sanitation

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April 12, 2004

Honorable Gifford E. Miller
Speaker, New York City Council
City Hall
New York, New York 10007

Honorable Michael E. McMahon
Chair, Committee on Sanitation and
Solid Waste Management
New York City Council
250 Broadway – 14th Floor
New York, New York 10007

Dear Speaker Miller and Chairman McMahon:

I am pleased to present the Consolidated Executive Summaries of the New York City Department of Sanitation Commercial Waste Management Study, prepared by a consultant as required by Local Law 74 of 2000. This Study, which examines how commercial waste in the City is managed, is one part of the Department's larger commercial waste planning and policy initiatives that will unfold over the course of this year. The complete Study will be sent to you shortly.

Local Law 74 established the goals of this Study. The first was to assess potential environmental and public health impacts on communities in which a number of privately owned solid waste transfer stations are located. The second was to provide a foundation for the Department's efforts to develop a new Comprehensive Solid Waste Management Plan (SWMP).

As part of achieving the Study's first goal, three separate evaluations were conducted after a public scoping process had been completed. The first identified four areas of the City with geographically proximate, privately owned transfer stations (Hunts Point and Port Morris in the Bronx; East Williamsburg/ Newton Creek area of Brooklyn; and, Jamaica, Queens), and evaluated the potential overlapping impacts to the environment (air quality, odor, noise, traffic, water quality, public health). The second evaluation surveyed over half of the commercial waste transfer stations in these Study Areas, in order to identify any operational measures and design modifications to improve the environmental performance of these facilities. The third evaluation assessed the effectiveness of current permitting and enforcement activities of City and State agencies that oversee transfer station operations, under existing rules and regulations.

The Department's transfer station enforcement staff has doubled since 2000, and the Department is committed to ensuring that transfer stations comply with all applicable regulatory requirements. The number of transfer station facilities in the City has declined from 153 in 1990 to 62 today, including 7 facilities with multiple permits. Of these, 22 are permitted to receive putrescible waste, while the others receive construction and demolition debris or clean fill material.

The Study recommends practical and effective design and operational improvements which, together with continued strong enforcement efforts, will lead to even better regulatory compliance and improved environmental performance at privately owned transfer stations in the City. The Department welcomes these recommendations and, as necessary, will move forward quickly, through a public rule-making process, to amend its regulations governing transfer stations. These more stringent design and operations regulations will apply not only to new transfer stations, but also to existing transfer stations, many of which will need to comply by retrofitting their facilities and upgrading their operations.

The findings of the Study will also help inform the Department's new transfer station siting regulations. The 1998 siting regulations imposed certain new restrictions on the locations in which transfer stations could be sited. The Department will promulgate new siting rules this summer, and will provide opportunity for public comment from communities, the regulated transfer station industry, and other interested parties.

The second goal of the Study was to help the City to assess and plan for management of both the residential and commercial waste streams in an efficient manner through the development of the new SWMP. The SWMP will set forth the Department's plans for managing solid waste generated in the City over the next 20 years. The Study provides useful data and an effective context for considering how the residential and commercial waste management systems might operate more effectively.

For example, the Study provides an estimate of the capacity at the Department's converted Marine Transfer Stations (MTSs) that is potentially available for commercial waste. However, the Study does not address the business arrangements or possible regulatory policies that would be necessary elements of a City policy to handle commercial waste at the converted MTSs. These will be important considerations for future study and analysis.

Other valuable Study data includes the quantities of commercial waste generated in the City today and projections of commercial waste generation rates in the City over the next 20 years. Waste disposal capacity at landfills available to the City by truck or rail over the next 20 years is also analyzed. The Department expects to present the draft SWMP to the Council in September. The Commercial Waste Management Study makes an important contribution to the City's on-going planning efforts and evolving understanding of solid waste management strategies and alternatives. The Department is pleased to make the Study available to the Council and the interested public.

Sincerely,

John J. Doherty

COMMERCIAL WASTE MANAGEMENT STUDY

CONSOLIDATED EXECUTIVE SUMMARIES

VOLUMES I THROUGH VI

March 2004

Prepared for:

New York City Department of Sanitation
for submission to the New York City Council

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List of Acronyms/Definitions

Acronyms	
ach	air changes per hour
BIC	Business Integrity Commission
C&D	construction and demolition
CD	community district
CEQR	City Environmental Quality Review
CH_4	methane
CNG	compressed natural gas
CO	carbon monoxide
CRAB	Citywide Recycling Advisory Board
DOC	diesel oxidation catalyst
DPF	diesel particulate filter
DSNY	New York City Department of Sanitation
ECB	New York City Department of Environmental Protection's Environmental Control Board
ECL	State Environmental Conservation Law
FHWA	Federal Highway Administration
HC	hydrocarbons
HCS	Highway Capacity Software
HEV	hybrid electric vehicle
ISCST3	Industrial Source Complex Short Term
ITE	Institute of Transportation Engineers

