

SOLID WASTE MANAGEMENT IN NASSAU COUNTY, NEW YORK: A STUDY OF SPATIAL CONFLICT AND POLITICAL COMPLIANCE

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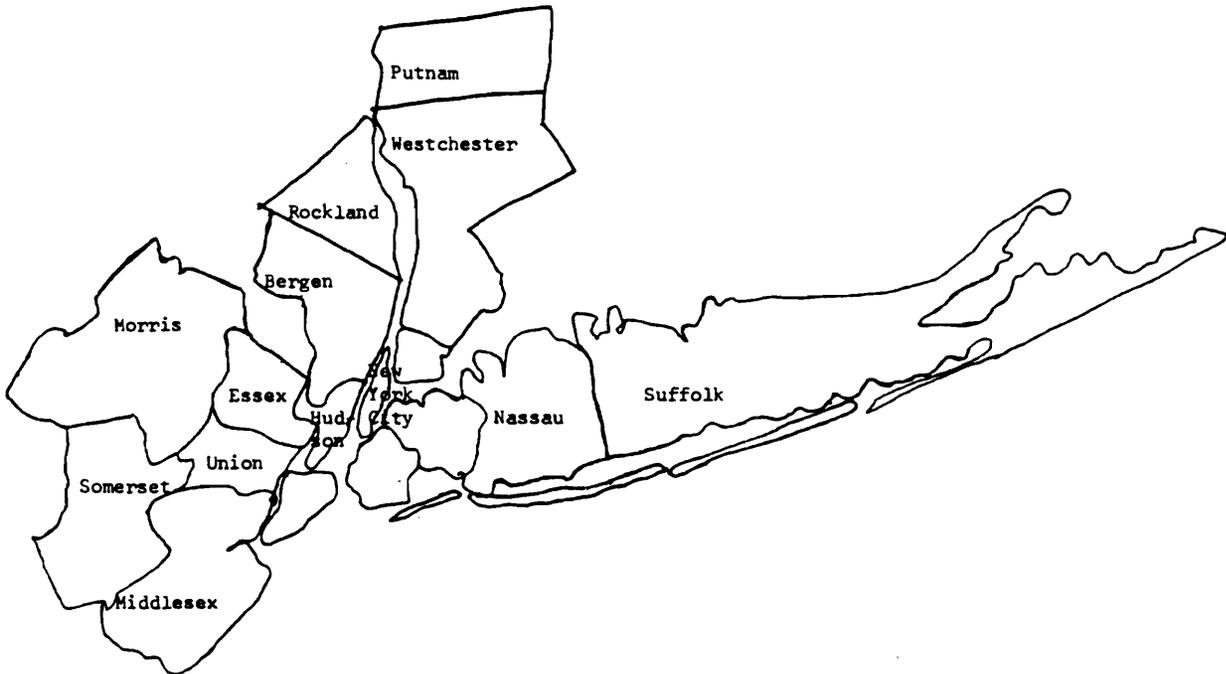
ABSTRACT. New technologies, social policies, and pricing schemes are currently being devised to lessen the environmental impacts of solid wastes. As with other social and economic policies, these changes do not affect all segments of the population or all areas equally - an indication not only of the problems specific to waste disposal regulation, but also of attitudes about who should bear the brunt of the problem. This paper uses Nassau County in New York as a microcosm of the United States to investigate spatial variations in the management of waste disposal. Nassau County is an interesting spatial entity. From a physical standpoint it could be viewed almost as a closed system, as most of its water supply comes from a series of aquifers of Long Island on which it sits. From a political and social standpoint, its governmental structure is a maze of layers. Any relationship between socioeconomic characteristics and intensity of environmental compliance might be indicative of courses that other localities across the nation may choose to follow.

The disposal of solid waste is an environmental problem that must be managed every day, both at home and at the workplace. Solid waste includes "residential, commercial, and institutional wastes, construction and demolition debris, sewage sludge, compostable wastes, ash residue, and hazardous wastes" (New York State 1988, 1-6). Since the disposal of these wastes involves not only problems of "pollution" but more traditional ones of sanitation, correct management is very important. Over the past few decades, and especially the last one, the definition of "correct" has changed. Solid waste of all kinds used to be dumped in dumps (now called landfills) or oceans or burned in incinerators. But as a result of new federal legislation regulating the disposal of solid wastes (Resource Conservation and Recovery Act (RCRA) of 1976, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1986 including Superfund, and Superfund Amendments and Reauthorization Act (SARA) of 1986), and subsequent state legislation, these methods are no longer considered "correct" in many states. New technologies, new social policies, and new pricing schemes have been and are currently being devised to lessen the environmental impact and the danger of solid wastes. But as with other social and economic policies, these changes do not affect all segments of the population or all areas in the same way. The lack of consistency is indicative not only of the problems specific to waste disposal regulation, but also of attitudes in our society about who should bear the brunt of this problem. This paper looks at solid waste management in Nassau County, a suburban county of New York City. Although Nassau County is rather small in area, it provides a whole spectrum of solid waste management techniques. This variety comes about partially from the particular physical configuration of Nassau County as well as diverse socioeconomic and political factors; a comparison of these techniques should be useful in understanding what options are available to other communities across the country.

