*)

System Scenario	System Cost/Ton	Collection Cost/Ton	Facilities Cost/Ton	Total System Cost ($000s)	Percent# Recycled	Percent# Composted	Percent# Waste-Energy	Percent# Landfilled	Increased Acreage**
Projected Baseline	$270/ton	$145/ton	$125/ton	$1,188,000	14%	1%	21%	69%	5 acres
Scenario #1: High Quality/Refuse w/WTE (6 new MRFs, 3 existing incinerators, BNY, 2 new WTE)	$219/ton	$126/ton	$100/ton	$ 964,000	22%	0%	66%	17%	66 acres
Scenario #2: Same as Scenario #1 except w/pre-processing [RDF] at all new WTE (except at BNY)	$220/ton	$126/ton	$101/ton	$ 967,000	24%	0%	63%	16%	71 acres
Scenario #3: Same as Scenario #2 except w/energy recovery at 3 existing incinerators	$213/ton	$126/ton	$ 93/ton	$ 935,000	24%	0%	63%	16%	71 acres
Scenario #4: Same as Scenario #3 except w/private-standard staffing levels at existing incinerators	$206/ton	$126/ton	$ 80/ton	$ 907,000	24%	0%	63%	16%	71 acres
Scenario #5: Same as Scenario #4 except w/out BNY (replaced by 2 larger and one additional WTE)	$209/ton	$126/ton	$ 83/ton	$ 920,000	25%	0%	59%	17%	84 acres

System Scenario (cont.)	System Cost/Ton	Collection Cost/Ton	Facilities Cost/Ton	Total System Cost ($000s)	Percent Recycled	Percent Composted	Percent Waste-to-Energy	Percent Landfilled	Increased Acreage**
Scenario #6: Same as Scenario #5 except w/out existing incinerators and w/BNY	$205/ton	$126/ton	$ 85/ton	$ 900,000	25%	0%	59%	18%	77 acres
Scenario #7: Same as Scenario #4 except w/composting of institutional organics (2 in-vessel facilities)	$203/ton	$124/ton	$ 79/ton	$ 895,000	24%	2%	61%	16%	78 acres
Scenario #8: High Quality/Refuse (no WTE) (6 new MRFs and 6 large mixed waste processing/composting facilities)	$219/ton	$126/ton	$101/ton	$ 965,000	28%	35%	0%	31%	134 acres
Scenario #9: High Quality/Organics/Refuse Same as Scenario #4 except w/composting of source-separated residential organics (3 in-vessel) and reduced WTE capacity	$221/ton	$143/ton	$ 85/ton	$ 974,000	24%	11%	51%	17%	84 acres

* Citywide residential and institutional waste only, using standardized mid-range assumptions for the year 2000. All scenarios (except "Projected" Baseline) assume that 7.2% of the City's residential and institutional wastes are "prevented," and thus diverted from entering the collection, processing and disposal system.

** Total acreage for all facilities except landfill, beyond acreage currently used in 1990.

Percentages do not sum to 100 because 7.2% of the waste-stream is assumed to be "prevented," and because ash from waste-to-energy facilities appears in both the waste-to-energy and landfill columns.

improved by using private-sector-standard staffing levels at the three existing incinerators, rather than continuing the Sanitation Department's current labor rates at these facilities (**Scenario #4**). (The current industry standard for a 1,000-tpd mass-burn waste-to-energy facility is about 66 personnel [see operating cost tables in Appendix Volume 5], at an annual cost [with fringe benefits and overtime] of about $3.2 million [in $1990]; in 1990, each of the three existing 1,000-tpd-sized incinerators [which actually handled an average of 410 tons per day each] was staffed by an average of over 90 personnel for a total labor cost of $6.2 million at each facility.)[5]

Another alternative tested (**Scenario #5**) is a system that does not include the proposed Brooklyn Navy Yard project, a 3000-ton-per-day, barge-fed waste-to-steam plant. Eliminating that facility, and replacing its capacity by expanding the Bronx facility to 1500 tpd, and the Staten Island facility to 3000 tpd, and adding a 1500-tpd facility to service the Southeast Brooklyn/Southern Queens wasteshed would add $3 per ton to the basic system ($13 million annually over scenario #4). This increase is in part due to the relative economics of selling steam as the primary energy product as opposed to electricity (the Navy Yard facility, unlike facilities in most locations, has an adjacent utility-scale steam market as a customer), and to the economies of barge transport. Additional advantages to a system that includes the Navy Yard facility are that fewer acres are required for a barge-fed than for a truck-fed facility, and that having two barge-fed facilities in the system (the other would be the Staten Island facility) would allow the benefits of treating the barge system as a surge tank to buffer overflow due to outages at other facilities.

Another system alternative (Scenario #6) would be to close the three existing incinerators and to replace them with new waste-to-energy capacity. This would reduce the overall system cost by $15 per ton over the system without energy recovery at these incinerators, and by $8 per ton over the system with energy recovery at these incinerators. However, if the existing incinerators were equipped with energy-recovery capacity and staffed at levels which are standard for privately run waste-to-energy facilities, the cost of the system with or without the existing incinerators would be the same.

A system that would rely primarily on waste-to-energy facilities for the non-recyclable portion of the waste stream, but in which source-separated organics from large-scale institutional generators (e.g., schools, hospitals, correctional facilities) were separately collected and composted (**Scenario #7**), would slightly reduce overall system costs (by $3 per ton over the basic waste-to-energy system), while composting two percent of the waste stream, but would substantially increase facility acreage requirements.

Another -- somewhat more theoretical -- system alternative (Scenario #8) would be to design a high quality/refuse system (which would have the same collection costs as in the previous systems), with the same MRF system, but in which all the waste-to-energy facilities were replaced by a network of mixed-waste-processing/composting facilities. Such a system needs to be considered in the context of a complete, expansive evaluation of the universe of potentially feasible alternatives, but it must be stressed that, unlike the other alternatives discussed above, the type of compost facilities upon which such a system would rely have not yet been demonstrated to operate reliably on a comparable scale in this country.

This system would require the construction of at least six composting facilities.[6] In this scenario, the overall system costs would be significantly more expensive ($58 million per year) than the refined waste-to-energy system described in scenario #4. From an engineering and technological perspective, the mixed-waste compost facilities represent a substantially greater risk than do waste-to-energy facilities. No track record has been established in the United States of successful operation of large-scale mixed-waste composting facilities. In fact, facilities in Portland, Oregon and Dade County, Florida have recently been closed due to odor and other problems. In addition to the start-up operational problems of the several smaller-scale facilities just getting under way in this country (e.g., odor-control problems), the compost product itself is beginning to come under increasing regulatory scrutiny, which might eventually restrict the uses for which this product might be marketed. The Environmental Defense Fund and other environmental groups have opposed mixed-waste composting because of concerns that the compost product may be contaminated with heavy metals or other toxics. In New Jersey, the State Advisory Council on Solid Waste Management has concluded that the risk of producing unmarketable compost is high and that New Jersey should not rely heavily on mixed-waste composting. In contrast, the market for energy is assured (through the federal Public Utilities Regulatory Policy Act of 1978.)

The other major drawback of such a "no-burn" system is that it would require nearly twice as much landfilling as the other system alternatives. Given the clearly established policy objective of minimizing landfill usage (as required by the State waste-management hierarchy, in reflection of the relative environmental and economic costs and benefits of landfilling versus the other waste-management techniques), and the fact that the eventual depletion of the Fresh Kills landfill's finite capacity will require reliance on more costly and less-reliable out-of-city landfills, this factor argues against the use of such a no-burn system.

A high-quality/organics/refuse system, in which source-separated organics were collected citywide for composting (not just from institutions), if done in a three-truck system, would be considerably more expensive due to the additional collection costs (Scenario #9).

15.3 Final-Phase Scenario Analyses.

The results of the intermediate-phase scenario analyses were used to develop a narrower range of still-more-detailed scenarios. To reflect this greater degree of refinement, these final-stage alternatives are labelled "systems," rather than the vaguer "scenarios." A major refinement added at this stage of analysis was the addition of commercial waste. Because of the uncertainty as to how much commercial waste will require disposal within the city, and the timing of that need, all final-phase systems were modeled both **with and without** commercial waste.

System A (an elaboration of scenario #7 above) uses the basic "high-quality recycling" system, a network of waste-to-energy facilities, and composts organics separately collected from institutions (only).

In System B (a more cost-effective refinement of scenario #9 above), organics are separately collected for composting citywide. In constructing this system, several improvements were made to build on lessons learned from the second-phase scenarios. First, two dual-compartment trucks (rather than three single-compartment trucks) were modelled to reduce costs. A two-truck system, in which refuse and source-separated organics were collected at the same time, would have the important corollary benefit of allowing more-frequent collection of organics at a minimal incremental cost -- an important consideration for this putrescible waste stream, particularly in high-density (small-apartment) areas. (An additional benefit of this system is that the same type of two-compartment truck might be usable citywide for both recyclables and refuse/organics, thus improving fleet efficiencies.) Finally, since dumping organic wastes into barges would not make their processing more difficult, truck-transport distances and costs could be minimized by using the City's existing MTS system to transfer organics and refuse in separate barges to their respective processing facilities.

In addition to these two system alternatives, two other "boundary" cases were analyzed as well. The "No-Burn" boundary case is the same as System B but with composting of mixed waste as well as organics, and without any waste-to-energy facilities: all non-recyclable/non-compostible refuse would be landfilled. The "Maximum-Burn" boundary case includes no recycling programs other than for bulk waste (which is non-combustible and must be separately collected anyway) and pre-Local-Law-19 levels of commercial recycling (i.e., commercial paper and corrugated cardboard).

The results of this final stage of modelling analysis are detailed in Chapter 17. The elements of these four systems are summarized in Tables 15.3-1 and 15.3-2.

Table 15.3-1: Elements of Final Solid Waste Management Systems (Residential and Institutional Waste)

N.B.: Facility locations (except the Staten Island MRF, Fresh Kills and the existing City incinerators) are for "generic" analysis purposes only. They are intended to represent wastesheds rather than specific sites.

SYSTEM A

COLLECTION SYSTEM

High Quality: Residential/Institutional
Leaf & Yard: Residential (low density only)
Organics: Institutional (selected sectors)
Refuse: Residential/Institutional (w/WTE)

FACILITIES

Materials Recovery (MRFs):
- Staten Island (500 TPD)
- Bronx (500 TPD)
- Manhattan (500 TPD)
- North Queens (500 TPD)
- SE Queens (500 TPD)
- NW Brooklyn (500 TPD)

Leaf & Yard Composting:
- Fresh Kills
- Edgemere

In-Vessel Composting:
- Wards Island (250 TPD)
- SE Brooklyn (120 TPD)

Waste-to-Energy:
- Betts avenue (1,000 TPD)
- Southwest Brooklyn (1,000 TPD)
- Greenpoint (1,000 TPD)
- Brooklyn Navy Yard (3,000 TPD)
- Bronx (1,000 TPD)
- Staten Island (2,000 TPD)

Landfill/Ashfill:
- Fresh Kills

SYSTEM B

COLLECTION SYSTEM

High Quality: Residential/Institutional
Organics: All Residential/Institutional
Refuse: Residential/Institutional (w/WTE)

FACILITIES

Materials Recovery (MRFs):
- Staten Island (500 TPD)
- Bronx (500 TPD)
- Manhattan (500 TPD)
- North Queens (500 TPD)
- SE Queens (500 TPD)
- NW Brooklyn (500 TPD)

In-Vessel Composting:*
- Bronx (300 TPD)
- Jamaica Bay (1,000 TPD)
- Staten Island (1,000 TPD)

Waste-to-Energy:**
- Southwest Brooklyn (1,000 TPD)
- Greenpoint (1,000 TPD)
- Brooklyn Navy Yard (3,000 TPD)
- Staten Island (1,800 TPD)

Landfill/Ashfill:
- Fresh Kills

* No leaf-and-yard-waste composting facilities are assumed for System B, since this relatively small volume of material would be composted with other organics in in-vessel facilities.