Acronyms	
LL74	Local Law 74, effective December 19, 2000, enacted by the City Council, requiring a comprehensive assessment of commercial solid waste management in New York City
LOS	level of service
MSW	municipal solid waste
MTS	marine transfer station
NAAQS	National Ambient Air Quality Standards
NO_2	nitrogen dioxide
NO_X	nitrogen oxide
NYAC	New York Air Code
NYCAC	New York City Administrative Code
NYCDEP	New York City Department of Environmental Protection
NYCDOT	New York City Department of Transportation
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOT	New York State Department of Transportation
OEM	original equipment manufacturers
PADEP	Pennsylvania Department of Environmental Protection
PCE	passenger car equivalent
PIU	DSNY's Permit and Inspection Unit
PM	particulate matter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter

Acronyms	
PM_{10}	particulate matter less than 10 microns in diameter
ppm	parts per million
RCNY	Rules of the City of New York
RFP	Request for Proposals
SCR	selective catalytic reduction
SO_2	sulfur dioxide
SPDES	State Pollution Discharge Elimination System
SWAB	Borough Solid Waste Advisory Board
TNM	Traffic Noise Model
tpd	tons per day
ULSD	ultra-low-sulfur diesel fuel
USEPA	United States Environmental Protection Agency
$\mu g/m^3$	micrograms per cubic meter
WTE	waste-to-energy

Definitions	
Building Code	New York City's Building Code
City	New York City
Commercial Waste Capacity Scenario	Scenario which identifies the available capacity on an hourly basis at each Converted MTS, and provides the basis on which potential air quality and noise impacts associated with the delivery of commercial waste in nighttime hours can be evaluated
Consultant	The DSNY's Consultant Team, including Henningson, Durham & Richardson Architecture and Engineering, P.C.; Parsons Brinckerhoff Quade and Douglas, Inc.; Ecodata, Inc.; Franklin Associates, Ltd.; Urbitran Associates, Inc.; HydroQual, Inc.; and Cambridge Environmental, Inc., who prepared the Commercial Waste Management Study
Converted MTS	One of DSNY's eight marine transfer stations, modified to containerize waste for out-of-City export by barge or rail
Draft Study Scope	Commercial Waste Management Study Draft Scope of Work issued February 2003
DSNY-managed Waste	Solid waste that DSNY collects from all residential households in the City and the institutional waste of City, state and federal agencies that DSNY collects and/or for which DSNY arranges disposal
DSNY-managed Waste Reserved Capacity Scenario	Scenario which determines the Converted MTS capacity that would be required for DSNY-managed Waste to provide for an adequate margin to meet its peak demand requirements under all conditions except declared waste disposal emergencies

Definitions	
Final Study Scope or Final Scope of Work	Commercial Waste Management Study Final Scope of Work issued on July 31, 2003
MTS Conversion Program	The City's initiative to develop, at the sites of the existing marine transfer stations (MTSs), new converted MTSs that will containerize solid waste for long-term export by barge with the potential for additional intermodal transfers to enable delivery of containerized waste to disposal facilities outside of the City
New SWMP	The new comprehensive Solid Waste Management Plan to be developed in 2004 for both DSNY-managed Waste and commercial waste for the planning period 2004 through 2024
New SWMP Planning Period	The 20-year period from 2004 to 2024 addressed by the City's New Solid Waste Management Plan
Preliminary Report	The New York City Comprehensive Commercial Waste Management Study Preliminary Report dated June 2002
Quarterly Reports	Quarterly Transfer Station Report system
Study	Commercial Waste Management Study
Study Area	One of the following four locations with high concentrations of commercial waste Transfer Stations: Jamaica, Queens CD #12; Brooklyn CD #1; Port Morris, Bronx CD #1; and Hunts Point, Bronx CDs #2 and #9
Transfer Station	Privately owned and operated transfer station in New York City that accepts, transfers and transports some portion of municipal solid waste or construction and demolition debris or fill material generated in the private sector for out-of-City disposal

Definitions	
Waste Hauling Vehicle	Collection vehicle/transfer trailer that is used to transport municipal solid waste, C&D debris or fill material to or from the Transfer Stations
Zoning Resolution	New York City's Zoning Resolution

