

The Incongruity of Policies Regulating New York City's Sewage Sludge: Lessons for Coastal Management

R. LAWRENCE SWANSON

Waste Management Institute
Marine Sciences Research Center
The University at Stony Brook
Stony Brook, NY 11794-5000

Abstract *Single purpose legislation and/or policies targeting a specific waste or geographic region are often conflicting. The costs of complying with uncoordinated laws, regulations, and policies can be extremely expensive and perhaps in the long term provide little relief to problems of environmental stress. Such may be the case regarding the management of New York City's sewage sludge. A more holistic and coordinated regulatory management approach is needed in order to optimize environmental protection/remediation at an affordable price.*

Keywords sewage sludge, biosolids, ocean dumping, water pollution control plants, dewatering facilities, nutrient loadings, centrate

Introduction

Guided by disparate laws, regulations, and policies, New York City has developed what appears to be an effective sewage sludge management plan. This article reviews the generalities of the plan in the context of some of the single-purpose constraints imposed by the regulatory process. It is beneficial to examine this issue because it illustrates a need for developing a more holistic approach to environmental policy in order to achieve sound environmental goals at a reasonable price.

Background

In 1988, Congress passed the Ocean Dumping Ban Act (P.L. 100-688). This Act prohibits ocean dumping, or the shipping of sewage sludge to sea for the purpose of disposal, after December 31, 1991. *Sewage sludge* is defined as "any solid, semisolid, or liquid waste generated by a wastewater treatment plant, other than material excluded" (U.S. Congress 1988). The Act also prohibits the disposal of sewage sludge, "at any landfill located on Staten Island, NY." Furthermore, the municipalities that historically had been ocean dumping were to develop a plan for implementing an "alternative system" for handling sewage sludge—a system that does not require an ocean dumping permit under the Marine Protection Research and Sanctuaries Act or the Ocean Dumping Ban Act (ODBA).

New York City is a municipality subject to ODBA. As such, the City has developed a comprehensive plan that ultimately relies on land-based beneficial reuse of the sludge as a biosolid.

Other laws in effect or proposed also limit New York City's sewage sludge manage-

ment options. The Clean Water Act Amendments of 1987 (Section 301h) prohibit sewage sludge from being discharged through an outfall in the New York Bight apex (Figure 1). To use an ocean discharge, a pipeline of over 37 km (20 nautical miles) from the mouth of the New York–New Jersey Harbor estuary would be necessary. In 1992, the Ocean Dumping Ban Improvement Act (H.R. 5863) was introduced in the U.S. House of Representatives and will be reintroduced in 1993. This Act proposes to prohibit facilities for land-based management of sewage sludge (it does not include dewatering facilities) within 3.2 km (2 miles) of a residential neighborhood (where population densities exceed 390 persons/km² [1,000 people/mi²]). This virtually excludes any such facilities in the city.

In addition to these legislative measures, it is a recommendation of the Long Island Sound Study (LISS) of the U.S. Environmental Protection Agency's (U.S. EPA's) National Estuary Program (NEP) that there should be "no net increase" in total nitrogen loads from point sources entering the Sound (U.S. EPA 1990). Water pollution control plants (WPCPs) along the East River are considered to be a major source of nutrients