** One of the three existing incinerators would not be required under the set of capacity assumptions made in this scenario.

The addition of commercial wastes (see Table 15.3-2) would require expansion of waste-to-energy capacity, including the use of all three existing incinerators.

Table 15.3-1 (continued)

NO-BURN SYSTEM

COLLECTION SYSTEM

High Quality: Residential/Institutional
Organics: All Residential/Institutional
Refuse: Residential/Institutional (w/out WTE)

FACILITIES

Materials Recovery (MRFs):
- Staten Island (500 TPD)
- Bronx (500 TPD)
- Manhattan (500 TPD)
- North Queens (500 TPD)
- SE Queens (500 TPD)
- NW Brooklyn (500 TPD)

Mixed Waste Processing:
- North Queens (860 TPD)
- Bronx (2150 TPD)
- Jamaica Bay 800 TPD)
- Staten Island (2150 TPD)
- Greenpoint (1200 TPD)
- Southwest Brooklyn (1100 TPD)

In-Vessel Composting:
- Bronx (300 TPD)
- Jamaica Bay (1,000 TPD)
- Staten Island (1,000 TPD)

Landfilling:
- Fresh Kills

MAXIMUM-BURN SYSTEM

COLLECTION SYSTEM

Refuse: Residential/Institutional
Organics: All Residential/Institutional
Refuse: Residential/Institutional (w/WTE)

FACILITIES

Waste-to-Energy:
- Brooklyn Navy Yard 3,000 TPD)
- Staten Island (3,000 TPD)
- Bronx (1,000 TPD)
- SE Brooklyn (1,500 TPD)
- Southwest Brooklyn (1,000 TPD)
- Greenpoint (1,000 TDP)
- Betts Avenue (1,000 TPD)

Landfill/Ashfill:
- Fresh Kills

Table 15.3-2: Elements of Final Solid Waste Management Systems (Residential, Institutional and Commercial Waste)

N.B.: Facility locations (except the Staten Island MRF, Fresh Kills and the existing City incinerators) are for "generic" analysis purposes only. They are intended to represent wastesheds rather than specific sites. Private processing capacity is not wasteshed specific.

SYSTEM A

COLLECTION SYSTEM

High Quality: Residential/Inst./Commercial
Leaf & Yard: Residential (low density only)
Organics: Inst./Commercial (select sectors)
Refuse: Residential/Inst./Commercial(w/WTE)

FACILITIES

Materials Recovery (MRFs):
- Staten Island (500 TPD)
- Bronx (500 TPD)
- Manhattan (500 TPD)
- North Queens (500 TPD)
- SE Queens (500 TPD)
- NW Brooklyn (500 TPD)
- Private Processing (4,500 TPD)

Leaf & Yard Composting:
- Fresh Kills
- Edgemere

In-Vessel Composting:
- Bronx (470 TPD)
- Jamaica Bay (665 TPD)
- Staten Island (620 TPD)

Waste-to-Energy:
- Betts Avenue (1,000 TPD)
- Southwest Brooklyn (1,000 TPD)
- Greenpoint (1,000 TPD)
- Brooklyn Navy Yard (3,000 TPD)
- Bronx (2,250 TPD)
- SE Brooklyn (2,250 TPD)
- Staten Island (3,000 TPD)

Landfill/Ashfill:
- Fresh Kills

SYSTEM B

COLLECTION SYSTEM

High Quality: Residential/Inst./Commerical
Organics: All Residential/Selected Inst. & Commercial Sectors
Refuse: Residential/Institutional (w/WTE)

FACILITIES

Materials Recovery (MRFs):
- Staten Island (500 TPD)
- Bronx (500 TPD)
- Manhattan (500 TPD)
- North Queens (500 TPD)
- SE Queens (500 TPD)
- NW Brooklyn (500 TPD)
- Private Processing (4,500 TPD)

In-Vessel Composting
- Bronx (470 TPD)
- North Queens (600 TPD)
- Jamaica Bay (1,500 TPD)
- Staten Island (1,500 TPD)

Waste-to-Energy:
- Betts Avenue (1,000 TPD)
- Southwest Brooklyn (1,000 TPD)
- Greenpoint (1,000 TPD)
- Brooklyn Navy Yard (3,000 TPD)
- Bronx (1,500 TPD)
- SE Brooklyn (1,500 TPD)
- Staten Island (3,000 TPD)

Landfill/Ashfill:
- Fresh Kills

Table 15.3-2 (continued)

NO-BURN SYSTEM

COLLECTION SYSTEM

High Quality: Residential/Inst./Commercial
Organics: All Residential/Selected Inst. & Commerical Sectors
Refuse: Residential/Institutional (w/out WTE)

FACILITIES***

Materials Recovery (MRFs):
- Staten Island (500 TPD)
- Bronx (500 TPD)
- Manhattan (500 TPD)
- North Queens (500 TPD)
- SE Queens (500 TPD)
- NW Brooklyn (500 TPD)
- Private Processing (4,500 TPD)

Mixed Waste Processing:
- North Queens (3,000 TPD)
- Bronx (3,000 TPD)
- Jamaica Bay (3,000 TPD)
- Staten Island (3,000 TPD)
- Greenpoint (1,000 TPD)
- Southwest Brooklyn (1,000 TPD)

In-Vessel Composting:
- Bronx (470 TPD)
- North Queens ((640 TPD)
- Jamaica Bay (1,500 TPD)
- Staten Island (1,500 TPD)

Landfilling:
- Fresh Kills

MAXIMUM-BURN SYSTEM

COLLECTION SYSTEM

High Quality: Commercial
Organics: All Residential/Selected Inst. & Commercial Sectors
Refuse: Residential/Inst./Commercial (w/WTE)

FACILITIES***

Materials Recovery (MRFs):
- Private Processing (4,500 TPD)

Waste-to-Energy:
- Brooklyn Navy Yard (3,000 TPD)
- Staten Island (3,000 TPD)
- Bronx (2,250 TPD)
- SE Brooklyn (2,250 TPD)
- Manhattan (2,250 TPD)
- NW Queens (1,500 TPD)
- Southwest Brooklyn (1,000 TPD)
- Greenpoint (1,000 TPD)
- Betts Avenue (1,000 TPD)