1.0 BACKGROUND

Every day, private carting companies collect the commercial solid waste generated in New York City (City)[1] and transport most of it to local facilities known as "Transfer Stations" where, after any sorting and processing, it is transferred to larger vehicles for further transport and final disposition. The City currently has 69 Transfer Station permits or other authorizations for the 62 private facilities at which such waste is transferred.[2] In addition to disposal of putrescible, non-putrescible and fill material wastes, private carters, Transfer Station operators and recycling companies divert significant quantities of materials to recycling, including paper, cardboard, metal, glass, plastic and materials recovered from processing construction and demolition (C&D) debris and the processing of fill material. Because the City has no operating landfills, incinerators or resource recovery facilities, all waste[3] generated in the City is either transferred from privately owned and operated Transfer Stations within the City or carted directly out-of-City for transfer and/or disposal. Except for waste transported by rail from one Transfer Station in the Bronx and another in Brooklyn, practically all waste exported from the City is dependent upon truck transport. The private waste management industry is an essential part of the City's infrastructure that the City's residents and businesses depend on every day to maintain the public health and attractiveness of the City.

Under City Department of Sanitation (DSNY) regulations, private carters and privately owned Transfer Stations are permitted to receive and process specific types of waste material, either putrescible waste, non-putrescible waste or fill material. These three types of waste are described below.

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[1] The City Department of Sanitation (DSNY) is responsible for the collection and/or arranging for disposal of all waste generated by City households, as well as waste from City, state and federal agencies and not-for-profit institutions in the City (DSNY-managed Waste).

[2] A few Transfer Stations hold dual permits to process putrescible and non-putrescible waste in separate areas at the same site. A few Transfer Stations have permits at separate addresses that are contiguous and operate as an integrated facility. Two intermodal facilities transload sealed, containerized waste from truck to rail but involve no waste processing.

[3] Under Interim Export contracts in 2003, approximately 7,250 tons per day (tpd) of DSNY-managed Waste were transferred out-of-City through in-City private Transfer Stations. Approximately 6,209 tpd of the total 7,248 tpd of commercial putrescible waste disposed were also transferred at these facilities.

1. *"Putrescible waste" is solid waste containing organic matter having the tendency to decompose with the formation of malodorous by-products. Putrescible waste generated by the City's businesses is principally office and retail waste with small quantities of putrescible material, but also includes restaurant and other waste. Significant amounts of office waste are recycled directly at the source by carters that primarily collect recyclable office paper from commercial buildings and deliver it to recyclers, exporters or paper manufacturers. Consistent with DSNY rules, putrescible waste referred to in this report includes the portions of commercial putrescible waste that are both disposed and recycled (such as office paper).*

2. *"Non-putrescible" waste is waste that does not contain organic matter having the tendency to decompose with the formation of malodorous by-products, including but not limited to dirt, earth, plaster, concrete, rock, rubble, slag, ashes, waste timber, lumber, Plexiglas, fiberglass, ceramic tiles, asphalt, sheetrock, tar paper, tree stumps, wood, window frames, metal, steel, glass, plastic pipes and tubes, rubber hoses and tubes, electric wires and cables, paper and cardboard.*

3. *"Fill material" is a subset of non-putrescible waste and, as defined in DSNY rules, is clean material consisting of earth, ashes, dirt, concrete, rock, gravel, asphalt millings, stone or sand.*

It is important to keep in mind these definitions in reviewing the Executive Summaries for each of the individual volumes, which follow.

DSNY is developing the City's new comprehensive Solid Waste Management Plan (New SWMP) that will address the long-term management, for the planning period 2004 through 2024 (New SWMP Planning Period), of both DSNY-managed Waste and commercial waste. To assess the effectiveness of the existing framework of rules and regulations and current enforcement practices governing operation of Transfer Stations and the operations of private carters in the City, the City Council enacted Local Law 74 of 2000 (LL74), effective December 19, 2000. LL74 mandated a study of commercial waste management in the City by a Consultant engaged by DSNY. This Commercial Waste Management Study (Study) undertaken to comply with LL74 is intended to enable the City to assess and plan for management of the commercial waste stream in the most efficient and environmentally sound manner, and to assist in the development of the New SWMP. A copy of LL74 is provided as Attachment A.