Physical Characteristics

Nassau County is part of Long Island (Map 1), which as a physical entity (island) includes two boroughs of New York City, as well as one of the few Primary Metropolitan Statistical Areas (PMSAS) with no central city-the Nassau-Suffolk PMSA. Most of the water supply of Nassau (and Suffolk County to the east) comes from the series of aquifers on which it sits. Until recently, most of the solid waste was deposited in landfills. Thus, in many ways Nassau County could be considered a closed system-gathering its own water from and disposing of its own solid waste onto its own land. However, leaching from the landfills appeared to be contaminating the aquifers, espe-

MAP 1
THE NEW YORK METROPOLITAN REGION



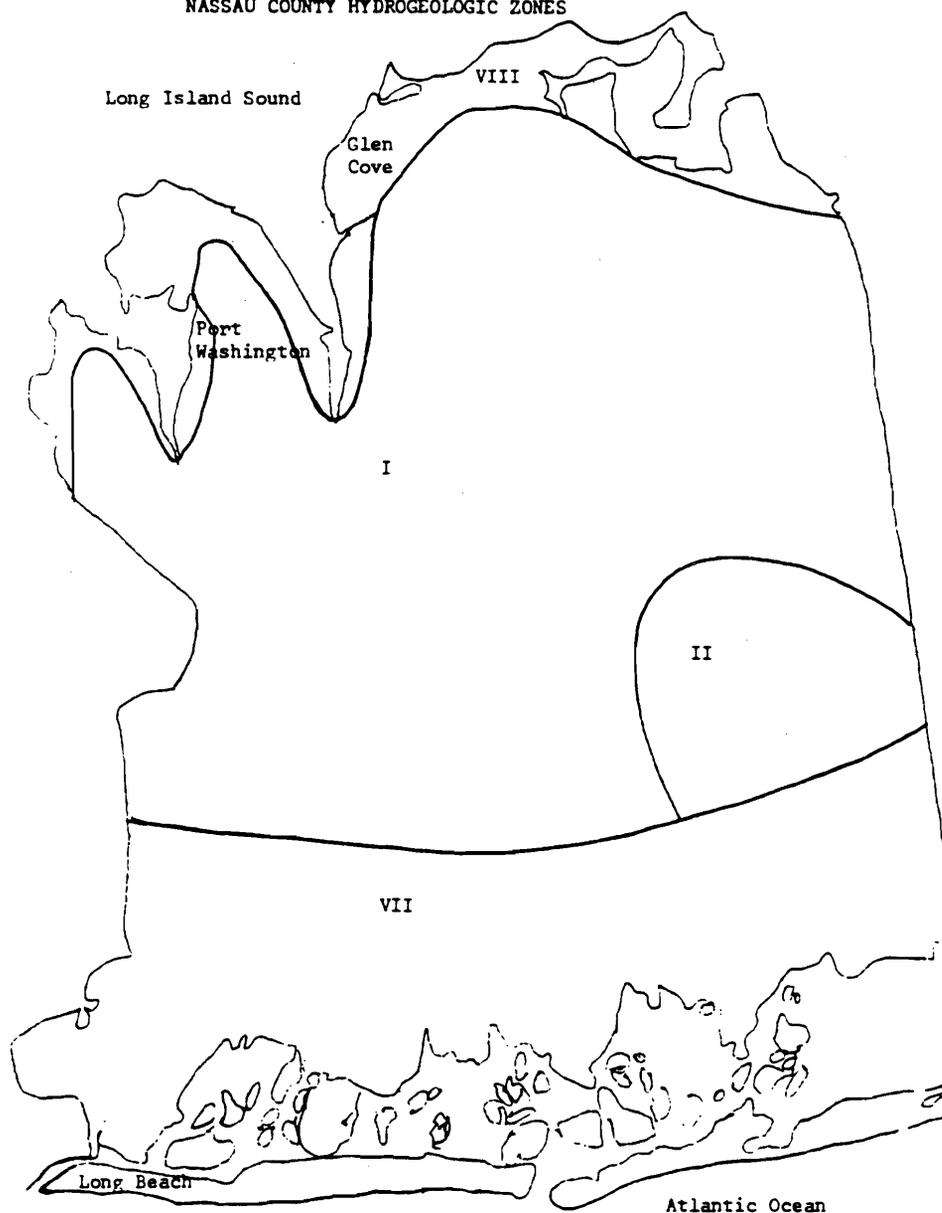
cially the deep-flow recharge zone, an area where "surface water travels downward and reaches groundwater" (New York State 1988, 3-18). Rainwater percolating through these rocks serves as the supply of drinking water for much of the island. In 1983, the state legislature, in recognition of the environmental unsuitability of this zone for waste disposal (as the wastes would contaminate the water supply of the island), passed, with support from the Long Island delegation, the 1983 Long Island Landfill law. It requires "landfills not built to strict design standards and located over deep-flow recharge zones ... to be phased out and closed by 1990" and "that, by 1990 ... only rigorously-engineered landfills will be allowed to operate in the shallow zone. These landfills will accept only material which is the byproduct of waste-to-energy, incineration, or composting facilities; 'downtime waste'; or waste that cannot be treated at waste-to-energy facilities" (New York State 1988, 3-18). As a result, communities were forced to find other ways to dispose of their solid waste over a fairly short period of time-seven years. All but one of the six landfills have been closed; the one in Port Washington is located outside the deep-flow recharge zone (Map 2).