Landfill/Ashfill:
- Fresh Kills

Figure 15.3-1: Materials Recovery Facility Wastesheds, Systems A and B

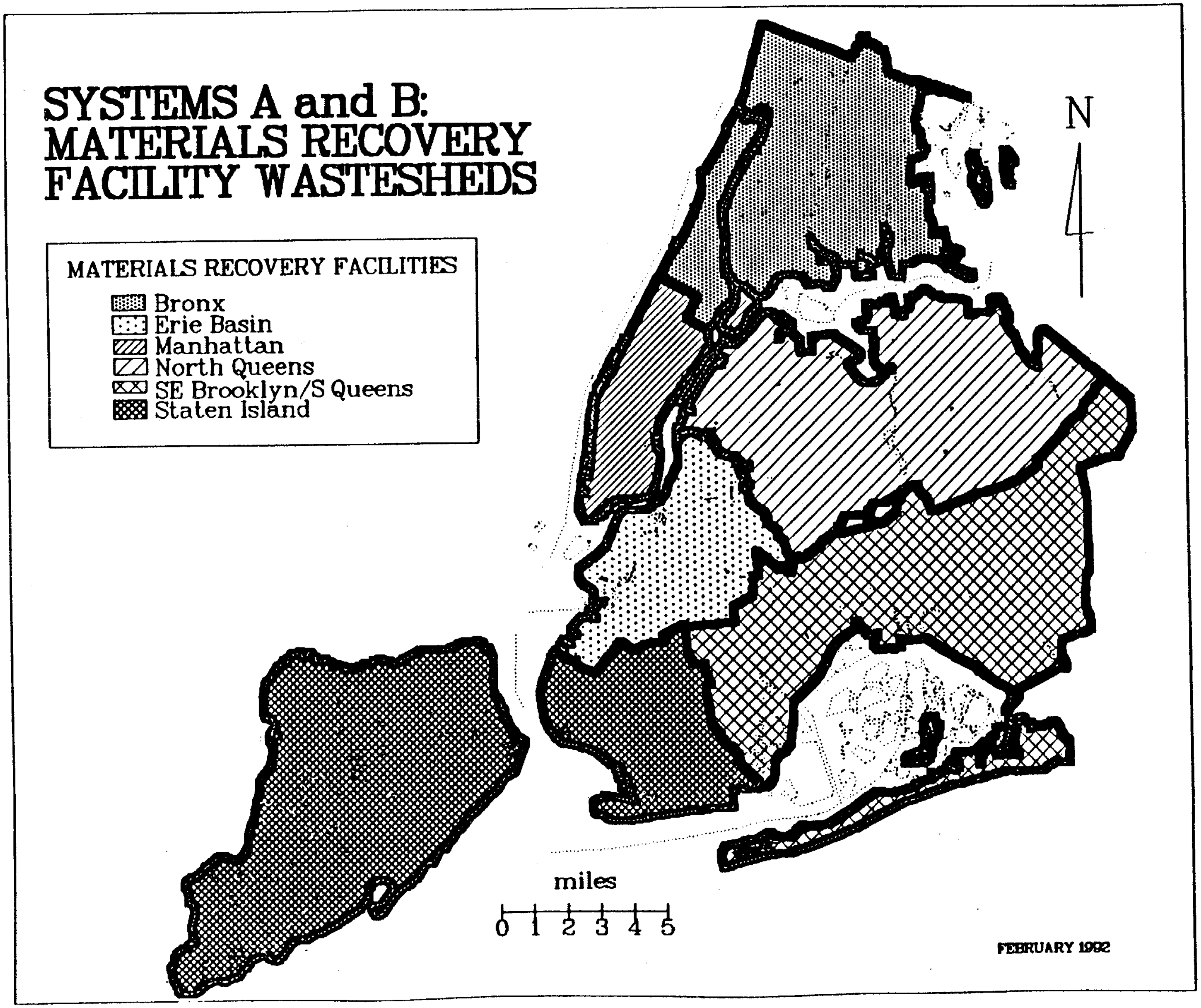


Figure 15.3-2: In-Vessel MSW-Compost-Facility Wastesheds, System B

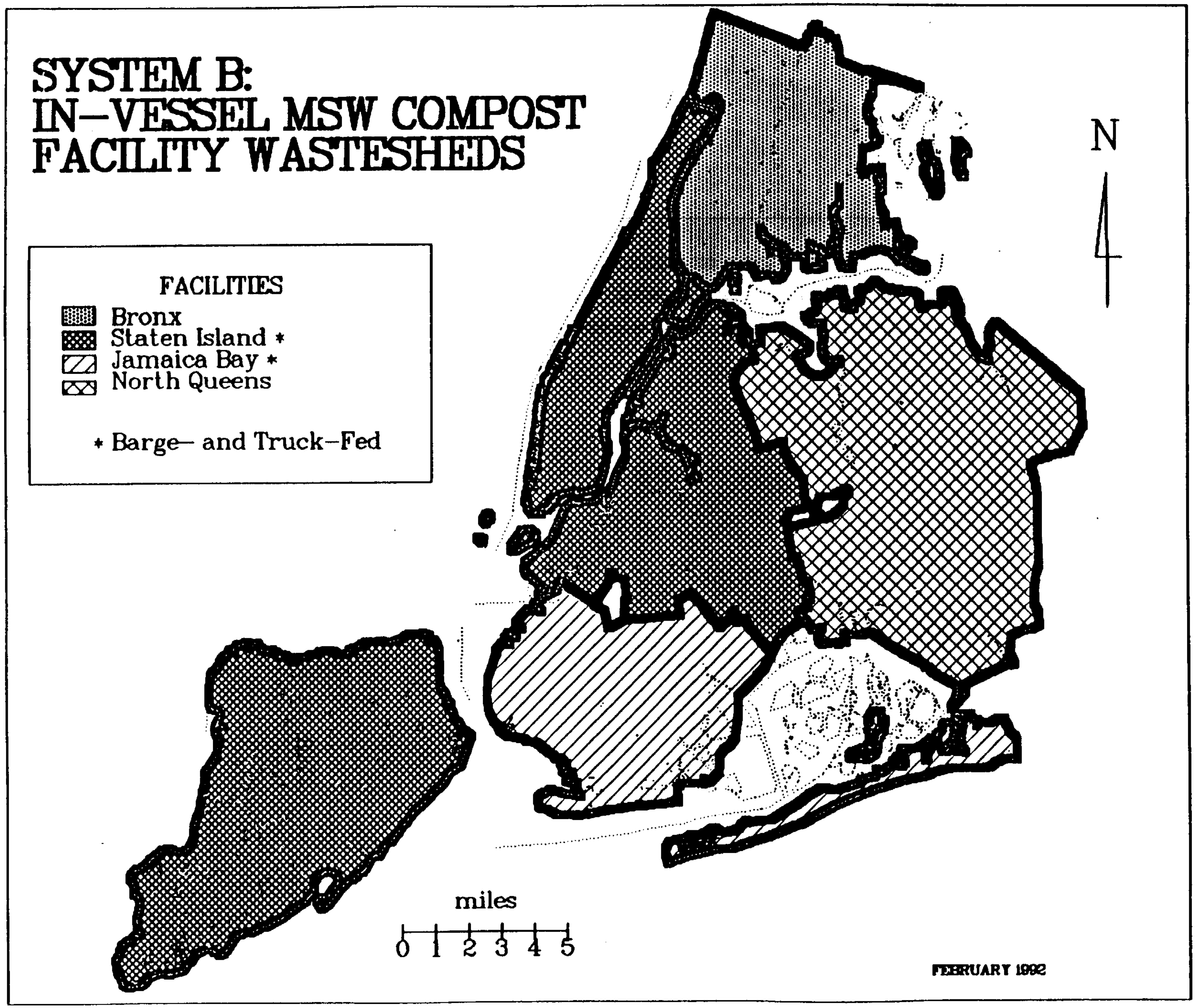


Figure 15.3-3: Waste-to-Energy Facility Wastesheds, System A

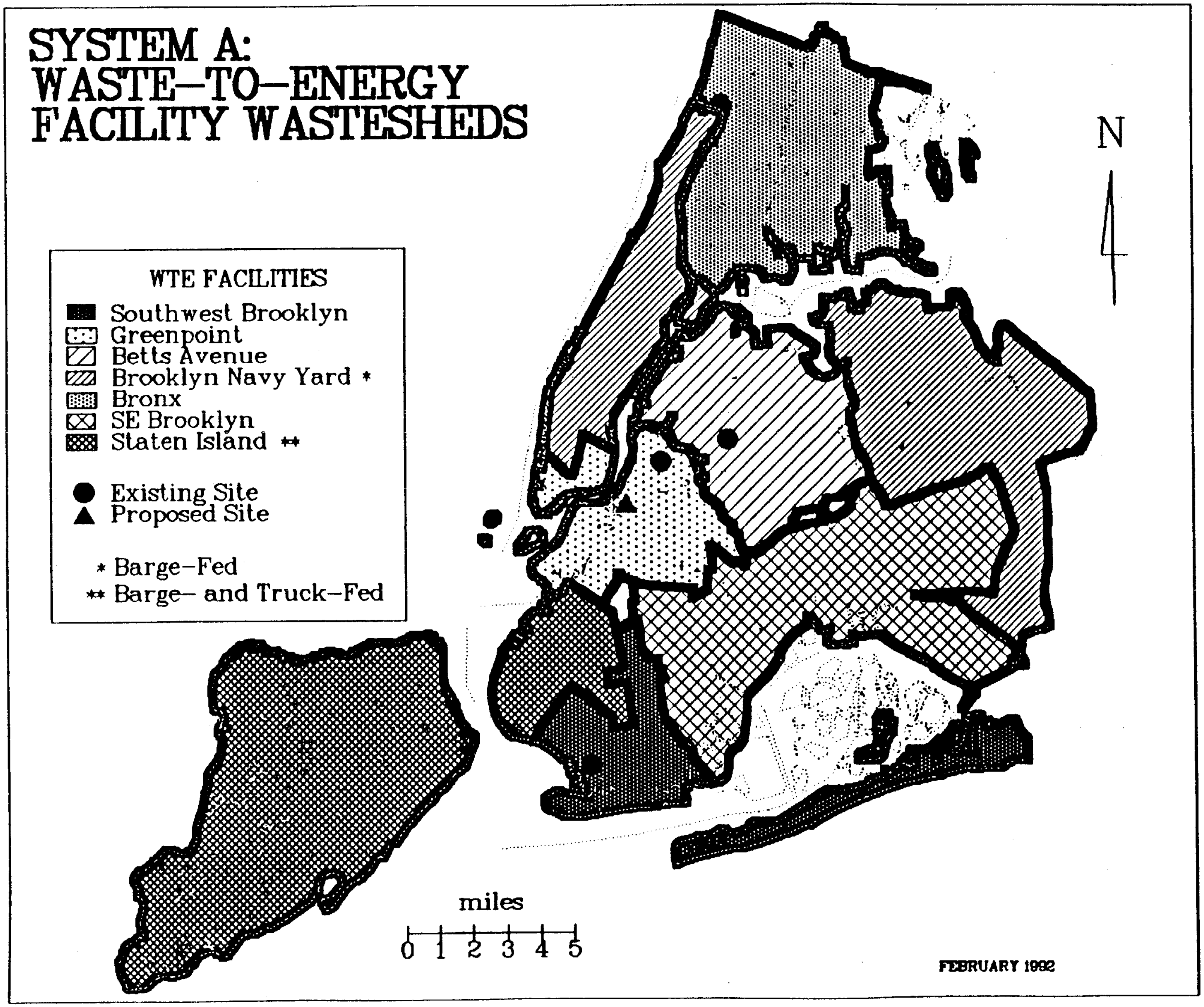
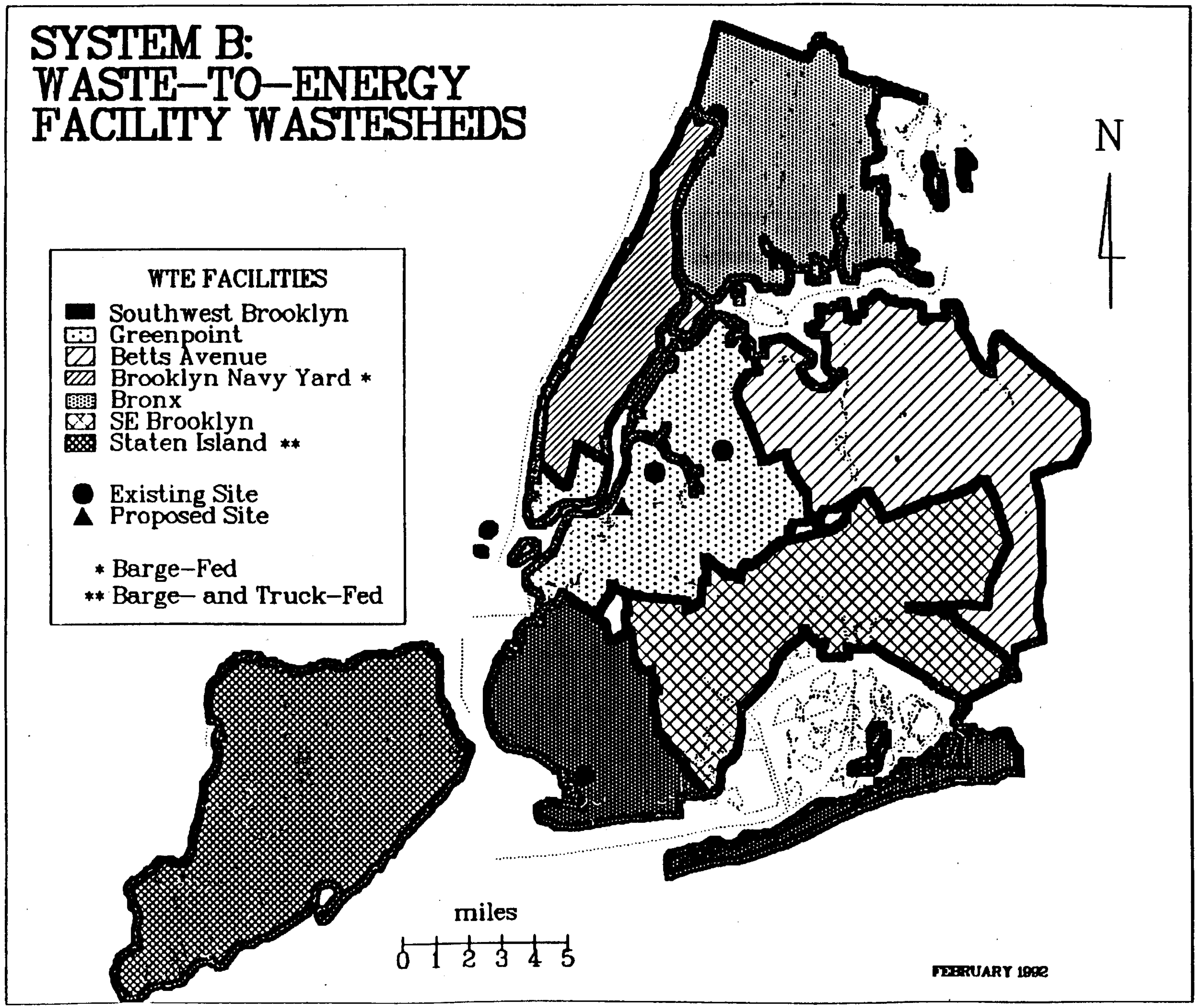


Figure 15.3-4: Waste-to-Energy Facility Wastesheds, System B



Endnotes

1. A fundamental constraint on the 1990 collection system -- a fixed number of daily truck shifts -- was not assumed in scenario analyses. However, no other improvements in labor efficiency were assumed.

2. Residential population density definitions followed the definitions used by the Sanitation Department for the waste composition study: low density = 1-4 family buildings; medium = over 4 units but under five stories; high = more than 4 units and five stories or over.

3. The values used are described in Appendix Volume 7.1, documents #13 and #14; the results are described in document #15.

4. One MRF is assumed to be in each borough, the remaining MRF in Southeast Brooklyn/Southern Queens.

5. 1990 DS incinerator costs provided to Benjamin Miller by Eric Zimiles, Director of Administration, Bureau of Waste Disposal, 5-24-91.

6. These were assumed to be 1500 tpd facilities in the Bronx, NE Queens, NW Queens, SE Brooklyn, and W Brooklyn, and a 2250 tpd facility in Staten Island.

CHAPTER 16. THE COMPONENTS OF THE WASTE-MANAGEMENT SYSTEM.

A "decision tree" is a central element of this plan. This decision tree is divided into three conceptual time frames.

The near-term implementation plan combines those projects that reflect the City's commitments over the next five years. Implementation of these programs and facilities, along with the monitoring and research-and-development programs to which the City is committed, will help to determine the most appropriate choices and directions for the mid-term program.