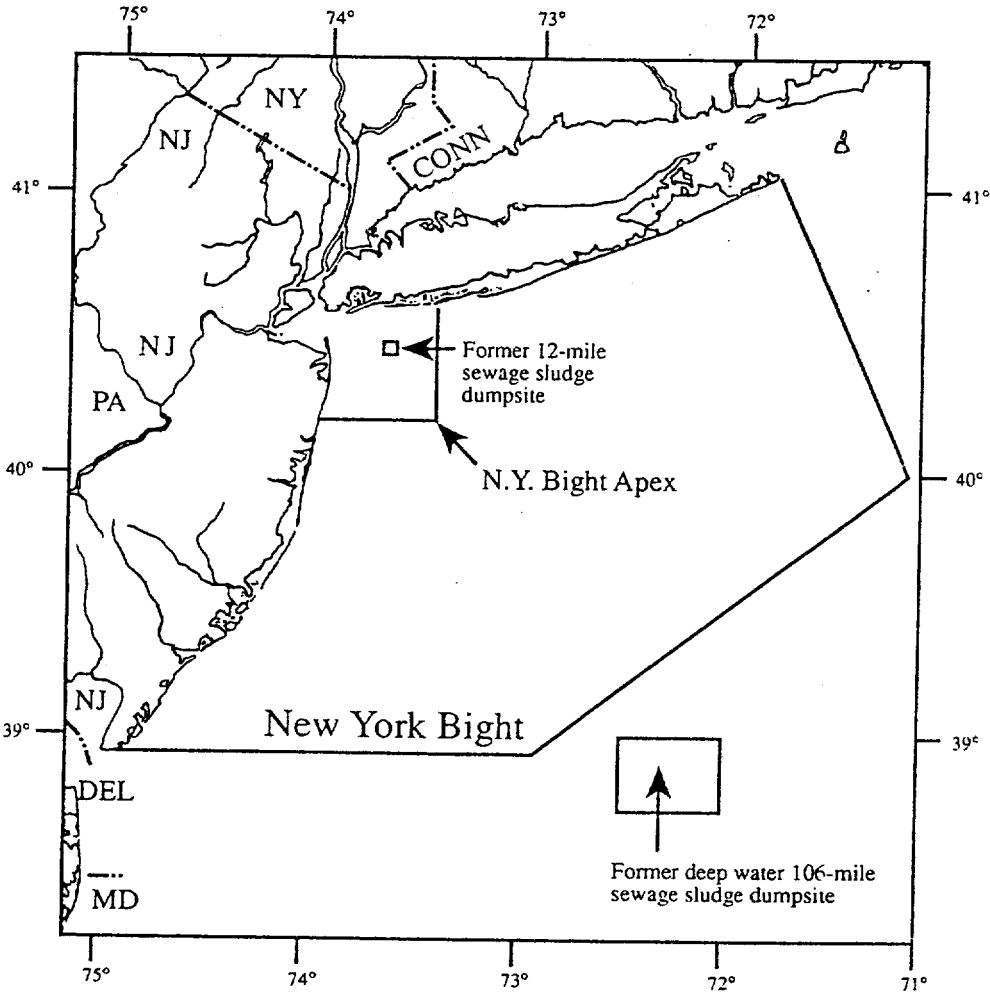


Figure 1. The New York Bight and the former 12-mile sewage sludge dump site.

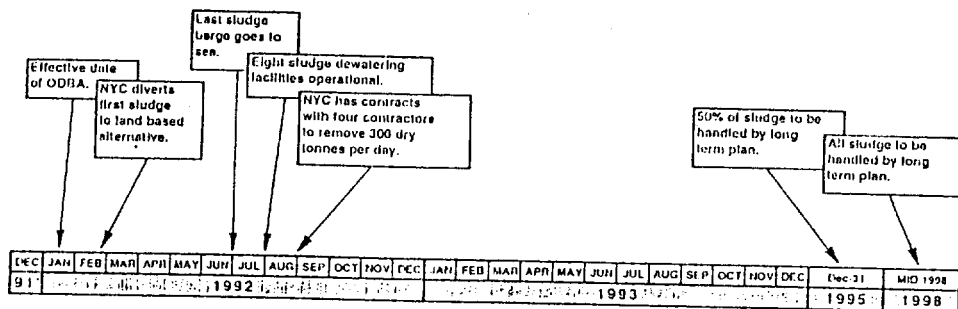


Figure 2. Time history of implementation of New York City sewage sludge management plan.

(particularly nitrogen) to western Long Island Sound (LIS) (U.S. EPA 1990). This recommendation constrains the design and implementation of an “alternative system” for treatment of sewage sludge.

New York City’s Sludge Management Plan

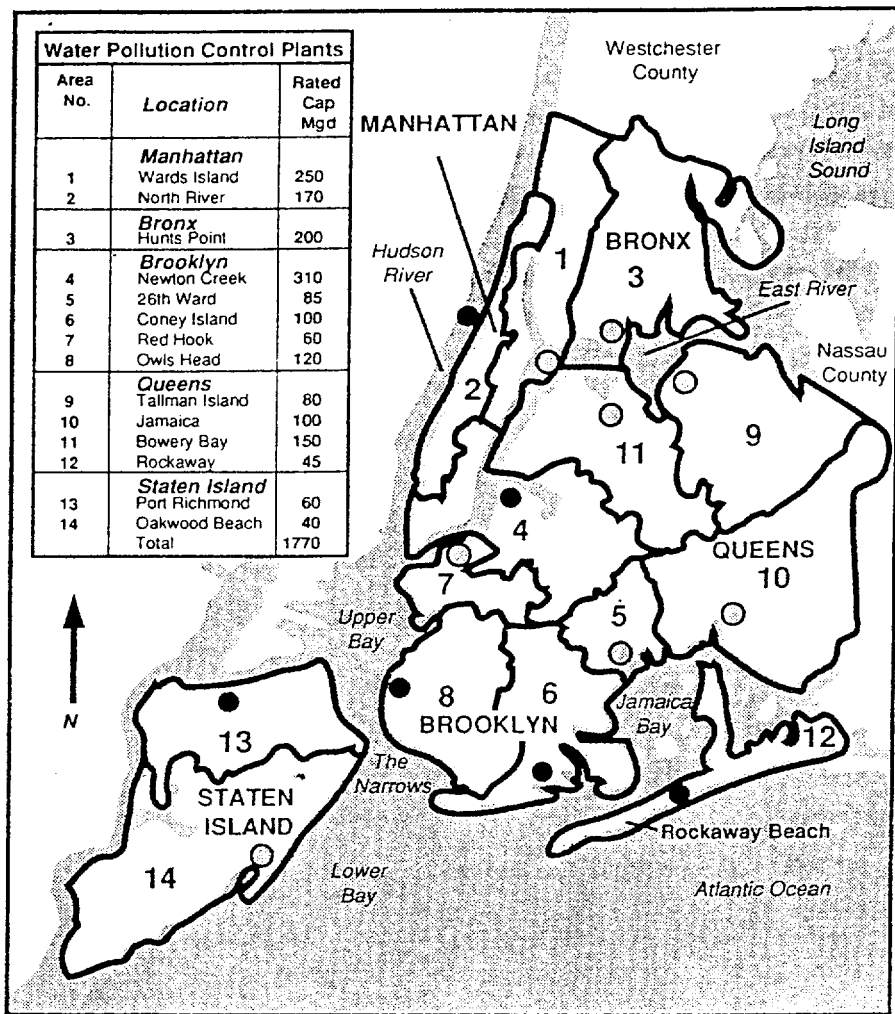
Ocean dumping of sewage sludge was completely phased out by the City as of July 1992. The City developed an intermediate plan and a long-term plan (Figure 2) to handle sewage sludge generated at its 14 WPCPs (Figure 3). An essential component of both the intermediate and long-term plans is eight facilities for dewatering the sludge to improve its handling characteristics for land application or disposal. All of these facilities (Table 1, Figure 3) use centrifuges to remove water, increasing the percent solids from 3 to 20 (NYCDEP 1990a).