To develop the Draft Scope of Work for the Study (Draft Study Scope), DSNY conducted a series of meetings in November and December of 2002 to solicit comments from elected officials, the public, the Citywide Recycling Advisory Board (CRAB), the Borough Solid Waste Advisory Boards (SWABs), community boards, environmental organizations, academics and other interested organizations. On March 3, 2003, the Draft Study Scope was posted on the DSNY website (www.nyc.gov/sanitation) for further public comment. Concurrently, the Draft Study Scope was mailed to all elected officials and Community Boards, the CRAB, the SWABs and to individuals who attended the public meetings held in 2002 and/or submitted comments in connection with the development of the Final Study Scope. Public comments received both during and after the established public comments period consisted of 19 letters (three from elected officials, two from solid waste industry representatives, one from a national environmental organization, four from the CRAB, six from neighborhood organizations or coalitions and three from special interest representatives). The letters were reviewed and a Final Study Scope was issued on July 31, 2003, and is provided as Attachment B. The Final Study Scope broadened the set of issues to be addressed in the Study by, for example, including studies of commercial waste generation, potential siting of new Transfer Stations in Manhattan and the availability of long-term volume waste disposal capacity to the City.

2.0 STUDY ORGANIZATION

The Study has been organized into six separate volumes, which provide a detailed discussion of the work undertaken and the findings, as well as any relevant recommendations. Additional technical backup data is included as attachments in the individual volumes or, in cases where it is voluminous, it is available in CD form on request. A brief description of the content of each volume is provided below.

2.1 Volume I: Private Transfer Station Evaluations:

This volume reports on the results of three separate evaluations.

- Four Study Areas with Transfer Stations in Geographical Proximity;
- Engineering and Operations Survey of Selected Transfer Stations; and
- Effectiveness of Enforcement

The first study examines Transfer Stations in geographical proximity located in the four Study Areas of Port Morris, Bronx Community District (CD) #1; Hunts Point, Bronx CDs #2 and #9; Jamaica, Queens CD #12; and Brooklyn CD #1 and provides the results of evaluations undertaken to assess the potential overlapping effects of such proximity on air quality, odor, noise, traffic, neighborhood character, public health and water quality. The second study reports the results of a survey of selected Transfer Stations within the Study Areas to identify operational measures and design modifications to improve the environmental performance of these facilities, and the third study evaluates the effectiveness of enforcement activities and permitting procedures and criteria of City and state agencies that oversee Transfer Station operations, under existing rules and regulations. Appendices A through K of Volume I provide the details for each of the analyses undertaken.

2.2 Volume II: Commercial Waste Generation and Projections

The Summary Report in Volume II synopsizes the results of five separate evaluations, included as Appendices A through E, which together constitute the basis for determining the quantities of putrescible, non-putrescible and fill material waste generated within the City that is managed by the private sector. Twenty-year projections of this commercial waste stream are presented through the New SWMP Planning Period, which will aid in determining the adequacy of planned facilities.

2.3 Volume III: Converted Marine Transfer Stations – Commercial Waste Processing and Analysis of Potential Impacts

Volume III reports on the capacity required by DSNY at each of the eight Converted Marine Transfer Stations (MTSs) to handle DSNY-managed Waste, and the remaining capacity potentially available to private carters for commercial putrescible waste deliveries at these facilities based upon the results of environmental analyses. These environmental analyses applied City Environmental Quality Review (CEQR) methodologies in evaluating whether that capacity could be utilized without causing potentially unmitigatible adverse impacts. However, the business arrangements, economics, possible regulatory policies, and a number of other significant variables that would be elements of a City policy to attract commercial waste to the Converted MTSs, were not addressed in this report.

As a foundation for the environmental analysis of potential commercial waste processing at these facilities, Appendix A of Volume III, MTS Environmental Evaluation, provides a comprehensive environmental evaluation, based on CEQR methodologies, of processing DSNY-managed Waste from the wasteshed that historically delivered to City MTSs at these locations.

2.4 Volume IV: Evaluation of Waste Disposal Capacity Potentially Available to New York City

Volume IV examines the waste disposal capacity potentially available within seven states (Georgia, New York, New Jersey, Ohio, Pennsylvania, South Carolina and Virginia) for accepting City waste, either via truck transfer or by barge or rail. Historic market price information was also gathered and reviewed.

2.5 Volume V: Manhattan Transfer Station Siting Report

Volume V investigates and evaluates potential sites for locating new truck-to-barge or truck-to-rail transfer stations in Manhattan, since no private putrescible waste Transfer Stations are located in this borough.

2.6 Volume VI: Waste Vehicle Technology Assessment

Volume VI reports on a survey of alternative fuels, new engine technologies and vehicle emission retrofit options that are appropriate for use on waste collection vehicles and profiles the innovative DSNY programs and initiatives implemented to evaluate alternative fuels, engine technologies and retrofit options. This volume provides an assessment of the advantages and disadvantages of the various options to reduce consumption of fossil fuels and/or reduce vehicle emissions, and recommends cleaner technologies, including technologies that DSNY had previously tested and, in some cases, targeted for implementation.