The mid-term program covers alternative systems that reflect basic programmatic choices encompassing the range of projected conditions (demographic, economic, generation, composition, technological, participation, marketing). One of these systems will represent a preferred alternative on the basis of environmental, cost, and policy grounds. The key variables associated with the demographic, economic, etc. conditions that will help to determine the eventual choice between alternative systems will need to be monitored by ongoing analyses specified in the immediate-term plan. Research-and-development (R&D) programs designed to maximize the probabilities of being able to implement the preferred mid-term program will also be specified in the immediate-term plan.

The full-implementation stage refers to the completely implemented waste-management system which, for purposes of the current planning exercise, is considered for heuristic purposes to be "steady state" (clearly an imaginary construct in the ever-changing real world).

The near-term program focuses on prevention and recycling programs, along with upgrading one of the City's existing incinerators and its landfill, and the development of the Brooklyn Navy Yard waste-to-energy facility. The specific implementation schedule and sequencing of specific program elements is laid out in Chapter 19. The near-term monitoring program includes periodic waste composition and generation analyses (including product-specific waste studies to facilitate waste-prevention planning), which will be tied to continued monitoring of population, household size, and business-sector changes. The monitoring program will also track technology developments (particularly in the composting field, since there has been little U.S. experience with these systems in the past, while the U.S. industry is growing rapidly at present) and market developments. The near-term R&D program focuses on both large-scale and on-site in-vessel compost systems, on two-compartment truck tests, bag-breaking equipment, and market applications for problematic materials such as tires.

The alternate mid-term systems have the same sets of prevention and recycling program assumptions (i.e., that about 2500 tons per day could be prevented and about 8,000 tons per day recycled -- assumptions, however, that can only be confirmed through actual testing and implementation). They differ in the relative proportions of composting, waste-to-energy, and landfilling.

System A, would involve a more limited degree of organics composting (involving certain dedicated institutional generators only) than System B, which would include the maximum potential level of composting by adding a citywide residential source-separated organics collection and composting program. The proportion of waste that is composted will directly displace the need for waste-to-energy incineration capacity. System B, therefore, would conform more closely to the state solid waste management policy at only modestly greater cost. However, its eventual viability is dependent on the succesful results of more near-term program variables such as the effectiveness of the split-body truck design, citizen participation levels in the materials source-separation program, and the performance record of in-vessel composting technologies.

The full-implementation phase, would develop out of the near-term implementation plan in the direction of the "A" or "B" templates -- or a hybrid encompassing some elements of both. It is by no means clear that the additional waste-to-energy capacity in Systems A and B will be needed, particularly if the City's waste-reduction efforts are successful and the recycling and composting diversion rates are high. The full-implementation phase has variants that would include City provision of disposal capacity (composting, waste-to-energy, landfill) for private carters in the event that waste is no longer exported from the City at its present levels. (In this case it is assumed for planning purposes that "the privates" would still continue to provide their own collection services and recycling processing facilities.)

The decision-tree approach to implementation of this plan is intended to address the inherent uncertainties associated with long-range (i.e, 20-year) planning under ever-changing circumstances. It provides the City with the maximum degree of flexibility in making future waste-management program choices that will best meet its public-policy objectives (see Chapter 5). It reflects a sequencing of implementation steps and decisions shaped by information and experience from preceding and current program performance as well as from monitoring other relevant factors.

16.1 Waste-Prevention Programs.

16.1.1 MSW Prevention Programs.

The City's near-term MSW waste-prevention activities will focus on implementing the following programs:

The City will develop and promote a backyard composting program for all "low-density" neighborhoods, which will target leaves, grass, brush, and foodwaste. The program may include workshops, information kits, and perhaps the provision of backyard composting bins.

The City will promulgate regulations that prohibit the collection of grass clippings and their disposal at City facilities. In addition to encouraging the management of this waste stream component by simply leaving it on the lawn, this measure may also encourage backyard composting, which would prevent other materials such as leaves and foodwaste from entering the collection and disposal system.

The City will revise purchasing policies to support the substitution of durable and re-usable goods in place of semi-durable and disposable goods and the substitution of non-toxic and less-toxic products for their more toxic counterparts.

The City will also develop a program under which vendors selling products to the City would be required to minimize packaging waste associated with their products and to retain possession of shipping waste.

The City's waste-prevention public-education program will be conducted on two broad fronts. The first will promote public-education strategies targeted to specific materials such as junk mail, retail packaging, and potentially repairable and re-useable products. Second, information designed to promote awareness of waste-prevention opportunities will be part of all Department-related public-education activities.

In addition to pursuing the programs described above, the City will continue to research and monitor ongoing waste-prevention programs, legislation and issues. These will include legislative proposals (such as the CONEG legislation), proposals to expand the materials covered under deposit legislation, packaging and product taxes/fees, product-specific waste-composition studies, and waste-prevention quantification and monitoring techniques. These research efforts will also focus on ways to implement systems for making the costs of waste-management more directly attributable to individual waste generators (i.e., through user fees) and thus creating a financial incentive to reduce waste.

Many legislative initiatives on waste prevention, particularly for packaging, would be most effective if adopted at the federal level. Local initiatives would have limited impact, result in inconsistent standards nationwide which would complicate industry compliance, and could result in economic dislocation. However, because waste-management problems generally manifest themselves on the local level, it is sometimes difficult to garner federal support for waste-prevention/-recycling initiatives.

To address this problem, the Department of Sanitation has explored establishing a multiple-cities coalition, whereby localities would work together to develop model waste-prevention/-recycling legislation. The model legislation would be submitted to local legislatures for adoption, but would only become effective if approved by a "critical mass" of localities. The multiple-cities-coalition strategy should be a mid-term goal of the City if its near-term federal and state lobbying efforts prove unsuccessful.

A user-fee system for residential, institutional and commercial sectors that would make generators pay for waste collection and disposal according to the quantities of trash they discard could be a significant waste-prevention strategy for the City to implement in the mid-term. Goals for such a program would include:

- Developing rate structures that offer significant rewards to low-volume generators;
- Refining cost-accounting structures so that costs can be appropriately allocated to relevant generators; and
- Devising systems that are fair and explainable to constituents.

In order to enhance the effectiveness of the user-fee system in the commercial sector, the Department of Sanitation will begin to work with the Department of Consumer Affairs to revise the existing commercial rate-structure to make private carting fees more volume-sensitive and to disaggregate collection and disposal costs. This process will include efforts to assign collection-cost savings to the hauler and disposal-cost savings to the generator. In addition, the Department of Sanitation is supporting legislation proposed by Consumer Affairs to authorize exclusive licensing districts for commercial-waste removal. Exclusive districts should enhance the City's ability to monitor and control the user-fee system.

More research and analysis needs to be done on institutional and residential user fees. The issues surrounding the residential sector are particularly complex. Nevertheless, quantity-based user fees might be established in low-density residential areas and in multi-tenant areas through a system in which users are charged for specially marked refuse bags or tags that would be affixed to bags. A prerequisite to developing this system would be pilot-scale field-tests to gather data on how waste quantities and composition are affected, as well as on the administrative feasibility of a bag/tag program.

Another potential mid-term prevention strategy involves designing a system for requiring waste audits to be performed in all businesses that have more than a specified minimum number of employees. Implementation of this program could be most effectively organized through relevant trade associations and business groups. The waste-audit program could be designed to:

- Provide time for the trade associations and groups to develop guidelines for how waste prevention can be accomplished in each business sub-sector. It would be expected that some companies could reduce waste generation well in excess of the 8-to-10-percent State goal.
- Require waste audits that meet the guidelines for business sub-sectors to be completed by a specified time.
- Require the trade associations and groups to report on implementation of the strategies generated by the waste audits and the level of reduction being achieved by the affiliated companies at least annually.

This approach to waste auditing could build on the activities of the New York City Partnership for Waste Prevention (see Chapter 3). This program could also be linked to the NYC Department of Consumer Affairs' rate-regulation activities, so that businesses could be provided with assurance that reductions in waste generation would result in reduced collection and disposal costs.

16.1.2 Programs for Reducing Pollutants in Sludge.

The Department of Environmental Protection has an ongoing "industrial pre-treatment" program, which is designed to identify and eliminate the major point-sources of industrial-pollutant discharge. (A description of the New York City Industrial Pre-treatment Program is contained in the Task 15 report on the Long-Range Sludge-Management Plan produced by Stone & Webster Engineering Corporation, October, 1989.)

16.1.3 Medical Waste Prevention Programs.

Due to the high cost of disposing of regulated medical wastes, clear economic waste-prevention incentives are an inherent part of the medical waste (red-bag/black-bag) regulatory system. These economic incentives help to provide a stimulus for prevention programs on an administrative level, such as programs to control unused product discards, to institute departmental accountability for waste-generation costs, to develop product-purchasing evaluation criteria, bulk food-service purchasing practices, reducing the use of plastic waste bags in administrative areas (as opposed to patient-care areas), and using re-usable rather than disposable hospital "admission kits."

However, refinements in current regulatory practices could sharpen waste-prevention incentives. Specifically, a waste-generator permit system could be developed to replace the current requirements for filing a waste-management plan. Under this proposed new system, annual permit filing fees based on certified waste quantities would be required. Such a system would also provide a means for collecting data on prevention (and recycling and disposal) rates.

As a requirement of this system, medical-waste generators would be required to file institution-specific waste-management plans that would take into account site-specific waste composition, quantities, and costs, and which would specify the waste-prevention steps that the particular generator would be committed to implementing. Generators who failed to implement their own waste-management plans adequately would be denied access to the Department of Sanitation's disposal system.

Table 16.1.3-1 shows four potentially significant waste-prevention measures that could be among the range of feasible programs considered for inclusion in certain medical facilities' site-specific waste-management plans:

1. Replacing paper towels by air dryers in all public rest rooms and staff locker rooms would reduce the generation of paper towels by about 60 percent. This technique has been used successfully in many facilities, and would be suitable for most hospitals.

2. Disposable plates, cups, knives, forks, spoons, bowls, trays, and tray covers could be replaced with re-usable substitutes. This would require the installation of sufficient dishwashing capacity.

Table 16.1.3-1: Prevention Impacts of Proposed Medical-Waste Programs

DESCRIPTION	EFFECT	PERCENT REDUCTION			TOTAL	COST	
		RMW*	NRMW**	TOTAL	TPD HANDLED	OPERATING#	CAPITAL##
Replacement of Paper Towels with Air Dryers	Should reduce paper towels by 60%	NA	3.8%	2.7%	21.4	$368,000	$720,000
Purchase of Reusable Stock for Food Service	Replaces disposable trays, tray covers, plates, cups, knives, forks, spoons	3.8%	5.6%	5.1%	40.4	$31,217,000	$2,937,000
Replacement of Disposable Linens	Will require the construction of on-site laundries	7.0%	2.9%	4.1%	32.5	$22,404,000	$1,084,000
Reusable On-Site Sharps Containers	Coupled with on-site disinfection, this would eliminate all disposable sharps containers -- for ACFs only	1.5%	NA	0.4%	3.2	$2,664,000	$585,000

* Regulated medical waste (red bag)
** Non-regulated medical waste (black bag)

\# Year 2000 dollars
\#\# 1990 dollars.

3. Because many New York health-care institutions no longer have on-site laundry facilities, replacing disposable linens with re-usable ones, in many facilities, could be accomplished most easily and economically by using a commercial service. Hospitals use many different types of disposable linen products. About a third of all disposable linen waste could be replaced with reusables, including isolation, examination, and surgical gowns and scrub pants, and diapers (both for children and for adults). Although many hospitals switched to disposable linens before the mid-1980s because they were less expensive than re-usable ones, the rapid escalation of medical-waste disposal costs since 1986 has changed the relative economics of their use for many facilities.

One way of replacing disposable sharps containers with re-usable ones is to use a commercial service to install and service wall-mounted, point-of-use sharps receptacles. Such programs include the removal of full containers by the contractor, and their replacement with clean, empty containers. Several large New York City hospitals currently use contracted sharps-removal services.