New York City’s intermediate sludge management plan consists of a series of contracts with private companies to remove 300 dry tonnes/day (330 dry tons/day) of sludge cake from the dewatering facilities. Some 60% is being used for composting in Arizona, land application in Colorado and Texas, and land reclamation in Pennsylvania. The balance, 40%, is being landfilled in Virginia and Ohio (Stone and Webster Engineering Corporation 1992 and Woods Hole Oceanographic Institution 1993).

The long-term sewage sludge management plan is to be implemented and managed by the City. It assumes that the highest priority for sludge management is that of recycling and reusing the material, and when possible, within the City and the state. Siting of long-term sludge processing and storage facilities is currently underway. Existing City-owned facilities and properties are a first priority for siting to diffuse public resistance, which has occurred with the siting of several of the eight proposed processing facilities. Five are now to be constructed. The plans for sewage sludge processing facilities at Red Hook in Brooklyn and Maspeth in Queens were withdrawn because of residents’ concerns about odors and increased truck traffic (Fried 1992).

Among the processes being considered for treatment of sludge are incineration, thermal drying, chemical stabilization, and composting (NYCDEP 1991a). Possible end uses being considered are land application for silviculture, land reclamation for mines, landfill cover (either daily or final), and hazardous waste site cover (NYCDEP 1991a).

The costs (capital and operating) associated with implementing the intermediate and long-term sludge management program over the period 1992–2002 in 1992 dollars are estimated to be in the range of \$2.5–2.7 billion (Eileen R. Kaufman, NYCDEP, personal communication).



Modified from New York Department of Environmental Protection, 1990b

- WPC Plant
- Dewatering Facility and WPC Plant
- Service Area Boundry
- 1 Service Area Number

Figure 3. Locations of New York City water pollution control plants and dewatering facilities.

New York City Sludge Quality and Associated Loadings

New York City sewage has been described as weak (Table 2). This is in part due to a low organic content, high water use, and high dilution. Organic content is low relative to other municipal sewage because garbage disposals are not allowed in the City (New York City Department of Sanitation 1992). Dilution is high because of excessive water usage due to low costs (55% of the City's buildings are not metered [NYCDEP 1992]), seepage of water into the sewage system, and use of combined sewers. New York City consumes about $5,375 \times 10^6$ l/day (1,420 MGD) or somewhere between 570 and 757 l/person/day (150–200 gallons/person/day), which approaches the upper limit of per capita water consumption of major cities around the world (Gunnerson 1991).

Table 1
Sewage Sludge Dewatering Facilities

Dewatering Location	Other Plants Served
Wards Island ^a	Newtown Creek
Hunts Point ^a	North River
26th Ward	Coney Island, Owls Head, Rockaway
Oakwood Beach	Port Richmond
Bowery Bay ^a	—
Tallman Island ^a	—
Red Hook ^a	—
Jamaica	—

^aDischarging to WPCPs located on East River (NYCDEP 1990a).

Many contaminants of concern in the influent to the City's WPCPs are also in relatively small concentrations because of the high dilution and an effective industrial pretreatment program and also because many industries have closed, contracted, or left the City for other locations (during the decade 1980–1989, the New York Department of Economic Development reports 982 major manufacturing closings with over 100,000 jobs lost). This results in low concentrations of contaminants in the sludge (see Table 3).