Government Organization and the Management of Solid Wastes on Long Island

The state government is the overall authority for the management and regulation of solid waste. It "regulates local government waste management operations to assure protection of public health and the environment. In the role of regulator, the state issues or denies permits for solid waste management facilities and enforces environmental laws. The state also provides technical assistance, promotes private sector involvement, and proposes legislative initiatives regarding solid waste management" (New York State 1988, 1-7). The actual collection, transportation, and disposal of solid waste across the state is generally the responsibility of the county governments, except for New York City and Long Island. On Long Island these are the responsibility of the town and city governments, resulting in more varied policies and practices and perhaps more discrep-

MAP 2

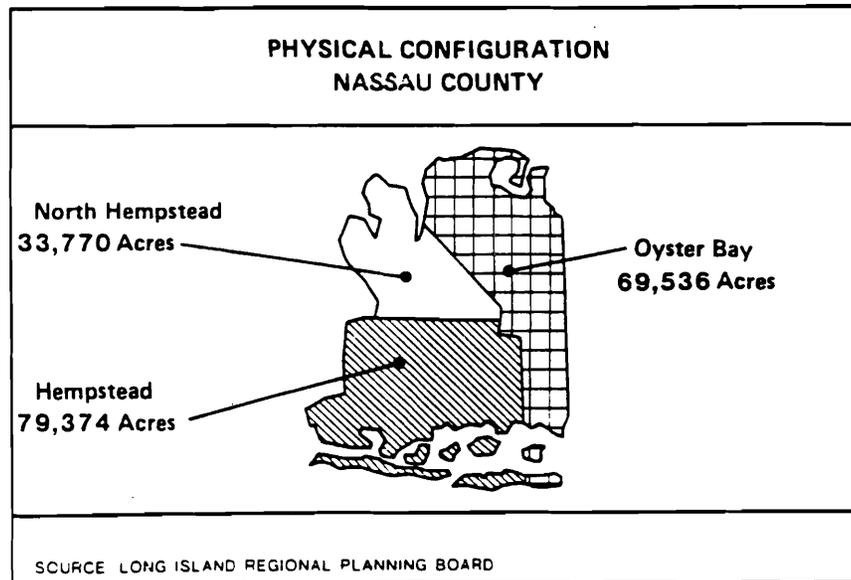
NASSAU COUNTY HYDROGEOLOGIC ZONES



Source: Long Island Regional Planning Board
Zones I and II: Major deep aquifer zones
Zone VII: Discharges to south shore bays; tidal exchange increases contaminant dispersion
Zone VIII: Discharges to Long Island Sound

ancies among residents in services they receive. Nassau County consists of three towns: Hempstead, North Hempstead, and Oyster Bay, and two cities: Long Beach and Glen Cove (Map 3). Within the three towns are innumerable local governments, including incorporated and unincorporated areas. Some have private garbage collection and some have town collection. Each of these municipalities has its own distinct ways of handling solid wastes.

The towns and cities, as the actual managers and providers of solid waste disposal under state authority, have each incorporated different and sometimes more environmentally rational ways of waste disposal than existed before. The variations result



from the municipalities' physical location and underlying geology, their economic activity and population density, the level and type of political activism of residents, and the particular viewpoints of the towns' elected officers.

The Town of Hempstead has a relatively low per capita income, with larger proportions of commercial and industrial land, than the Town of North Hempstead or Oyster Bay. North Hempstead has the highest income levels and the largest amount of residential land, with Oyster Bay being in the middle.

Regardless of the particular characteristics of the communities, they all must conform to state laws. The state does not usually dictate specific policies, but in its role as regulator, it has promoted alternatives in this order of preference: waste reduction, recycling and reuse, waste-to-energy systems, and sound disposal of residues and nonrecoverable materials (New York State 1988, 1-7).

One might think that a simple comparison could be made among the communities' relative volumes and costs of recycling, waste reduction, and resource recovery. However statistics are not easy to come by. Paralleling the different levels of government is the fragmentation of the monitoring of management techniques. The State Division of Solid Waste of the Department of Environmental Conservation provides statistics and reports of solid wastes including incinerated and sewage material. The town governments' provision of information on recycling and solid waste collection and disposal is more haphazard. Data are not usually obtained from formal reports easily available to the public, but rather orally or in answer to formal written requests. However, recently at least one town, Oyster Bay, has started to include some statistics about recycling in its newsletter to residents (Town of Oyster Bay September 1990). Since these numbers are based on actual fees paid by the towns for disposal (tipping fees), or to recyclers, or in some cases moneys received from certain recyclable materials, they should in theory be consistent. Yet the statistics supplied by the towns and the state and those published in the newspapers (especially Newsday, the Long Island newspaper) and newsletters often differ. The numbers in the newspaper and newsletter can be expected to have the most impact on the public, while the numbers given by the towns to the state can be expected to influence state policy the most. Table 1 shows some variation, thus hinting that the bases for public knowledge and government policy might not always totally

coincide. This difficulty in obtaining information evidently presents a problem as well to businesses working with some towns. The company contracted to help design and construct an incinerator wrote a letter to the town supervisor of North Hempstead (reported in Newsday July 29, 1990), expressing frustration at receiving information only through newspaper reports, rather than direct correspondence with the town.

The fragmentation of data provision is paralleled by the fragmentation of state and local responsibility. There might be several reasons why the state oversees resource recovery directly, while leaving recycling to the locals: 1) collecting statistics on recycling might involve too much detail work, thus necessitating a local approach; 2) incineration or the state-of-the-art waste-to-energy plants require high levels of technology and the state feels that these facilities must be regulated for the public good, while recycling appears as a relatively straightforward process with little need for governmental oversight; 3) resource recovery needs large, expensive plants and the state feels it should regulate such large enterprises; or 4) tradition.