These sorts of practices, on an aggregate basis, could reduce the medical-waste stream (both regulated and non-regulated wastes) by about 12 percent, an estimated 32,000 tons per year, by the year 2000. More than a quarter of that total could consist of regulated medical waste.

16.1.4 Harbor Debris Prevention Programs.

A combination of currently planned CSO-abatement programs, current anti-littering enforcement and street-cleaning activities, planned sewage-treatment-plant upgrades, and ongoing pier-removal programs should reduce harbor debris to the projected levels (6250 tons in 2010). These currently planned programs (described in Chapters 3 and 4) effectively exhaust the range of feasible alternatives for preventing the generation of harbor debris.

16.2 Recycling Programs.

16.2.1 Recycling Programs for Residential MSW.

16.2.1.1 Targeted Materials.

The basic, citywide source-separated residential recycling program eventually will target 25 materials (all metal, glass, plastics, dry paper, textiles, dry cell batteries, about 46% of the residential waste stream) for separate curbside collection in bags and in dual-compartment trucks to keep paper and textiles separate from other materials. The same materials would be targeted in apartment buildings that receive containerized recyclables collection. These materials, and the proportions of the residential waste-stream that they constitute are identified in Table 16.2.1-1. Bulk items also will be targeted for separate collection and recycling.

In addition, there will be specialized drop-off and buy-back sites designed to collect additional materials, such as household hazardous wastes and bulk goods.

This system, however, presumes that the City's recycling program is already well established in all five boroughs and that there is adequate MRF capacity to separate these materials.

In the immediate term, the City will collect the six currently designated materials, along with leaf and yard waste and bulk metal. Metal, glass, and plastic will be collected in blue bags, and the paper materials will be tied and put out separately (until bag-breaking/separating equipment has been demonstrated to be effective for bags of papers). These materials will be taken to the City's processing facilities, sorted and marketed for recycling.

Table 16.2.1-1: Materials Targeted in the High-Quality Source-Separation Program

	% of Total*	High Quality
Corrugated/Kraft	5.6 %	X
Newsprint	8.9 %	X
Office/Computer	1.0 %	X
Magazines/Glossy	3.8 %	X
Books/Phonebooks	1.8 %	
Non-Corrugated Cardboard	2.5 %	
Mixed Paper	9.9 %	X**
Clear HDPE Containers	1.1 %	X
Colored HDPE Containers	1.1 %	X
LDPE	0.2 %	X
Films & Bags	5.5 %	X
Green PET Containers	0.1 %	X
Clear PET Containers	0.8 %	X
PVC	0.4 %	X
Polypropylene	0.3 %	X
Miscellaneous Plastics	0.8 %	X
Grass/Leaves	3.0 %	
Diapers	2.5 %	
Food Waste	10.9 %	
Miscellaneous Organics	7.3 %	
Glass Containers-Clear	1.9 %	X
Glass Containers-Green	0.7 %	X
Glass Containers-Brown	0.6 %	X
Miscellaneous Glass	0.2 %	
Food Containers/Foil	0.5 %	X
Aluminum Beverage Cans	0.5 %	X
Miscellaneous Aluminum	0.1 %	X
Food Containers	1.6 %	X
Miscellaneous Ferrous	2.0 %	
Bi-Metal Cans	0.02 %	X
Ceramics	0.1 %	
Miscellaneous Inorganics	1.8 %	
Pesticides	0.01 %	
Non-Pesticide Poisons	0.02 %	
Paint/Solvents/Fuel	0.2 %	
Dry Cell Batteries	0.02 %	X
Car Batteries	0.04 %	
Medical Waste	0.02 %	
Miscellaneous HHW	0.1 %	
Textiles	4.4 %	X
Rubber	1.9 %	
Fines	2.2 %	
Brush/Stumps	0.7 %	
Lumber	2.1 %	
Polystyrene	0.8 %	X
Bulk	10.0 %	
Total	**100.02 %**	**45.6 %**

* Projected composition in the year 2000 after 7.5% is "prevented."
** 50% of mixed paper is assumed to be "high quality."

16.2.1.2 Public Information/Education.

The recycling public information/education program is intended to achieve two ends: informing citizens about how they should recycle, and convincing them of the importance of that activity. In turn the program rests on two fundamental principles: First, it should be as easy as possible for New Yorkers to participate in source-separated recycling programs. This means that programs must be designed in a way that makes it easy for citizens to understand what to do and when to do it, and that makes it possible to communicate this information efficiently to citizens throughout the City. Secondly, the City's commitment to its recycling program should be clearly visible and unmistakable.

The design of the collection program, as well as the that of the public information program, is meant to address the first of these principles:

- The basic source-separated residential collection program will be the same -- the same materials, the same "set-out" method -- citywide. It will be phased in over the city, borough by borough, over the course of the next three years. This will enable the use of simple, efficient, low-cost "broad-channel" communications media (such as subway posters and TV and radio public-service announcements). This approach, however, will be supplemented by community outreach -- with the assistance, where possible, of the skills and talents of community environmental groups. It is through activities of these groups that citizens are most likely to be convinced of the education/information program's second objective -- that recycling is an important and worthwhile activity.

- The material designations will remain constant. They are designed to be simple to communicate and understand (e.g., all clean, dry paper and textiles, all glass, metals, and plastics). As a result, the program will change as little as possible over the years -- allowing the City to respond easily to new technologies and markets.

- A colored-bag system, in which recyclables are placed in plastic bags (paper and textiles in one, metals, glass, and plastics in the other) maximizes convenience for the waste generator. In contrast to open bins, bags do not have to be stored, carried down to the curb and back, cleaned, or replaced after breakage or theft. Further, they provide flexibility. A resident can use as many or as few bags as needed, rather than being constrained by a fixed container size. Another advantage is that bag-making companies and retailers will have an incentive to contribute to public-awareness advertising campaigns. Finally, the colored bags -- like the blue bins -- will serve as a visible reminder of the program.

The City's commitment to recycling will be made as clear and visible as possible through measures such as these:

- Long-term marketing contracts coupled with a combination of long-term processing contracts and the development of City-owned processing centers for recyclables.

- Stepped up implementation of mandatory recycling responsibilities by City agencies and authorities. That is, the City Housing Authority, other City-managed residential properties, schools, hospitals, parks and other City agencies will be directed to participate full in recycling programs, and a monitoring system will be put in place to ensure compliance.

- Enforcement programs will be simplified, so that they can play a more effective roles as a communications technique. Compared to most legally mandated Sanitation-related citizen behavior in this City (e.g., alternate-side parking rules, the "pooper-scooper" law, and litter regulations), recycling programs have made little use of clear-cut signage. This has been due in part to the complexities of the City's initial neighborhood-specific recycling programs. However, the advent of a standardized, city-wide program would allow the use of street signs as simple as "Curb Your Dog!" or "No Parking Tuesdays, Thursdays, or Saturdays" -- e.g., "Paper, Metals, Glass, and Plastic on Wednesdays Only" -- with equally direct ticketing measures. In conjunction with changes in the alternate-side-of-the-street-parking signs, the Sanitation Department will institute a pilot recycling-sign program.

An additional component of the incentive for the public to participate, if this proves feasible, is a volume-based fee for non-source-separated refuse collection. This user fee would be structured in such a way that landlords and tenants shared the incentive to recycle.

The basic public information program to support the recycling program would include newspaper advertising, school curricula, utility bill stuffers, as well as subway posters and public service announcements. All of these media would highlight the basic components of the program (the materials, the bags, the collection days), and all would direct those who needed additional information on the basic program, or on the auxiliary programs (drop-off and buyback centers, household hazardous waste and bulk drop-off locations, backyard composting, thrift shops, appliance repair/"re-use-it" centers, waste reduction information, etc.) to a telephone 24-hour "hot-line," which would be connected to on-line information and to direct-mail services. A central element of the general advertising strategy will focus on waste prevention, since raising public awareness of this issue is one of the most effective ways of achieving waste reduction by consumers, and since this advertising will have the double benefit of also raising awareness of the need for recycling. Beyond the generalized citywide public information/advertising campaigns, the major focus for targetted campaigns will be landlords and building superintendents, who serve as a primary mechanism for facilitating the recycling efforts of apartment-house residents.

16.2.1.3 Collection Systems.

The basic citywide source-separation recycling program will eventually involve once-a-week collection of bagged recyclables in a dual-compartment rear-loading compactor truck.

The bags will be a different color than normal refuse bags (e.g., blue), semi-transparent so that their contents are not visible from a distance (e.g., 40 feet), but are distinguishable by collectors (e.g., at four feet). They will be purchased by residential waste generators. All recycling bags will be required to be made of the same plastic resin (e.g., low-density polyethylene only and containing at least a specified percentage of recycled content), so that the bags themselves can be recovered for recycling at the processing facilities.

This basic system will be supplemented through drop-off igloo-type containers, voluntary drop-off centers and bulk and household hazardous waste drop-off centers, and buy-back centers.

16.2.1.4 Processing Facilities.

The City will develop or contract for sufficient processing capacity, estimated to be in the range of 3,000 tons per day, to handle this "high-quality" waste stream. Facilities developed by the City are likely to be on the order of 500 tons per day (with 2-shift operation, 302 days a year). They will be capable of handling each of the separately dumped materials streams from the two-compartment trucks in separate processing lines. The first piece of processing equipment in the respective lines will be a bag-opening device. The facilities will have enough processing/sorting flexibility to make varying degrees of positive and negative sorting to produce material specifications of varying grades to meet shifting market circumstances (e.g., plastics can be sorted into a variety of individual resins or aggregated as miscellaneous plastics in order to meet market demands most cost-effectively).

For a detailed description of this facility, see "Materials Recovery Facility" in Appendix Volume 5 ("Reference Facilities").

16.2.1.6 Market Requirements.

The proposed residential and institutional recycling collection system will produce estimated quantities of materials in the ranges identified in Table 16.2.1-2.

Table 16.2.1-2 shows that, under current conditions, based on an assessment of estimated regional supplies and demand, slightly more than half of the "high quality" materials captured in the City's proposed recycling program would not be marketed. The shortfall in demand is due to the fact that currently there is not a dependable demand for certain materials in the designated high-quality waste stream because it is outstripped by existing regional supply. The materials for which markets are weak are textiles and various types of paper and plastics. For other paper and plastics, and for glass and metals, the market could absorb this additional supply from the City. For those materials (certain paper, plastic, and textiles) for which there is currently not sufficient demand, market problems are less due to any inherent technical or economic infeasibilities than to the fact that sufficient processing capacity by manufacturers capable of using these secondary materials simply has not been developed yet. Developing a dependable supply of these materials, which is what the City's proposed recycling program would do, should help to increase the amount of processing capacity, and hence, demand.

16.2.2 Recycling Programs for Institutional MSW.

The recycling programs for institutional MSW would parallel those for residential MSW. One difference is that institutional collections would rely more on automated collection of large containers. Another difference is that it will be easier to develop volume-based charging mechanisms for institutions, the effectiveness of which would be enhanced by a proposed waste-audit program. A third difference is that institutions will allow the cost-effective implementation of certain specialized collection programs, such as for computer/office paper. As noted above, institutional programs also offer good opportunities for high-visibility "drop-off" systems.

Table 16.2.1-2: Estimate of Materials Captured and Marketed in Proposed High-Quality Recycling Program: Year 2000, Residential and Institutional Waste Streams.