In 1990, an average of $3,864 \times 10^6$ l/day (1,021 MGD) of treated sewage effluent was discharged by six WPCPs to the East River (NYCDEP 1991b) from a population of some 4.8 million (Figure 4). All are at full secondary treatment except the Newtown Creek Plant ($1,245 \times 10^6$ l/day, 329 MGD), which remains operating at advanced primary treatment. Raw sewage discharges to the East River have decreased from about

Table 2
Typical Municipal Wastewater Characteristics Compared
with New York City Sewage for Conventional Pollutants

Parameter	Typical Weak Raw Sewage ^a (mg/l)	New York City Raw Sewage ^b (mg/l)	New York City Secondary Effluent (mg/l)
TSS	100	110.00	20.00
BOD	110	104.00	15.00
TOC	80	93.00	39.00
NH ₃ -N	12	10.00	7.90
Org-N	8	13.00	6.10
NO ₂ -N	0	0.07	0.19
NO ₃ -N	0	0.38	1.30

Note. TSS, total suspended solids; BOD, biological oxygen demand; TOC, total organic carbon; NH₃-N, ammonia-nitrogen; Org-N, organic nitrogen; NO₂-N, nitrite nitrogen; NO₃-N, nitrate nitrogen.

^aFrom Metcalf and Eddy, Inc. 1991.

^bFrom Mueller et al 1982.

Table 3
Concentration of Selected Metals and PCBs in mg/kg in New York City Sewage Sludge^a
in 1988-1989^b and 1991-1992^c Compared to New York State Part 360 Regulations

Wastewater Treatment Plant	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead mg/kg	Mercury	Nickel	Zinc	Total PCBs
Wards Island	5.4	0.2	12 (8)	242 (102)	1421 (1443)	269 (202)	2.7 (2.6)	34 (28)	966 (1121)	3.08
North River	4.5	0.2	16 (10)	338 (141)	1280 (1505)	433 (256)	5.8 (2.4)	58 (45)	1315 (1078)	2.95
Hunts Point	4.2	0.3	43 (15)	187 (111)	1255 (1048)	265 (219)	1.8 (2.3)	47 (47)	1192 (1024)	3.08
Newtown Creek	6.1	0.4	33 (15)	743 (303)	1564 (1460)	468 (340)	4.1 (2.7)	99 (102)	1425 (1433)	2.57
26th Ward	6.3	0.3	14 (9)	217 (149)	1160 (1029)	376 (269)	1.6 (1.8)	58 (42)	1593 (1172)	3.08
Coney Island	4.7	0.3	9 (8)	59 (57)	1144 (1387)	282 (285)	2.9 (2.7)	44 (38)	1237 (1446)	2.48
Red Hook	8.4	0.3	83 (35)	168 (87)	923 (1063)	428 (281)	4.3 (3.4)	42 (37)	1182 (1201)	2.80
Owls Head	3.9	0.2	18 (13)	194 (305)	1338 (695)	456 (332)	3.1 (2.0)	50 (37)	1531 (1071)	2.52
Tallman Island	5.7	0.2	31 (23)	181 (139)	1054 (854)	180 (157)	2.3 (2.9)	183 (48)	898 (1075)	2.75
Jamaica	5.5	0.2	15 (17)	173 (154)	1062 (933)	198 (156)	2.1 (3.1)	44 (27)	1031 (1320)	2.89
Bowery Bay	3.9	0.2	22 (17)	275 (158)	1271 (1053)	299 (329)	3.3 (2.9)	89 (63)	1728 (1683)	3.36
Rockaway	6.0	0.2	13 (8)	60 (55)	1244 (1125)	200 (187)	2.0 (2.0)	27 (19)	793 (1011)	3.22
Port Richmond	60.7	0.3	12 (7)	75 (63)	1098 (1077)	587 (180)	3.4 (2.6)	71 (57)	1252 (995)	2.96
Oakwood Beach	6.1	0.2	16 (9)	41 (39)	1237 (838)	129 (130)	3.8 (2.8)	86 (58)	831 (943)	9.33
<i>New York State Part 360 Land Application Regulations</i>										
Class I composting			10	1000	1000	250	10	200	2500	1
Class II composting			25	1000	1000	1000	10	200	2500	10

^aData is from wet sludge shown on a dry weight basis.

^bAdapted from New York City Department of Environmental Protection 1990b.

^cData provided by New York City Department of Environmental Protection.