Despite these problems we can look at the relative importance of the state-promoted alternatives among the three towns and two cities of Nassau County. After this analysis, we can see what spatial variations exist among the different communities.

First State Alternative: Waste Reduction

Since only one municipality, Glen Cove, had a decline in garbage volume since 1982 (Table 1), it appears that, currently, municipalities are not endorsing input reduction, but rather the improvement of disposal techniques. The state seems to be aware of the inherent difficulties in reducing waste volume, including great changes in individuals' and organizations' practices in packaging, wrapping, use of paper and plastic bags. Although the state has set a goal of 50% waste reduction/reuse/recycling by 1997, it has allocated only 8% to 10% for actual waste reduction and 40% to 42% reuse/recycling (New York State 1989, 2).

Two interrelated approaches that have had an impact on the solid waste stream include the 1983 Returnable Container Act and recycling. The Container Act has reduced the weight of the waste stream statewide by a significant amount, 5%, and the volume by 8% (New York State 1988, 3-4) statewide. Presumably, Nassau County's solid wastes have had a parallel decline.

Greater dependence on recycling appears to have lessened the amount of solid wastes. For example, Oyster Bay's recycling program recovered over 11,000 tons from the waste stream (Town of Oyster Bay September 1990), 2), while Long Beach estimated that it can recycle 175 to 250 tons per month out of a total 1,300 to 1,800 tons of solid waste, or around 15% (City of Long Beach 1990,).

In some cases a decline in solid-waste disposal can be detrimental to a town. For example, less commercial waste is being dropped at the Port Washington landfill. While this decline saves space in the landfill, it also deprives the Town of North Hempstead of needed revenues; \$66/ton or over \$650,000 for six months (Rivers 1990).

Second State Alternative: Recycling and Reuse

Although New York State lists recycling and reuse as the second most desirable approach to solid waste management, it does not provide as much aid to local governments for this as it does for other alternatives. Of the \$242 million appropriated for grants, only \$10 million were used by local resource reuse and recovery programs, compared to \$215 million for waste-to-energy resource recovery programs (New York State 1989, 56). Part of this great difference in funding results from the nature and technolo-

TABLE 1: TONNAGE AND COST OF SOLID WASTE DISPOSAL

| Town | Tons(a) | Cost/ ton | Total Disposal Cost(b) | Tons(a) | Cost/ ton | Cost/ household |
|--------------------|---------|--------------|------------------------------|---------|--------------|--------------------|
| Hempstead | 710 | 20 | 44.00 | 936 | 77 | 179 |
| North Hempstead | 210 | 21 | 7.75 | 287 | 27 | 67 |
| Oyster Bay | 245 | 37 | 20.00 | 331 | 121 | 195 |
| Glen Cove | 42 | 26 | 1.28 | 27 | 49 | 141 |
| Long Beach | 25 | 19 | 1.70 | 30 | 94 | 123 |

(a) thousands; (b) \$ millions. Sources: Newsday 1982, 1989; Town of Long Beach, 1990; Town of Oyster Bay, 1990.

gies of the two approaches, as waste-to-energy resource recovery programs, sometimes called incinerators, are much more expensive. But regardless of the variable expense of the technologies, a message is given that incinerators are more valuable monetarily than recycling (regardless of environmental values).

The materials and the techniques for collection of recyclables vary somewhat from town to town. All towns and cities currently provide curbside collection of cans, most glass bottles, and newspapers. These collections are very young and have generally been instituted gradually through pilot programs, which over time have extended to larger and larger areas until the whole community was covered. Glen Cove is the only municipality with community-wide curbside collection of plastics. North Hempstead and Long Beach encourage recycling of plastics through individual drop-off at designated sites at specific times and days; Oyster Bay has designated a few weekends a year as voluntary plastic recycling days at specific locations. But both North Hempstead and Oyster Bay have started pilot programs of curbside plastic collection, which can probably be expected to expand townwide, especially in North Hempstead, in the near future. The Town of Hempstead does not seem to encourage recycling of plastic containers, perhaps because it needs this waste to provide the contracted tonnage of solid waste to the operator of the waste-to-energy-resource recovery plant.

The types of materials recycled by each community are not mutually exclusive. For example, Long Beach recycles magazines, but the Town of North Hempstead may not, as the quantity of contaminants in the magazines is too great for the one recycler to process magazines from both communities (Becker June 12, 1990). This problem may soon be solved as a new technique is being developed to recycle magazines, despite the contaminants.

Each of the municipalities recycles between 7% and 15% of its total tonnage of solid waste (Table 2). (One should remember that these are estimates, some by the state, and

TABLE 2: RECYCLING AND RESOURCE RECOVERY: TYPES, COSTS, AND REVENUES

| Town | Resource Recovery | Percent | Recycling | | |
|-----------------|-------------------------------------------------|---------------|---------------------------------------------------------------------------|--------------------|----------------|
| | | | Materials | Cost \$/ton | Revenue \$/ton |
| Hempstead | Operational | 10(a) | Paper, Glass Metal | (d) | |
| North Hempstead | Delayed | 14(a) 7(b) | Paper, Glass Metal (Pilot; corrugated cardboard, plastics) | NP:18 G-M:22 | Plastic: 43 |
| Oyster Bay | Application complete, waiting state approval | 14(a) | Paper, Glass Metal, Leaves (Pilot; plastics) | NP:(d) G-M:29 | Plastic: 70 |
| Glen Cove | Operational (environmental violations) | 10(c) | Paper, Glass(d) Metal, Cans | | |
| Long Beach | Operational | 15(c) | Glass, Metal Paper, Newspapers, Magazines | NP:40 G-M:43.66 | |