	Captured	Marketed
TOTAL PAPER & TEXTILES	520,000	220,000
PAPER	450,000	220,000
Corrugated/Kraft	98,000	0
Newsprint - #6 (a)	40,000	40,000
Newsprint - #8 (a)	120,000	120,000
Office/Computer	18,000	0
Magazines/Glossy	65,000	65,000
Mixed Paper	111,000	0
TEXTILES	69,000	0
TOTAL CONTAINERS	250,000	210,000
GLASS	68,000	68,000
Glass Containers-Clear (b)	12,000	12,000
Glass Containers-Green (b)	0	0
Glass Containers-Brown (b)	3,500	3,500
Glassphalt	52,000	52,000
PLASTICS	130,000	91,000
Clear HDPE Containers	19,000	19,000
Colored HDPE Containers	19,000	19,000
LDPE	3,000	0
Films & Bags	29,000	29,000
Green PET Containers	2,800	2,800
Clear PET Containers	15,000	15,000
PVC	7,000	0
Polypropylene	5,000	5,000
Polystyrene	13,000	0
Miscellaneous Plastics	12,000	0
METALS	54,000	54,000
Food Containers/Foil	10,000	10,000
Aluminum Beverage Cans	9,100	9,000
Miscellaneous Aluminum	2,400	2,400
Food Containers	33,000	33,000
Bi-Metal Cans	360	360
TOTAL CAPTURED/MARKETED	770,0000	440,000
TOTAL RESIDUE/UNMARKETABLE	140,000	470,000
GRAND TOTAL	910,000	910,000

(a) Assumes that 25% of newspaper will be marketed as #6 newsprint and 75% as #8.
(b) Unbroken clear and brown glass containers are to be sent to cullet markets.
Unbroken green glass as well as broken glass will be used by City for glassphalt.

16.2.3 Recycling Programs for Commercial/Industrial MSW.

For purposes of this plan, it is assumed that recyclable materials will continue to be collected and processed by private carters, without the need for significant changes in or expansion of the existing collection or processing/transfer system. Private carters should be able to market any materials that the City will be able to market. In addition, there are likely to be materials markets -- e.g., corrugated cardboard, office paper, textiles -- for which private haulers are better-suited to compete, either because private-sector waste generators and haulers can produce secondary materials of higher quality, because their source-segregated collection methods are more cost-effective (due, in part, to the fact that sectors of the commercial waste stream are more homogenous), or because they are able to use existing market arrangements and private-sector contracting flexibility.

Local Law 19 offers two options for recycling commercial wastes: source separation by the waste generator or post-collection separation at transfer stations. Both types of systems are proposed in this plan. The proposed programs are based on programs already operated by private haulers. The first is a "mixed paper" program for commercial sectors that generate waste that is predominantly paper, and the second is a "high quality" program for commercial sectors that generate a cross section of recyclable materials. (In addition, there is also a commercial organics-collection program, which is discussed in Section 16.3.1.2.)

Each of the commercial sectors are assigned to one or more of these programs based on the compositions of their respective waste streams. The mixed-paper program targets commercial sectors that generate large quantities of different recyclable paper grades. These grades include: corrugated cardboard, office paper, newspaper, magazines and glossies, and mixed paper. The sectors that are serviced by this program include:

Retail - non food
Retail - food
Finance, Insurance, Real Estate
Personal Repair
Business/Legal Services
Proprietors
Hotel/Amusement
Transportation, Communications, Utilities
Wholesale
Airports

The mixed-paper collection program, in all likelihood, will in practice be comprised of many types of paper-collection programs, depending upon the sector being serviced, the type of establishment being collected, and the type of hauler doing the collection. Some programs will target only a specific grade of waste paper (for example, corrugated programs from foodstores and restaurants, or office paper from office buildings). Some will collect several grades together (for example, retail establishments that generate large quantities of both corrugated and mixed paper/white paper). The mid-range projections for participation rates for this type of program are 85 percent (on a per-employee basis) and capture rates are 75-90 percent, depending on the type of material. This program would capture on the order of 960,000 tons of material per year by the year 2000.

The second type of commercial recycling program is based on the residential/institutional "high quality" program. This program targets those sectors that generate a cross section of recyclable materials, without any one material being dominant. The materials targeted by the commercial high-quality program include corrugated cardboard; newspaper; office/white paper; magazines; mixed, clear and colored HDPE; plastic film and bags; clear and green PET; miscellaneous plastics; all colors of glass; all grades of aluminum; all grades of ferrous metal; and textiles. The sectors targeted by the high-quality program are the durable and nondurable manufacturing sectors. Participation and capture rates for this program are projected to be 65 percent and 80 percent respectively. Overall, this program would collect about 330,000 tons of materials per year by the year 2000.

Although it is anticipated that the processing capacity that would be required for this material would continue to be provided by the private sector, the costs and environmental impacts of this amount of processing capacity have been estimated based on the materials-recovery and paper-processing reference-facility data. In practice, not all of this capacity is likely to be newly developed, since existing transfer stations will no doubt continue to handle some material, and existing paper brokers will continue to absorb some material. Overall, the commercial sector will require 3,200 tons per day of paper-processing capacity and 1,100 tons per day of mixed-recyclables processing capacity.

Commercial waste that is not collected by source-separation programs will continue to be processed by post-collection processing systems for mixed waste, which, in all likelihood, will generally continue to be located at existing transfer stations. Currently, transfer stations may transfer mixed waste to another facility for recovery of designated recyclable material. However, the Department of Sanitation will seek to amend its transfer-station requirements to require operators to separate designated recyclables at their facilities, which should result in facilities being upgraded with improved equipment to enhance their material-recovery capabilities. These processing/transfer facilities for commercial waste will process/transfer roughly 1.9 million tons of waste. Out of this total waste stream, based on data from existing mixed-waste processing facilities, an estimated 436,000 tons, or 23 percent of the incoming waste stream will be recycled.

16.2.4 Recycling Programs for Medical Waste.

16.2.4.1 Targeted Materials for Recycling in Medical Institutions.

The same basic universe of materials will be targeted for medical institutions as for other institutions. In addition, several specialized waste streams for materials that are uniquely abundant in medical institutions -- notably batteries, needles and other "sharps," and PVC tubing, bags, and gloves -- will be targeted for separate recycling collection and processing.

16.2.4.2 Diversion Rates for Recyclable Materials from Medical Institutions.

Projected diversion rates for the major medical-waste recycled materials are presented in Table 16.2.4-1.

Table 16.2.4-1: Projected Recycling Diversion Rates for Medical Waste.

Description	Effect	% Reduction in Medical Waste Stream			TPD
		RMW*	NRMW**	Total	Collected
Corrugated Baling	Baling OCC on-site; 90% diversion assumed	NA	10%	7.4%	40.1
Office Paper Recycling	High grade paper, including CPO, bond; 90% diversion assumed (50% for mixed paper)	4.4%	14%	11%	52.2
Glass & Metal Recycling	For food containers, not for clinical areas; 90% diversion assumed	NA	1.4%	1%	5.2
On-Site Collection of IVs & Sharps; Grinding & Disinfection	85% segregation assumed	53%	22%	NA ("Red-bag" waste is "reduced" by becoming "black-bag" waste)	37.6

*Regulated medical waste (red bag); ** Non-regulated medical waste (black bag)

16.2.4.2 Public Information/Education Programs for Recycling in Medical Institutions.

Public information programs, as in other institutional settings, will be easier to target directly to specific categories of waste generators than are citywide information programs for residential generators; most of these programs will be similar to those used in other institutions, by piggy-backing on existing employee-training programs, posters, memoranda and announcements to staff, etc. Another technique, which is also applicable to non-medical types of institutions, is making managers directly responsible for recycling (and waste-prevention) programs by adding their departments' waste-disposal costs to their evaluation criteria.

16.2.4.3 Collection Systems for Recyclable Materials from Medical Institutions.

Outside the medical facility's door -- i.e., on the loading dock -- collection of recyclables from medical facilities will be like the collection of any other institutional waste. Inside the medical facility, however, source-separation systems for recyclable materials will be somewhat more complex than in most institutions due to the need to address health-related concerns and to keep regulated and non-regulated medical wastes separate. One basic technique will be to distinguish patient-care areas of medical facilities from administrative, visitors', and food-preparation areas of the facility. Recyclable materials from these non-patient-care areas can be handled as they would be in any other institution. The primary recyclables from patient-care areas would be sharps, i.v. bags, and gloves, all of which would be collected in dedicated rigid reusable containers for processing on-site in grinding/disinfecting systems.

16.2.4.5 Processing Facilities for Recyclable Materials from Medical Institutions.

With several exceptions, recyclables from medical facilities would be processed in the City's standard materials-recovery facilities. Those exceptions are sharps, i.v. bags, and gloves, which would require specialized grinding and disinfection equipment at the facility itself. This equipment is described in detail in Appendix Volume 8.

16.2.4.6 Market Requirements for Recyclable Materials from Medical Institutions.

Again with the exception of metals and plastic from the on-site grinding and disinfection facilities, the recyclable materials from medical facilities will be marketed along with the City's other materials, and will constitute an insignificant portion of this supply. There is not at present an assured market for the steel and polyvinyl chloride from grinding and disinfection facilities (representing a relatively small volume of material), but these materials have an inherent economic value that should allow them to be marketed over the long term.

16.2.5 Recycling Programs for Construction and Demolition Waste.

16.2.5.1 Targeted C&D Recyclable Materials.

Ten types of materials are targeted for recovery at construction-and-demolition-debris processing facilities. These materials include: metal, concrete, rock, "green wood" (i.e., trees, brush, and stumps), plastics, dirt, glass, "urban wood" (i.e., lumber that has been used for construction), paper, and "other" materials such as asphalt and brick.

16.2.5.2 Diversion Rates for C&D Recyclable Materials.

In the year 2000, about 2.5 million tons of construction and demolition debris are projected to be delivered to construction-and-demolition-debris processing facilities. For system-modeling purposes, these facilities were assumed to recover about half of that material for recycling. This assumption is likely to be in the mid-range of possible outcomes, since processing of mixed loads may recover between 25-30%, whereas homogenous loads may permit the recovery of 70-90%. The remaining residue would be landfilled. Expected diversion rates for the recycling of construction and demolition debris on a material-specific basis are summarized in Table 16.2.5-1.

Table 16.2.5-1: Projected Recycling Diversion Rates for C&D Waste.

Material	Diversion Rate	% Reduction in C&D Waste Stream
Metal	90 %	5.1 %
Concrete	75 %	.3 %
Rock	75 %	.5 %
Green Wood	50 %	12.6 %
Plastics	25 %	1.4 %
Other (asphalt, brick, etc.)	75 %	21.4 %
Dirt	75 %	1.6 %
Glass	25 %	.2 %
Urban Wood (pallets, etc.)	50 %	3.7 %
Paper	25 %	3.1 %

16.2.5.3 Collection Systems for C&D Recyclable Materials.

Construction and demolition (C&D) debris, for the most part, is generated by the commercial sector, and therefore is collected and disposed of by private carters. This private-management system for this waste stream is expected to continue throughout the duration of this plan.

Construction and demolition debris, including both recyclable and non-recyclable wastes, is collected in 40-cubic-yard roll-on/roll-off trucks. Construction and demolition debris is not compacted when it is collected. Assuming that the containers are filled to capacity, 1,800 containers would need to be hauled each day of a 302-working-day year to collect all 22.25 million cubic yards of construction and demolition debris that are projected to be produced in the year 2000. If each roll-on/roll-off collection truck transports an average of three loads per day, 614 vehicles would be required.

Although it is usually difficult to segregate loads of construction-and-demolition debris by their recyclable components, any source-segregation that can take place will facilitate processing and increase the quantity of recovered recyclable materials.

16.2.5.4 Processing Facilities for C&D Recyclable Materials.

With the exception of rock-crushing equipment at the Fresh Kills landfill (which is described in Chapter 3, and which is expected to be sufficient for the Department of Sanitation's processing requirements), the C&D-processing capacity within the City is privately owned and operated. Existing private capacity is expected to be adequate for the City's projected needs in the year 2000, which would equate to about 17 facilities of 500-tons-per-day capacity each.