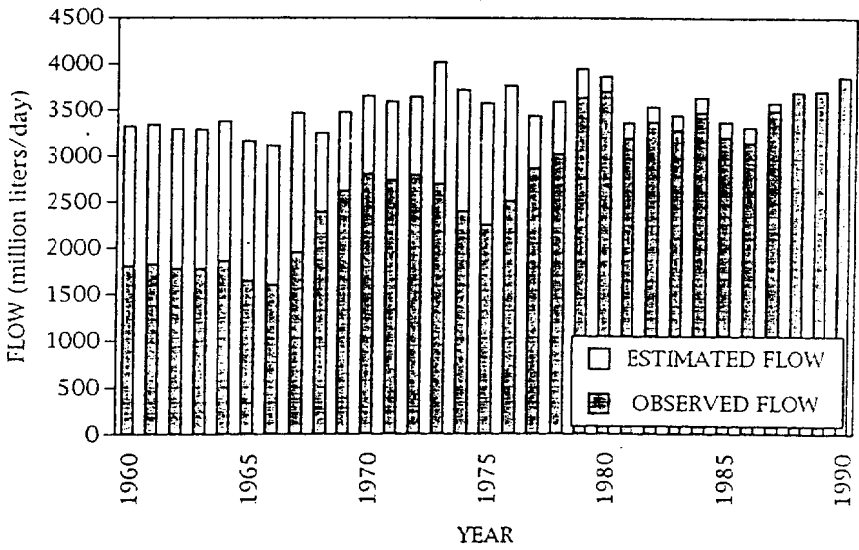


Figure 4. Estimated (untreated) and observed (treated) effluent from East River water pollution control plants.

1,514 × 10⁶ l/day (400 MGD) in 1960 to only that associated with treatment plant breakdowns and combined sewer overflows in 1990.

Total nitrogen (NH₃-N + Organic-N + NO₂-N + NO₃-N) entering the East River from raw sewage discharges and sewage treatment plants (Figure 5) is estimated to have decreased from a peak of 72 tonnes/day in 1973 to about 60 tonnes/day in 1990. Much of this decrease would appear associated with a reduction of organic nitrogen associated

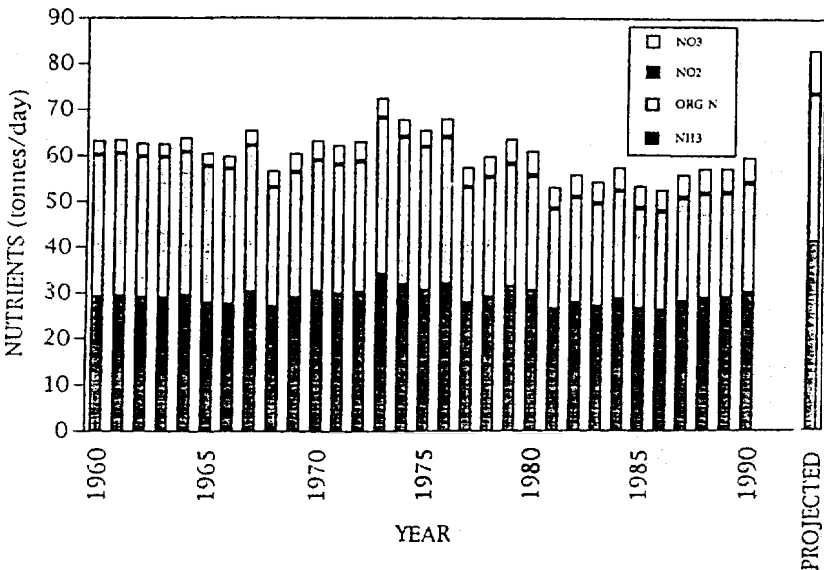


Figure 5. Estimated total nitrogen from untreated and treated effluent from East River water pollution control plants.

with the removal of the raw discharges. Some of the nutrient load in the raw discharges was probably shunted to the primary and secondary sludges (Swanson et al. 1991a). These sludges were ocean dumped and their nutrient loads and other contaminants dispersed and assimilated in oceanic waters.

Of the eight sewage sludge dewatering facilities constructed, five of them are located along the East River. The sludges from the Newtown Creek Plant and North River Plant are dewatered at Wards Island and Hunts Point, respectively (Figure 3). At the dewatering facilities, the sludge is separated into sludge cake and centrate. The cake is diverted to processing facilities to be stabilized and converted for beneficial reuse purposes as a biosolid. The centrate is routed to the WPCP adjacent to the dewatering facility.

It is estimated that sludge dewatering at all 14 WPCPs will create some 25.4×10^6 l/day (6.7 MGD) of centrate in 1992 of which 17.4×10^6 l/day (4.6 MGD) will be returned to East River plants for treatment (NYCDEP 1990c). In 1998, it is projected that sludge centrate will amount to 22.5×10^6 l/day (6.0 MGD) of which 13.7×10^6 l/day (3.6 MGD) will be from plants discharging to the East River (Alec Fu, New York City Department of Environmental Protection, personal communication).