(a) state estimate; (b) newspaper estimate; (c) city estimate; (d) not provided by town

some by the community itself.) Currently, since a glut exists for paper, glass, and metal, the municipalities are paying the recyclers to remove the material. Newspapers cost between \$18 and \$40 per ton, while glass and metal ranges from \$22 to \$44 per ton. At one time, about three years ago, the municipalities received revenue for these materials. For example, Long Beach received \$15 per ton in May 1987, but as the total volume increased throughout the island, the recycler found the contract unprofitable. Long Beach then agreed to charge nothing for the recycling materials for the last half of the contract. Now, Long Beach pays over \$40 per ton. Thus, for some materials, as the volume of recycling grows, the value to the communities appears to decline. But the alternative to recycling is paying to have the material either carted away, added to the few remaining landfills on Long Island, or burned in a waste-to-energy plant. This cost is very high; the tipping fee varies from \$70 or \$75 per ton for material to be incinerated (telephone conversation, Senior Sanitary Engineer, June 1990), to \$120 or \$130 for waste to be transported to an off-island landfill. Recycling remains a viable economic alternative.

The recycling of plastics involves economic and technical difficulties that do not exist for glass or paper. One problem is the high volume-low weight ratio of most plastic containers; collection and transportation are not cost-effective. Another problem is that

all plastics are not alike; their resins vary. Plastics must be separated by resin type in order to be recycled economically. The return-deposit system for beverage containers does allow separation of containers by resin type and in some parts of the state, municipalities are collecting plastic bottles for recycling. So far no economically practical and widely applicable method of distinguishing plastic solid wastes easily by their resin type has been found. The overall future for recycling plastics appears promising as prices are now high for resin separated plastics and demand exceeds supply (New York State 1989, 62). In fact, fact, Oyster Bay receives \$70 per ton for plastics (Kirby August 1990). Predictions of the potential for recycling differ significantly from actual collection. The environmental impact statement for the proposed Oyster Bay resource recovery facility predicted much higher proportions of the solid waste stream being recycled than is currently occurring (Table 3). This difference might be temporary, as Oyster Bay's recycling program is only about one year old. But as the environmental impact statement points out, "recycling is unique to all other waste disposal techniques in that success depends primarily on public acceptance and practice." To be successful, recycling should be transformed "from a burden reluctantly practiced by Town residents to a normal activity that is completed without any hesitation" (Camp Dresser and McKee 1988, 9-2). Public education and advertising are seen as the best ways of encouraging active participation. The provision of separate containers for recycling materials is also seen as a major impetus. However, too many different containers can lead to decreased participation. Recycling, then, is a means of garbage management that depends very much on the micro-scale of participation, but it is up to local governments to figure out the techniques and inducements. One should keep in mind that there are several alternative measures of recycling including: rate of household participation expressed as a percentage of total households in a community; tonnage per year; and curbside collection weights. As with most other statistics, one must be careful that comparisons are legitimate.

The most ambitious recycling plan to date is North Hempstead's call for an unprecedented rate of participation as well as successful application of new technologies. These include 75% residential participation, full-scale recycling of commercial waste, mixed waste composting (a developing technique that transforms organic food wastes and papers and other garbage into an organic mulch that advocates say can be put to many uses), and finding satisfactory markets (Spindle 1990; Committee to Save Hempstead Harbor, 1988). Considering that no community in the United States appears to be recycling more than 36% (Seattle) of its solid waste stream, this plan will probably test the local government's ability to convince the community of the importance of recycling. The alternative to massive recycling at the present time seems to be the closing of the Port Washington landfill and the construction of a waste-to-energy facility; many residents have opposed this option as reflected in local elections, including voting the former administration out of office and replacing it with the current one.

Third State Alternative: Waste-to-Energy Resource Recovery

Waste-to-energy resource recovery plants take solid wastes and burn them at high temperatures to produce electricity. The physical product is primarily ash, of much smaller volume than the garbage from which it came, and some airborne particulates, including dioxins and other toxic materials. There are three operating waste-to-energy resource recovery plants in Nassau County; one in Hempstead, one in Glen Cove, and one in Long Beach. Oyster Bay has completed applications to the state for a waste-to-energy plant, and is waiting for state approval. North Hempstead once considered a resource recovery plant, but over the past few months has developed a large-scale recycling plan for which the town would like state permission to keep its landfill open and to delay any construction of a resource recovery plant for four years.