At C&D-processing facilities, positive and negative sorts would remove recyclables from the waste stream. Some of the recovered materials would require additional processing before they would be marketable. The wood component of the waste stream would be sent to a wood chipper or shredder to produce wood chips and saw dust that could be sold. The concrete, rocks, and bricks would be further processed in a rock-crushing and screening operation. (For a more detailed description of this type of facility, see "Construction and Demolition Processing Facility" in Appendix Volume 5.)

16.2.5.5 Market Requirements for C&D Recyclable Materials.

Certain C&D components, such as wood, concrete, and metal, have a high potential for reuse and/or resale. ~~Several transfer stations ship wood to New Hampshire for use as fuel in a waste~~

Table 16.2.5-2 summarizes the projected tonnage outputs for each type of recovered material.

Table 16.2.5-2: Projected Quantities of Materials Recovered from C&D Recycling Program.

	Thousands of Tons Recovered: Year 2000
Metal	128
Concrete	7
Rock	13
Green Wood	314
Plastics	35
Other (asphalt, brick, etc.)	535
Dirt	40
Glass	5
Urban Wood (lumber, pallets)	93
Paper	76
TOTAL	1,246

16.2.6 Recycling Programs for Harbor Debris.

It is technically and economically infeasible to use harbor debris materials in the manufacture of new commodities, due to the fouling of this primarily wood material with marine chemicals and salts, and its encrustation with metal hardware. In the absence of any market demand, the best "re-use" of this material is to burn the wood (after shredding) in a waste-to-energy facility, with recovery and sale of the metal. Recycling recovered floatables is likewise infeasible (due to their smallvolume as well as to the problems caused by immersion in a marine environment).

16.3 Composting Programs.

16.3.1 Composting Programs for MSW.

16.3.1.1 Targeted MSW Compostible Materials and Diversion Rates.

Two types of residential and institutional "composting" will not be discussed in this section, since they are described in the prevention section above and are taken as a given here: grass clippings must be "left on the lawn" since the Sanitation Department in future will neither collect them nor accept them for disposal at its facilities; and backyard composting programs will be encouraged in all suitable areas of the City.

Additionally, small-scale, on-site composting facilities would be developed to handle the needs of institutions that generated sufficient quantities of food waste to make such a facility feasible, and which had the space in which to operate such a facility (e.g., at Rikers Island).

Non-grass leaf-and-yard wastes will be composted at windrow-type facilities at Fresh Kills and Edgemere in the near term, and probably at in-vessel facilities, along with other organics, when they are available.

For the remaining organics in the residential and institutional waste streams, this plan proposes separate collection of food wastes, in plastic bags, on the same days that refuse is collected. The designated organic materials for source-separated collection, along with their Citywide generation rates and projected diversion rates, are listed in Table 16.3.1-1.

The institutional sectors that generate the greatest proportion of easily segregated organics, and, accordingly, the institutional sectors for which there would be a separate organics collection program, are correctional facilities, schools, hospitals and nursing homes. The commercial-sector waste-generators most adapted to source-separated organics programs are restaurants, hotels, and food stores.

16.3.1.2 Collection Systems for Source-Separated MSW Compostable Materials.

The proposed collection system for the basic citywide residential and institutional source-separated organics program is a two-compartment rear-loading compactor truck, which is similar to or the same as the truck proposed for the recyclables collection program, using colored plastic bags (which either will be transparent enough for the collector to differentiate between bags of recyclables and bags of kitchen waste or a separately designated color). Waste generators that receive containerized collections would have designated containers for kitchen wastes. Collection would be done on the same days, and with the same frequency as regular refuse collections, since refuse bags would be collected in the larger compartment of the same dual-compartment truck.

Kitchen wastes from institutions would be collected in dedicated trucks on dedicated routes. This would also be the case for private-carter collections from the commercial sectors with separate food-waste routes.

Table 16.3.1-1: Residential Wastes Designated for Proposed Source-Separated Organics-Composting Program

	% of Total*	Targeted Organics
Corrugated/Kraft	5.6%	
Newsprint	8.9%	
Office/Computer	1.0%	
Magazines/Glossy	3.8%	
Books/Phonebooks	1.8%	
Non-Corrugated Cardboard	2.5%	X
Mixed Paper	9.9%	X**
Clear HDPE Containers	1.1%	
Colored HDPE Containers	1.1%	
LDPE	0.2%	
Films & Bags	5.5%	
Green PET Containers	0.1%	
Clear PET Containers	0.8%	
PVC	0.4%	
Polypropylene	0.3%	
Miscellaneous Plastics	0.8%	
Grass/Leaves	3.0%	X
Diapers	2.5%	X
Food Waste	10.9%	X
Miscellaneous Organics	7.3%	X
Glass Containers-Clear	1.9%	
Glass Containers-Green	0.7%	
Glass Containers-Brown	0.6%	
Miscellaneous Glass	0.2%	
Food Containers/Foil	0.5%	
Aluminum Beverage Cans	0.5%	
Miscellaneous Aluminum	0.1%	
Food Containers	1.6%	
Miscellaneous Ferrous	2.0%	
Bi-Metal Cans	0.02%	
Ceramics	0.1%	
Miscellaneous Inorganics	1.8%	
Pesticides	0.01%	
Non-Pesticide Poisons	0.02%	
Paint/Solvents/Fuel	0.2%	
Dry Cell Batteries	0.02%	
Car Batteries	0.04%	
Medical Waste	0.02%	
Miscellaneous HHW	0.1%	
Textiles	4.4%	
Rubber	1.9%	
Fines	2.2%	
Brush/Stumps	0.7%	X
Lumber	2.1%	
Polystyrene	0.8%	
Bulk	10.0%	
Total	100.02%	31.85%

* Projected composition in the year 2000 after 7.5% is "prevented."
** 50% of mixed paper is assumed to be "high quality."

During the interim period when leaf-and-yard wastes are separately composted at windrow facilities, they would be collected in special paper bags (distributed through retail stores, for purchase by homeowners) either by the Sanitation Department in the peak yard-waste weeks of the fall and spring, or by private landscaping contractors.

The commercial organics collection program targets the following portions of the commercial waste stream: 20 percent of the corrugated cardboard, newspaper, white paper, and magazines; 50 percent of the mixed-paper stream; and 100 percent of the yardwaste, foodwaste, miscellaneous organics and diapers. The sectors targeted for the organics collection program are:

Retail - food
Hotel/Amusement
Transportation, Communications, Utilities
Wholesale

16.3.1.3 Processing Facilities for Source-Separated Compostable MSW Materials.

In System B, the City would develop sufficient composting capacity to process the anticipated range of source-separated organics from the residential and institutional waste streams. Sufficient capacity would also be made available to satisfy any private-carter demand. These facilities are expected to be in the range of 2,800 tons a day.

For a detailed description of the proposed type of in-vessel composting facility, see "In-Vessel Composting Facility" in Appendix Volume 5 ("Reference Facilities.")

The open-air leaf-and-yard waste windrow composting facilities at Fresh Kills and Edgemere will be operated either by Sanitation personnel or under contract to private landscaping contractors. For a description of this type of facility, see "Leaf-and-Yard-Waste Composting Facility" in Appendix Volume 5.

16.3.1.4 Market/End-Use Requirements for MSW Compost.

Table 16.3.1-2 summarizes the potential markets for compost in the New York City area, by market type, with the estimated range of quantities they use.

Table 16.3.1-3 compares the available compost market with the quantity of compost that would be produced in each of the four final systems analyzed in this plan.

The compost that would be generated in either Systems A or B could be absorbed by the existing potential compost market. In the No-Burn case, in the low-range market case, almost twice as much compost material would be generated as the local market would be able to absorb in the low market-capacity estimate.

Table 16.3.1-2: Potential Compost Markets in the New York City Area

Market	Low Range (cy/yr)	High Range (cy/yr)
Public Sector:		
NYC Parks and Recreation	69,150	207,500
NYC Housing Authority	36,500	73,250
NYC Shade Tree Commission	2,800	7,000
NY/NJ Port Authority	110,250	147,000
NY Department of Transportation	2,250	5,600
NYC Dept of Sanitation and Other NYC-Area Landfills	1,180,700	2,450,000
Private Sector:		
Landscapers	49,300	355,800
Nurseries	56,600	214,000
Golf Courses	7,300	42,800
Soil Dealers	75,000	265,200
Sod Farmers	97,500	390,000
Cemeteries	11,000	52,500
Mine Reclamation	14,000	42,000
Total Market for Compost Products[1]	1,712,600	4,252,650
Adjustment for double-counting of soil-amendment markets:		
Soil Dealers	(75,000)	(265,200)
Landscapers	(12,000)	(88,950)
Total Market for Compost Products[2]	1,625,300	3,898,500

Table 16.3.1-3: Compost Generated by Each System as Percent of Available Market

Case	Compost Generated	% of Low Case	% of High Case
System A	620,000	38%	16%
System B	1,250,000	77%	32%
No-Burn System	3,150,000	194%	81%
Maximum-Burn System	0	0	0

16.3.2 Composting Programs for Sludge.

16.3.2.1 Sludge-Composting Facilities.

The Department of Environmental Protection's long-range sludge management plan calls for composting a total of 350 dry tons of sewage a day in seven facilities ranging in size from 25 to 95 tons a day.[3] For further information on this type of system, see "Sludge Composting Facility" in Appendix Volume 5 ("Reference Facilities").

16.3.2.2 Market Requirements for Sludge Compost.

Approximately 190,000 cubic yards of compost product would be produced by these facilities per year. The markets available for this material are a subset of those identified in section 16.3.1.6, and represent only about a tenth of the projected low-range demand. As in the case of MSW compost products, net revenues will be insignificant.

16.3.3 Composting Programs for Mixed Waste Streams.

The only waste streams that it would be viable to co-compost are MSW and sludge. There are sound reasons to combine these waste streams, since sludge composting requires the addition of a bulking agent, for which MSW can be used, while MSW composting requires the addition of moisture, which is contained in sludge. The relative volumes of sludge and organic MSW generated in the City are such that sludge-composting capacity requirements are only about a tenth of the capacity requirements that would be needed if all of the source-separable organic MSW were to be composted. The City's sludge composting needs could therefore be subsumed within facilities built to compost MSW. In terms of facility design and operations, there are no significant differences between a facility designed to compost MSW alone or a facility designed to co-compost both MSW and sludge.

The greatest difficulties in co-composting these waste streams, therefore, are the potential logistical problems posed by different implementation schedules for composting facilities for these two waste streams, since the sludge-composting capacity, on the one hand, is required to be developed by 1998 in order to meet federal consent-order requirements, while the Sanitation Department does not propose to develop MSW composting capacity for a full-scale residential and institutional source-separated organics program until a pilot-scale facility has established that such a system can be operated in New York City cost-effectively and without creating significant adverse environmental impacts. The most likely possibility for co-composting of these waste-streams in the near-term, therefore, is for tests of co-composting in the pilot-scale facility proposed by the Sanitation Department.