In terms of total flow, the amount of centrate discharged through the respective WPCPs to the East River due to dewatering operations is only 0.3–0.5%, a seemingly insignificant amount. Also, according to the Final Generic Environmental Impact Statement, there should be no more than a 0.01 mg/l decrease in dissolved oxygen concentrations (DO) in the East River as a consequence of increased flow from centrate (NYCDEP 1990c). However, the New York City Department of Environmental Protection (NYCDEP) recently has determined, through direct measurements at the new dewatering facility at Wards Island, that loadings and particularly nitrogen loadings of centrate are much higher than originally anticipated. Table 4 shows the measured concentrations of several nitrogen species in the centrate of the Wards Island WPCP.

Using the few nitrogen measurements from the centrate of the new dewatering facility at Wards Island (Table 5) as representative of all the dewatering facilities discharging to the East River, the total Kjeldahl nitrogen ($\text{NH}_3\text{-N} + \text{Organic N}$) increase is approximately 21 tonnes/day and $\text{NH}_3\text{-N}$, 15 tonnes/day. Note that NYCDEP's measure of total Kjeldahl nitrogen underestimates total nitrogen by about 10%. Thus, the increase in total nitrogen is about 23 tonnes/day or a 38% increase relative to 1990 (Figure 5).

In terms of total nitrogen, the mass load to the East River would be approximately 83 tonnes/day, considerably more than the peak 1972 loads (Figure 5). The small reductions in nitrogen to the East River that were the result of eliminating raw discharges and

Table 4
Means and Sample Standard Deviations of Seven Measurements of Nitrogen Species in Centrate of Dewatered Sewage Sludge from Wards Island Water Pollution Control Plant (May 1992)

Total Kjeldahl Nitrogen ^a mg/l	NO_3^- mg/l	NH_3 mg/l
1188 ± 235	2.59 ± 0.51	834 ± 135

^aNew York City Department of Environmental Protection reports as total organic nitrogen + inorganic NH_3 .

Table 5
 Estimated Mass Load of Total Nitrogen from East River Sewage Sludge
 Centrate Dewatering Facilities Returned to WPCPs

Total Flow 10 ⁶ l/Day	Total Kjeldahl ^b Nitrogen Concentration mg/l	Total Nitrogen ^c Concentration mg/l	Mass Load Tonnes/Day
17.4 ^a	1188	1307	23.7

^aNew York City Department of Environmental Protection 1990c.

^bFrom Table 4.

^cNew York City Department of Environmental Protection estimates of Kjeldahl nitrogen under estimates total nitrogen by 10%.

converting to secondary treatment as required by the 1972 Clean Water Act are more than eliminated by having to treat sewage sludge for land-based use.

The impact of nitrogen in the marine environment could be reduced by introducing nitrification-denitrification processes in the plant. Some benefit in this regard might be achieved by increasing the detention time of the sewage in the treatment plants (Freudberg and Lugbill 1990). Unfortunately, by increasing the total flow through the plants with the addition of sludge dewatering centrate, this possibility is reduced since the plants already are working close to capacity. Average detention times could be increased, however, if serious endeavors to conserve water were followed, which could reduce the total volume needing treatment (Cropf 1989; Swanson et al. 1991a).

Discussion

By many measures, the quality of the New York–New Jersey harbor waters has improved considerably. See, for example, the Harbor Water Quality Survey, 1988–1990 (NYCDEP 1991b). However, sewage sludge disposal has been a contentious issue since the mid-1960s and is a particular concern of the U.S. Congress (Squires 1981, 1983). A brief temporal history is given in Figure 6.

Closing the 12-mile sewage sludge site in the New York Bight apex in 1987 by the U.S. EPA and requiring the municipalities using that site to move to the 106-mile site only temporarily allayed the U.S. Congress's concern about dumping sludge at sea. The deaths of dolphins in the North Atlantic in 1987, shell-burn disease in red crabs and lobsters, the wash-up of floatable waste on New York and New Jersey ocean beaches, and poor catches of some fish species in 1988 were all taken as indications of the generally poor health of the coastal ocean. Despite the fact that none of these unfortunate events had anything to do with ocean dumping of sewage sludge, Congress was compelled after nearly two decades to once and for all end ocean dumping of sludge with passage of the ODBA (Swanson et al. 1991b).