TABLE 3: RECYCLING RATES- POTENTIAL AND ACTUAL: OYSTER BAY EXPRESSED AS A PERCENTAGE BY WEIGHT OF THE TOTAL MUNICIPAL SOLID WASTE STREAM

| Material | Potential Rate(a) | Actual Rate(b) |
|-----------------------------------------------------------------------|-------------------|----------------|
| Newspapers, books, magazines | 11.3 | |
| Commercial waste paper, corrugated cardboard, high-grade office paper | 16.9 | 8.3 |
| Glass Containers | 3.3 | 2.2 |
| Metal Containers | 2.4 | 0.5 |
| Plastics | 0.8 | <0.1 |
| Yard Wastes | 13.8 | NA |
| Bulky Items | < 1.0 | NA |
| Hazardous Pollutants | < 1.0 | <0.1 |
| Tires | | 0.1 |
| Total | 48.5 | 11.2 |

(a) Environmental Impact Statment for the American Ref-fuel Oyster Bay Recovery Plant (November 1988); (b) Town of Oyster Bay (July 1990)

The Glen Cove and the Long Beach plants are both rather small and are both operated by the same firm. The Glen Cove plant incinerates around 70,000 tons per year, some of which comes from outside the city, including 14 villages in the Town of Oyster Bay. The ash is currently deposited in a landfill in Islip, a town farther east on Long Island in Suffolk County. This arrangement might change in the next year, perhaps resulting in the ash being trucked to some location in Ohio as occurred previously (Department of Public Works July 10, 1990). It generates 2.5 megawatts of electricity, 1.0 megawatt of which is used on site and 1.5 of which is sold to the Long Island Lighting Company (LILCO), the utility on Long Island (New York State status report of Glen Cove, N.Y.). However, there are some problems with this plant's operation. According to a senior sanitary engineer in the State Department of Environmental Conservation, the Glen Cove plant is inefficient, and the millions of dollars, including much state and federal aid, spent to build it were wasted (telephone conversation, 1990). In April 1990, the City of Glen Cove and the company that operates its incinerator "agreed to pay \$15,000 in fines and to make more than \$2 million in plant improvements to reduce air pollution under an agreement with the State Department of Environmental Conservation." By operating at a temperature below the state standard of 1,400 degrees, the plant is inefficient, and also emits potentially undesirable pollutants into the atmosphere. Under the agreement, the plant will install gas burners to burn the garbage at higher

temperatures and more efficiently, and will also enclose the tipping floor where the garbage and ash are deposited (Vincent 1990).

The Long Beach plant incinerates 200 tons per day and produces around 6 megawatts, some of which is sold to LILCO (New York State, March 1990). Only around 50 tons come from Long Beach. The remainder comes from other communities (Eisenberg 1990). This plant evidently is more efficient than the Glen Cove plant, as it uses less garbage to produce more electricity. Its ash is deposited in the Oceanside landfill (also in Suffolk county) and will be shipped to a monofill in Ohio. (A monofill is a less permeable landfill with better leakage detection.) Long Beach and North Hempstead are reportedly negotiating an agreement in which some of North Hempstead's garbage would be incinerated at Long Beach in exchange for Long Beach participating in North Hempstead's recycling project and dumping ash on its landfill. This agreement is far from complete (Eisenberg 1990.).

The Hempstead waste-to-energy facility was built on the site of an earlier, unsuccessful, and environmentally undesirable incinerator that closed in 1980. The successful operation and implementation of this plant resulted not only from its sophisticated and ostensibly more environmentally sound technology, but also the operator's ability to convince the public of its advantages. The owner-operator used and continues to use a good public relations policy, including newsletters publicizing its contributions to community groups (American Ref-Fuel 1986 and 1989). The operator even modified its original design to respond to public criticism to use an alternative technique to filter out ash particles (baghouse filters replaced electrostatic precipitators). The plant is designed to produce 72 megawatts of electricity from 2,319 tons of solid waste per day (New York State March 1990). Some of the electricity, 8 megawatts, is used on site and some, 64 megawatts, is sold to LILCO (Hanrahan 1989). The state requirement that the public utility must buy the electricity is expensive for LILCO and its customers, as the cost per megawatt is around twice the normal cost. This extra cost is the result of New York State's "improving" the federal 1978 Public Utilities Regulatory Policies Act. This act required the utility to pay its ordinary rate for electricity production; New York State set the fixed rate higher (Maier 1989). Here is an example of spatial dispersion of the cost of incineration: the incinerator receives revenue for burning the garbage into electricity, while the customers of the utility across the Island pay the costs.

The ash is trucked off-island to a landfill near Buffalo, at a cost of \$140 per ton (Smith 1990). The town's waste disposal fees have dropped to \$79 per ton from \$160 per ton (Smith 1990), of which \$32.50 is the tipping fee paid to the operator of the plant (Hanrahan 1989). Although the cost per ton is higher than the waste disposal fees, the final product, ash, is the compacted remains of the much more voluminous and heavier solid waste. The air pollutant emission is reportedly very much below federal and state standards.

It is ironic that the apparently satisfactory operation of this plant results in some problems and inconsistencies inherent in environmental management. First of all, the success of this plant depends on a continuous and large stream of solid waste; the town guaranteed the plant a minimum of 540,000 tons per year. Since the town has not been able to supply this amount, under the contract the operator has been allowed to receive garbage from other communities, and Hempstead must pay the cost of shipping this ash to the landfill. A second inconsistency is that the type of waste that the plant finds most attractive as they burn at high temperatures, paper and plastics, are also very suitable for recycling. Thus the very operation of this plant contradicts the primary objectives of the state in managing solid waste, namely the reduction of the output of solid waste plus more recycling and reuse. A third problem in environmental management is conflict that arises sometimes between government agencies. Although the Wall Street Journal states that the Department of Environmental Conservation is impressed by the emission

levels and that the State Health Department claims the cancer risk was one in a million, the State Environmental Protection Agency is not in favor of the plant (Forum at C.W. Post April 1990). Mass incineration is considered environmentally less desirable than other options because of airborne pollutants and toxic substances in the residue ash. A fourth incongruity is the spatial dispersion of solid waste. This new plant was built in the most densely populated of the three towns of Nassau County, as well as the one with the most nonresidential (commercial and industrial) land. This combination of economic factors and population density probably contributed to the attraction of a centralized large-volume garbage disposal unit. Yet, the ash residue from the plant is trucked off island to a landfill near Buffalo, an example of the not-in-my-backyard-syndrome.