16.4 Waste-to-Energy.

16.4.1 Waste-to-Energy Program for MSW.

The Sanitation Department will continue its planned upgrade of the existing Southwest Brooklyn incinerator ~~(and explore the feasibility of expanding it from 750 tpd to its original 1000 tpd capacity)~~, add energy-recovery capability, and, if further detailed analysis establishes its feasibility, pre-processing equipment to recover recyclables from the incoming waste stream. The Department will also examine the feasibility of privatizing the operation of this facility in order to reduce operating and maintenance costs. ~~When the upgrade of the Southwest Brooklyn incinerator is completed, the Department will carry out similar upgrades and changes at the existing Betts Avenue and Greenpoint incinerators. A decision will be made in fiscal year 1995 as to whether a similar upgrade will be carried out for the Greenpoint incinerator.~~

~~New waste-to-energy facilities, for up to 10,000 tons of daily capacity (in the event that capacity is required for private-carter wastes), as necessary, will be constructed in phases after permits have been obtained.~~

16.4.2 Waste-to-Energy Program for Medical Waste.

The Health and Hospitals Corporation proposes to upgrade and retrofit ~~nine~~ an existing on-site ~~hospital~~ incinerators at Coney Island Hospital to meet all applicable regulations. An evaluation of existing on-site medical-waste incinerators in the City found that another eight facilities at private hospitals could be cost-effectively upgraded to comply with State regulations. Each facility, ~~once~~ if upgraded, ~~will~~ would incinerate an average of 2.2 tons of regulated medical waste each day, for a total of approximately 20 tons a day, or 7,100 tons a year. The remaining red-bag waste requiring disposal would be incinerated in a 48-ton-per-day regional medical-waste incinerator with energy recovery capacity.

Black-bag medical waste that remains after the proposed prevention, recycling, and composting programs have been implemented -- projected to be about 300 tons a day -- would continue to be incinerated in the Sanitation Department's facilities.

~~16.4.3 Waste-to-Energy Program for Harbor Debris.~~

~~Demolished wooden piers would be processed at a harbor-debris processing facility. This facility is proposed as an add-on to an incinerator, so that marine wood waste could be shredded and the metal in it recovered before the shredded wood is incinerated. Such a facility, at a rated capacity of 150 tons per day for a 365-day year, would be capable of processing 47,000 tons per year (operating at 85% of rated capacity). Harbor debris processed at this facility would include pier material collected at the shoreline as part of the U.S. Army Corps of Engineers' pier-demolition program, and floating pier debris collected from the harbor. In the year 2000, an estimated 23,000 tons of material would be delivered to this facility, where it would be processed at a projected cost of $75 per ton (net of $12,500 in projected revenues from the recovery of 850 tons of metal). Incinerating the amount of material that would remain after processing would require 60 tons per day of incinerator capacity -- about three percent of the capacity of a 2,250-ton-per-day incinerator (operating at 85 percent capacity). The net cost associated with incinerating this shredded residue would be an additional $75 per ton. The incineration of this material would produce 585 tons of ash.~~

~~Coupling the harbor-debris processing equipment with a new or existing barge-accessible incinerator (rather than a truck-fed facility) would significantly reduce handling costs and transport distances. Of the three existing municipal incinerators, only the Greenpoint and Southwest Brooklyn incinerators are accessible by barge. Of these two, the Southwest Brooklyn facility is likely to be closer to the generation points of most harbor-debris material, which might make it better suited as a potential location for this facility. If it were determined a feasible location, the installation of this equipment might occur during the planned upgrading of this facility.~~

16.4.4 Construction and Demolition Waste.

Although it is theoretically feasible to incinerate the organic portions of construction and demolition debris after it has been shredded and the organics (chiefly wood and paper) have been separated from the remainder, there is no need to incinerate any of this processed material. Wood chips can be sold for use in commercial boilers, used as landfill cover, in the manufacture of new products, and in a variety of landscaping uses.

16.4.5 Mixed Waste Streams.

The proportionately small quantities of black-bag medical waste and harbor debris generated in the City would be coincinerated with MSW, as described above. In addition, it would be technically feasible to co-incinerate de-watered sewage sludge with MSW. However, the Department of Environmental Protection's sludge-management plans do not require any incineration capacity for sludge.

16.5 Landfilling.

16.5.1 MSW By-pass and Processing Residues. (Not including ash residue from waste-to-energy facilities.)

Figure 16.5.1-1 summarizes the tons of MSW that would be landfilled on an annual basis after full implementation of Systems A and B and the No-Burn and Maximum-Burn Systems. Before the year 2000, while the proposed waste-management systems are being developed, landfill capacity will be used at a greater rate, depending on the pace of facility development. The Fresh Kills landfill, provided that planned upgrades are carried out and that a permit for its operation is granted by the State DEC, has enough potential capacity for either of the proposed Systems A or B for the 20-year planning period.

Post-Fresh Kills landfill needs will require out-of-City capacity.

Further study is required to evaluate the feasibility of innovative landfilling techniques such as landfill mining and off-shore islands.

16.5.2 Sludge.

No landfill capacity is anticipated to be required for sludge disposal. If it were to become necessary to landfill dewatered sludge, this material could be included with other wastes requiring landfilling in the City's facilities, at a ratio not to exceed one part sludge to seven parts MSW. However, disposal of sludge at Fresh Kills is currently prohibited by federal statute.

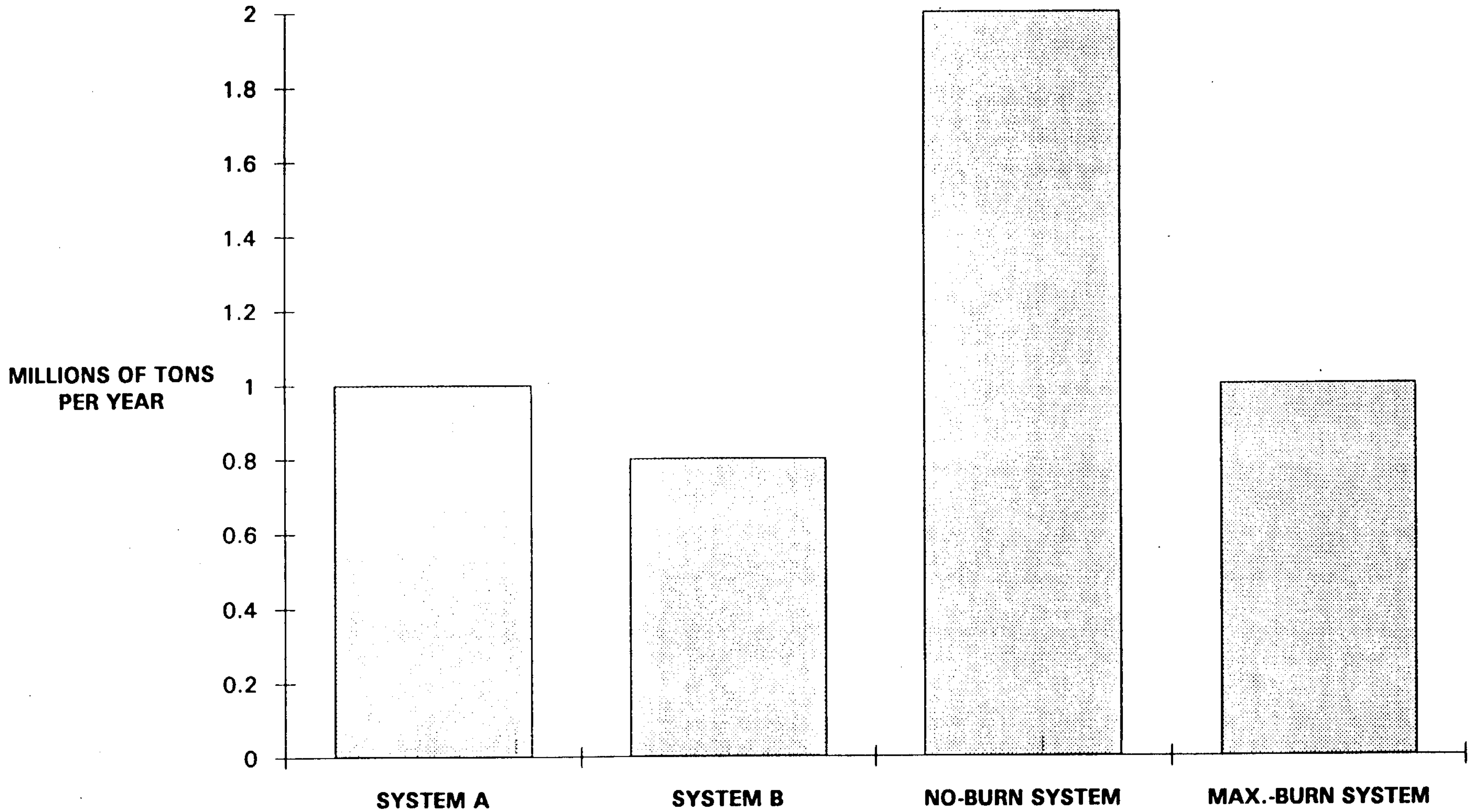
16.5.3 Landfilling Harbor Debris.

In the year 2000, a projected 700 tons of floatable harbor debris, collected by skimming boats, would be landfilled.

16.5.4 Landfilling Dredge Spoils.

Most dredge spoils from New York Harbor will continue to be disposed of at the Corps of Engineers' ocean dump site. Dredge spoils generated by the Sanitation Department will be dewatered.

Figure 16.5.1-1: Tons of MSW Landfilled (Excluding Ash, Year 2000)



A facility capable of handling the amount of dredge spoils that the Sanitation Department is estimated to generate in the year 2000 (30,000 wet tons) would cover 58 acres, and have an annualized capital cost of nearly $5 million (a cost that primarily reflects the value of land) and an annual operating cost of $1 million.

16.5.5 Landfilling Construction and Demolition Waste.

Only the residue from processed construction and demolition debris requires landfilling, and most of this material can be used for landfill cover. Since most construction and demolition debris is generated by private-sector enterprises, currently stays out of the City's disposal system, and is recyclable, it is likely that very little of this material would require landfilling in City facilities.

16.5.6 Landfilling Waste-to-Energy/Incinerator Ash Residue.

Table 16.5.6-1 summarizes tonnages of waste-to-energy and incinerator ash residue projected to be landfilled in the year 2000 in Systems A and B and the two benchmark systems.[4]

Table 16.5.6-1: Ash Disposal Requirements in Alternative MSW WTE Programs (Year 2000)

	System A	System B	No-Burn System	Maximum-Burn System
MSW	513,800	490,700	0	747,400
Regulated Medical Waste	4,800	4,800	4,800	4,800
Harbor Debris	600	600	0	600
TOTAL	519,200	496,100	5,400	752,700

~~The proposed ash disposal facility would be on a 40 acre site on a 75 acre parcel within the existing boundaries of the Fresh Kills landfill. (See "Fresh Kills Ash/Residue Landfill" in Appendix Volume 4.2 for a detailed description of this proposed facility.)~~

~~In order to assure that continued ashfill capacity is available after this facility is filled to capacity,~~ The Department of Sanitation will take steps to develop contracts for exporting ash outside the City. It will also monitor the progress of on-going studies devoted to developing beneficial re-use options for ash residue.

16.6 Collection, Transfer, and Transport Systems.

In addition to developing a two-compartment collection-truck fleet, the Sanitation Department will examine the feasibility of using semi-automated collection trucks, and of developing shuttle systems for transporting filled trucks to dump sites while collection crews continue on their routes.

The Sanitation Department will attempt to make maximal use of a marine-transfer/barge-transport system. The major advantages of such a system, in addition to the reductions in vehicle miles travelled, environmental impacts, and costs, are that a network of processing facilities can be operated at maximum capacity via the "micro"-routing of barge shipments of waste, and that the contents of the separate compartments of a two-compartment truck could be transferred directly into two separate barges for transport to different types of processing facilities, thus greatly enhancing the flexibility and cost-effectiveness of the overall waste-management system. In order to maximize the potential applications of this system, processing facilities will be designed to receive and ship waste and materials either by truck or by barge whenever possible.

Opportunities for developing rail and/or barge/rail shipping systems for the future long-distance export of waste will also be considered.

Endnotes

1. Markets may not be totally additive.

2. Total accounts for repetitive use of products.

3. DEP, Bureau of Wastewater Treatment, New York City Long Range Sludge Management Plan, 5-91.

4. Ash residue from the 48-ton per day regional medical waste incinerator is included in these totals.