The Terrestrial Problem

Five years since the passage of ODBA, the issues surrounding sludge disposal have not gone away, largely because the environmental impacts of land-based alternatives and

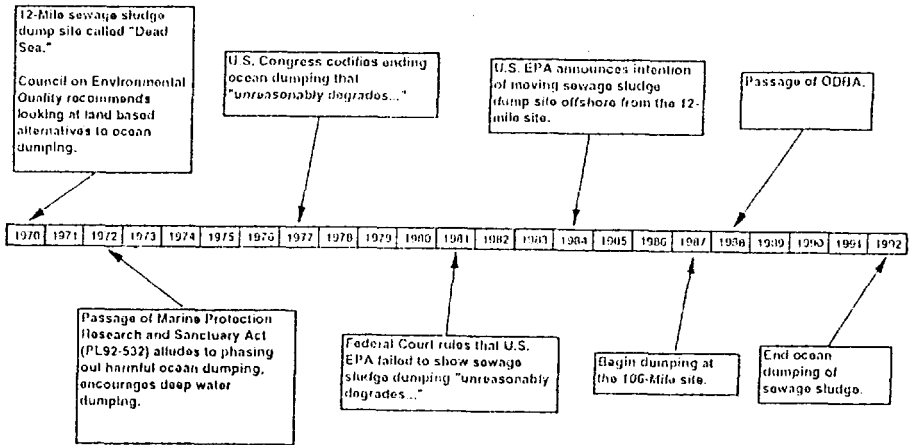


Figure 6. Temporal history of ocean dumping of sewage sludge laws and regulations. Source: Brady 1970, Council on Environmental Quality 1970, Erdheim.

their associated waste streams and facilities are not completely understood. Many social and political issues associated with the siting of sludge composting facilities and implementing of alternative systems were also unanticipated or ignored when drafting the legislation—issues that the City is now having to resolve and that are being raised by the Ocean Dumping Ban Improvement Act (H.R. 5863).

The U.S. EPA's interpretation of ODBA unfortunately sends an inconsistent and inappropriate signal to the entire nation concerning the safe and beneficial use of stabilized sewage sludge, sometimes called biosolids. Further, it is not consistent with the intentions of the U.S. EPA's sewage sludge rule that encourages but sets standards for beneficial reuse of sewage sludge (U.S. EPA 1993a). Section 1005 of ODBA prohibits the disposal at the Staten Island landfill of sewage sludge from a wastewater treatment plant. It does not mention anything about prohibiting a stabilized sewage sludge product, biosolids, that can be used for some beneficial purpose. A stabilized sewage sludge product, as discussed in the City's intermediate and long-term plans, could be extremely beneficial as daily cover or final cover and perhaps for silviculture on the landfill in the years to come. It might also save the City some \$7–10 per ton for commercially available cover material. However, in a letter to Congresswoman Susan Molinari of Staten Island dated July 11, 1991, the Administrator of the U.S. EPA summarizes the agency position: Chemically stabilized sludge cannot be used at the Fresh Kills landfill because it "meet(s) the definition of sewage sludge"; according to the Solid Waste Disposal Act applied to landfills, disposal is defined as the "placing of any solid waste on any land or water so that such solid waste may enter, the environment or be emitted into the air or discharged into any waters, including ground waters" (Reilly 1991, p. 1). This interpretation of the ODBA seems excessively narrow. It is difficult to understand how a stabilized sewage sludge product can be construed as sewage sludge under the provisions of the ODBA and the sludge rule. The U.S. EPA's interpretation of "placing" as meaning "dispose" in this situation is stretching a point. To legislatively preclude sewage sludge from the landfill further complicates the City's dilemma of safely solving the sludge problem without shipping it to other parts of the country. If New York City won't accept its own stabilized sludge, who else would or should?

It could also be argued that since the landfill is not lined, use of a stabilized sludge

product for landfill cover could be a threat to ground water or marine waters adjacent to the landfill. Of course the same product will in all likelihood meet federal and state criteria for some form of agricultural use or at least silviculture. It must be difficult for Coloradans to accept land application of New York City's stabilized sludge product when it's not good enough to use on a Staten Island landfill.

The Marine Problem

According to the LISS, the likelihood that a hypoxic (<3 mg O_2/l) condition will develop in western LIS has increased over the last decade, with increased duration, greater geographical area of impact, and decreased DO concentrations. Hypoxic conditions have been observed to varying degrees since 1986, reaching anoxia (0 mg O_2/l) in the summer of 1987 (U.S. EPA 1990).

Nitrogen loadings are thought to be a significant contributor to the hypoxia problem, and as a consequence, the LISS has proposed a "no net increase" policy for discharges of nitrogen. New York City's East River WPCPs contribute a major fraction of the total point source nitrogen load to the Sound, so they are, in particular, a target for nitrogen control (U.S. EPA 1993b).

There is considerable debate as to why the western LIS appears to be becoming more eutrophic despite increased levels of sewage treatment (Parker and O'Reilly 1991; Swanson et al. 1991a). However, regardless of what the ultimate cause proves to be, it is evident that little consideration was given with passage of the ODBA to the consequences of additional nutrient loadings to Sound and harbor waters from land-based sludge alternative technologies and specifically those nutrient loadings associated with the centrate from sludge treatment. New and perhaps costly mechanisms have been proposed for the existing WPCPs along the East River to accommodate the management plan of the LIS (U.S. EPA 1993b). The City is now exploring the possibility of holding the increase in nitrogen loading due to dewatering to about 10% of the 1992 predewatering effluent loads. This might be achieved by implementing biological nutrient removal in the plants (John Petito, NYCDEP, personal communication).