All of these waste-to-energy facilities are expensive; their financing is quite interesting. They are funded through tax-exempt bonds, which means that the companies that have built the plants are taking tax revenues away from the community. In effect, although the facility is a private venture, it is funded by public money, operated by a private corporation, with the services being paid for by the residents. The waste-to-energy facilities are an example of the privatization of public services.

The other two towns in Nassau County are not totally convinced of the desirability of such a large plant. The landfill of the Town of Oyster Bay is closed; at least part of it has been declared a hazardous waste site to be cleaned up through Superfund. The public garbage trucks and those of some private carters transfer their collections to large trucks at the closed landfill; the large trucks then transport the unsorted solid waste (minus some recyclables) to a site in Pennsylvania. Although its applications for a waste-to-energy plant have been completed and although the same company that built the Hempstead facility has printed up and distributed some very nice brochures about the facility, the plant has not received final approval. This nonoperating facility also provides some useful information for environmental management. The existence of these brochures gives the impression that the facility is close to operation, if not actually operating. The public therefore might believe that in the near future, Oyster Bay will have solved its solid waste problem. A second point is the state requirement for long-term planning of ash disposal. The town must contract for off-island disposal of ash for 20 years before the plant can be built, and as environmental awareness increases across the country, sites are not so easy to locate as in the past. In fact the Town of Oyster Bay has had to change its landfills several times since 1987 as landfills in Ohio and Pennsylvania have been fined or shut down by their own states for environmental violations (Bunch 1989). No ash disposal site has yet been found for the proposed waste-to-energy plant. The importance of long-range planning has also been significant in the approach taken by the Town of North Hempstead. The town's landfill in Port Washington is not over a deep water-recharge zone, and part of it is still being used; another part is being capped as part of its closing procedures under the Long Island Landfill Law; and another part is to be cleaned up as part of Superfund. Many community residents have fought the opening of a waste-to-energy facility, largely because of concern about air pollutants, especially dioxin. They are also concerned about potentially dangerous chemicals in the ash (New York Times April 11, 1989, 2). In June 1990, the town presented a plan to the State Department of Environmental Conservation under which the town would operate an intensive recycling and composting program over a three- to five-year period. The building of the incinerator would be delayed or put on hold to see how successful the new program would be. A key to this plan is that the landfill must remain open, which requires state approval (Eisenberg June 17, 1990, and Fan and Mintz 1990). Even before June, the town had developed a fairly extensive solid waste management program, apparently more comprehensive than other towns, as it provides for easier disposal of plastics and other items such as corrugated cardboard and tires. It also allows more opportunities for the disposal of hazardous wastes.

It will be interesting to see how the residents of this wealthiest and most highly educated of the towns or cities of Nassau County respond to the recycling plans. They have resisted an incinerator, whose construction was once considered inevitable but that many thought was environmentally unsafe. They voted out of office the administration that supported the waste-to-energy facility. The town is trying to use an advantage that most of the rest of Nassau County does not have; its underlying geology is not a deep water recharge zone. However, even as the Town of North Hempstead recycles, its residents will receive air that has passed over the Hempstead, Glen Cove and Long Beach plants. People and governments set boundaries; pollutants are not restricted by them.

Fourth State Alternative: Sound Disposal of Residues and Nonrecoverable Materials

This last alternative for solid waste management is in many ways the most complicated as it is both a "miscellaneous category" and a catchall category. It includes landfills as well as wastes. The wastes include sewage sludge, hazardous wastes, including batteries and swimming pool chemicals, tires, and construction and demolition wastes. All have unique problems of disposal and are regulated by different government agencies.

As discussed earlier in the paper, the State passed the 1983 Long Island Landfill Law which required the closing of "landfills not built to strict design standards and located over deep-flow recharge zones" by 1990. The only open landfill in Nassau County, in Port Washington, is dependent on state approval of North Hempstead's aggressive recycling plan to continue operating. Even it cannot remain open indefinitely without a drastic drop in the volume of solid waste, which could occur with the new plan. Some have complained that the landfill law forced communities to make too precipitous decisions, some too costly; economically and ecologically. Others state that communities procrastinated, waiting until the last minute (or year) before attempting to solve the problem (Lyall 1990). It should be noted, however, that most of Nassau county has complied with the law; primarily Suffolk county communities have delayed.

One way to lessen the need for more landfills is to have communities deposit their waste or their ash at a few landfills for the whole island. But this regionalization of ash has not been very successful, as conflicts have arisen over the years about ash from one municipality being deposited in another town's landfill. However, Long Beach and Glen Cove do send some of their ash to landfills in neighboring Suffolk County. On the whole, the construction of new landfills or ashfills is extremely unlikely, so that one could say that the state has succeeded in its goal of restricting landfills and starting to control their damages.