No panacea exists for managing coastal resources and environments. Conflicts are inevitable when competing interests are at stake. Coastal preservation, conservation, and exploitation issues are not easily resolved, particularly in regions that have had a historical reliance on the marine environment for livelihoods and where population and economic stress are recurrent problems.

However, with regard to the management of New York City's sewage sludge, there is a history of external pressures to dictate what cannot be done. Little assistance has been offered concerning what can be done to solve the sewage sludge problem, although the ODBA does provide money through fines and penalties to explore alternatives to ocean dumping.

Sewage sludge has been expressly prohibited from specific environmental media using specific disposal technologies in the ODBA and the Clean Water Act. Sewage sludge or its stabilized biosolids by-products have been prohibited from the City's only active landfill, and questions remain as to what must be done to properly discharge the sludge dewatering centrate. The Ocean Dumping Ban Improvement Act may further restrict what the City has been directed to do. These prohibitions and restrictions may be appropriate. However, they were not developed through any holistic assessment of the environmental or economic consequences of the particular management options. Instead, they are material, media, geographic area and technology specific limitations.

A considerable body of knowledge exists concerning environmental consequences of sewage sludge use and management alternatives. Yet, the management of the material by the City has been restricted to options that remain following implementation of a legal/regulatory framework that inadequately considers what is known about sewage sludge or its beneficial products in water, air, or on land. The City has been put in the position of having to search for loopholes in the legal/regulatory framework to manage the public's domestic wastes. Even the initial stages of the management plan of the LISS were drafted without the full knowledge and understanding of what a net increase for nitrogen would have on the City's sludge management program. The sewage sludge issue clearly indicates the complexities of independently managing a waste material (sewage sludge) and a geographic region (the harbor or LIS).

Recently, the Joint Group of Experts on Scientific Aspects of Marine Pollution completed a study titled "Global Strategies for Marine Environmental Protection." In that study, they stated that "human activities cannot be managed successfully if they are dealt with individually or in isolation. Thus, legal instruments for protection of the environment need to take account of interactions, both between different practices and environments and between the various mechanisms developed for regulatory and protection purposes" (GESAMP 1991, p. 3).

This is sound and certainly should apply to the sludge management situation that has been presented. Single-purpose legislation/regulations that target pieces of a problem cannot effectively maintain and protect the environment and often prove contradictory and extremely costly as well.

Conclusions

The domestic wastes of New York City's residents must be appropriately treated; the by-products of that treatment (wastewater effluent and sewage sludge) should be managed in a manner that has the least effects on public health and the environment, but also at a cost that taxpayers can afford. To the degree possible, it is reasonable to expect that the management of this total waste stream have a minimal effect on other communities or other environmental settings.

The City, under a consent decree with the Federal Court and with the assistance of federal and state regulatory agencies, developed a series of plans that attempt to meet the above objectives within the limits of understanding of the problems and of the appropriate technology to deal with those problems. However, with regard to implementing the provisions of ODBA to cease the ocean dumping of sewage sludge, the City has to some degree been stifled by a legislative and regulatory process that gives insufficient attention to the complexities of the sewage issue as a whole.

In implementing the ODBA, the City has had to divide the sewage sludge into two waste streams—dewatered cake and centrate. Siting problems for conducting these operations within the City remain contentious. While people have been quite vocal in demanding an end to ocean dumping, they are not altruistic when it comes to siting necessary facilities for implementing the landbased sewage sludge management alternatives.

Legitimate concerns remain with regard to the use of stabilized sewage sludge in terrestrial settings. Research to more effectively stabilize contaminants in the sludge is important, as is research to find appropriate uses of the stabilized sewage sludge products. Long-term environmental and epidemiological monitoring of the sites of application are also an essential part of a sludge management program.

The impact on the marine environment from the centrate from dewatering facilities

is of particular concern. The nutrient loads from the centrates and their contribution to increasing the eutrophication problem in western LIS are not well known. The situation should be watched closely and perhaps modifications in current plans will be necessary.

A comprehensive review of the operative laws, rules, and regulations plus any coastal management plans relevant to the City's management of sewage sludge is appropriate. Specifically, Section 1005 of the ODBA and U.S. EPA's interpretation of it should be reviewed with regard to its original intent and information base. The current interpretation sends a negative signal to the entire country regarding sludge reuse and perhaps sets a poor legal precedent.

Finally, the New York City sewage sludge issue should serve as an example to Congress and regulatory agencies of shortcomings of the overall legal/regulatory process. It has been confusing and costly. Apart from benefits of a pretreatment program, it is not clear that the environment and public health are any more protected today than 20 years ago. The problems may have been only translocated from one geographic location and media (the ocean) to other geographic locations (various terrestrial sites and ground waters).

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