This miscellaneous category includes not only landfills but also several different wastes, of which the most voluminous is sewage sludge, the product of sewage treatment. Fourteen sewage treatment plants process sludge in Nassau County; some of these (Cedarhurst, Great Neck, Great Neck Village, Lawrence) deposit the sludge at landfills in Oceanside or Port Washington; one, Glen Cove, co-incinerates its sludge with municipal solid waste, then transporting the ash off-island; one, Port Washington, incinerates it in a sludge incinerator and deposits the ash in its landfill; one, Oyster Bay, stores its sludge on-site; the remainder dump the sludge in the ocean at the 106 mile site. As with other solid wastes, some communities are following environmental mandates and others are going to have to change their procedures in the near future. Technically and governmentally these approaches are not integrated with the other solid wastes.

Dangerous pollutants, including solvents, tires, drain and oven cleaners, tires, and most pesticides are handled by all the towns and cities through STOP (Stop Throwing Out Pollutants) programs. These pollutants are supposed to be disposed of only on specified days and at specified sites. However, in most cases, with the possible exception

of North Hempstead, this type of disposal is done on a very voluntary basis, with few or no practical penalties for ignoring the rules (Town of Oyster Bay, Department of Public Works). North Hempstead has a mandatory tire disposal program, using its landfill as a disposal site.

Disposal of leaves and yard wastes through composting is another environmentally acceptable technique that has had slow acceptance in Nassau County. The City of Long Beach has its own composting facility. The Towns of North Hempstead and Oyster Bay have an exchange agreement of compost refuse from North Hempstead to Oyster Bay in exchange for tires from Oyster Bay. The "rate of exchange" is 25 tires for one ton of leaves, with Oyster Bay providing 12,500 tires to North Hempstead (Town of Oyster Bay 1989). Oyster Bay is using an old landfill site as its composting site. The new proposed North Hempstead plan calls for more composting.

Relationships of Solid Waste Management to Socioeconomic and Political Policies

We have examined the approaches taken by the five governmental bodies responsible for solid waste disposal in one county in New York State. We have seen that the state's monetary aid programs contradict its own policy recommendations of solid waste management. We have seen one state department favor a project while another objects. We have seen some limited attempts at regionalization or sharing of disposal facilities, in some cases with Nassau County communities using landfills in neighboring Suffolk. We have seen that overall, the communities are not really making money on their environmentally rational approaches, but rather spending less. These savings result sometimes from compactness (or more weight per unit volume—a classic geographic phenomenon) of ash versus garbage. In recycling cases, demand, and corresponding price, for some materials (paper and glass) has declined as community participation and thus volume has grown—the more recycling, the less profitable it is. This relationship may change with the development of new technologies and new pricing schemes both for the disposal of wastes and the use of raw materials.

We have also seen the partial privatization of solid waste management. The waste-to-energy resource plants are private ventures, and like most profit oriented enterprises, their primary aim is to satisfy their stockholders. Community satisfaction and environmental compliance are only means to that end. From a different viewpoint, they are purpose-built with guarantees from the local government; they are almost being run under contract for the local government. A 20 year contract, with set stipulations, is much longer than the mandate given by the voters to their elected town officials. The operation of these private ventures for the public good is not as straightforward as might first appear. Because of existing pricing schemes and legislation, the actual handling of much of our solid waste in one town and two cities is not performed by the governmental units, but by private subcontractors. The town and cities are paying to have someone else perform what once was a governmental, and thus public, responsibility. Paralleling the state's delegation of recycling to the localities while incineration remains under its own purview, at least now, the localities are allowing incineration to be controlled by nonlocal organizations, while recycling remains local.

As communities around the country decrease their dependence on the traditional landfills, ocean dumping and incineration, some have found the waste-to-energy incinerators attractive for several reasons: their ostensible lack of significant pollution, their beautiful technology (a trait Americans value), their ability to use virtually unsorted garbage with their lack of demand for more than minimal sorting and their implicit demand for more garbage, and thus their lack of insistence on declining waste output. And of course they make money—they take a voluminous product that has been costly to truck elsewhere and they compact it, sending it to some area where land is more available and thus a cheaper place to dump garbage.

Not all communities view high-burn incineration as desirable as recycling. Nor do all communities view privatization of solid waste collection as a good idea. Regardless, it can be seen that the equality of solid waste management is nonexistent; that, as with other public services, solid waste management varies with location. Long Island provides a spectrum of alternatives: Hempstead, Long Beach, and Glen Cove depend mostly on incineration; Oyster Bay depends mostly on off-island dumping or landfill; North Hempstead is depending on aggressive recycling and composting, with minimal landfilling. There is a wide variation in costs per household of solid waste disposal, with North Hempstead having the lowest cost, largely because it has a landfill. It is interesting to note that the town with the most highly educated and highest income residents has chosen to follow the currently "environmentally safest" choice, while Hempstead with large proportions of commercial and industrial activity, as well as lower per capita incomes and education, has chosen to hire an outside firm; it has chosen a technology that is dependent on large amounts of garbage and probably also on more intensive land use. Oyster Bay, which spans the island and also has a great range of income and education, is awaiting state approval of a high-technology incinerator, while continuing to depend on out-of-state landfills and expanded recycling. One must suspect that the town government is aware that community activism can greatly influence political decisions, as occurred in North Hempstead. A community's concern about "environmental issues" and the type of activism members choose to adopt as well as the economic structure and sometimes the physical structure of the land will all affect the choice or choices of technique. All communities must work within the limits of federal, and, in turn, state legislation. But as with Nassau county, even with strict guidelines, exceptions can always be found. The federal government may set the overall goals and rules of solid waste management, but it is the local communities, on a small scale, that determine the actual techniques and policies.

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