3.0 CONSOLIDATED EXECUTIVE SUMMARIES

3.1 Volume I: Private Transfer Station Evaluations

Privately owned and operated commercial waste Transfer Stations play a vital role in the City's solid waste management system. Putrescible Transfer Stations currently transfer approximately 6,200 tons per day (tpd)[4] of commercial waste and 7,250 tpd of DSNY-managed Waste disposed by City residents, agencies and not-for-profit institutions to disposal facilities outside the City. Non-putrescible and fill material Transfer Stations play a similarly important role in the recycling and disposal of C&D debris and excavation material, with approximately 8,630 tpd and 19,070 tpd handled at these facilities in 2003, respectively. While critical to the City's waste infrastructure, these facilities must operate and be maintained in an environmentally sound manner, and in accordance with City and state rules and regulations. This volume consists of three independent but inter-related studies on Transfer Stations located throughout the City that examine the effects of geographical proximity in four Study Areas, assess whether the enforcement of existing regulations and the permitting procedures and criteria are effective, and recommend practical means to improve the operation of these facilities which may impact upon the quality of life in the surrounding communities.

It is important to note in this Study that DSNY's MTS Conversion Program relies on shipping DSNY-managed Waste by barge and rail, and so is expected to reduce the numbers of trucks currently hauling DSNY-managed waste from private Transfer Stations for disposal. Moreover, DSNY has taken the initiative to issue three Requests for Proposals (RFPs) solicitations to private vendors that may result in the award of a contract that would have the effect of reducing transfer trailer truck traffic associated with the transport of commercial waste in the Study Areas. Specifically, DSNY long-term export RFPs seek vendor proposals to containerize DSNY-managed Waste at private transfer facilities and transport it out of the City by barge or rail. These RFPs seek alternatives to the rebuilding of the Greenpoint and Bronx MTSs, and a contract entered into by the City would specify that all waste (not just DSNY-managed Waste)

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[4] Tons per day are calculated on the basis of a six-day week, 312-day year.

accepted at Transfer Stations on which proposals are based be containerized and transported out of the City by barge or rail. This would have the potential effect of significantly reducing the volume of outbound traffic from Transfer Stations in portions of Brooklyn, Queens and the Bronx.

The approach taken and findings for each of these studies is summarized below.

3.1.1 Four Study Areas with Transfer Stations in Geographical Proximity

3.1.1.1 Scope of Analysis/Approach

The objective of the Study Area analysis was to evaluate whether areas with a number of Transfer Stations in geographical proximity have the potential of producing overlapping environmental effects on air quality, odor, noise, neighborhood character and water quality. In addition, the off-site effects of these facilities on traffic, air quality and noise from mobile sources (Waste Hauling Vehicles) were analyzed. The potential public health effects of the findings of these evaluations were also considered.

The Study Areas were selected based upon a review of the location and geographical proximity of the 69 operating private Transfer Station in the five boroughs. (See Footnote #2.) Four Study Areas encompassing 43 of the facilities were identified for analysis: Port Morris, Bronx CD #1; Hunts Point, Bronx CDs #2 and #9; Jamaica, Queens CD #12; and Brooklyn CD #1 (primarily East Williamsburg, but including three facilities with four permits in Queens). Table ES-1 shows the name, location and type of Transfer Station in each Study Area.

First, current conditions (including the presence of the Transfer Stations) in each of the Study Areas were evaluated. Second, the conditions without the Transfer Stations were evaluated to determine the net contribution of the Transfer Stations. Third, the conditions without the Transfer Stations, but with assumed other industrial uses occupying the same sites, were evaluated assuming the Transfer Stations were replaced by as-of-right general light industrial land uses (e.g., printing plants, laboratories) in the Study Area. This land use replacement scenario assumed that the Transfer Station land uses would be occupied by other M-zone land

Table ES-1
Permitted Commercial Waste Transfer Stations within Study Areas

Name	Address	Type Of Transfer Station
Port Morris, Bronx CD #1		
Bronx County Recycling	475 Exterior Street	Fill
Felix Equities	290 East 132nd Street	Fill
Tilcon NY	980 East 149th Street	Fill
USA Waste Services of NY (Waste Management)	98 Lincoln Avenue	Putrescible
USA Waste Services of NY (Waste Management) (1)	132nd Street & Saint Ann's Avenue	Putrescible (Intermodal)
Waste Services of NY	920 East 132nd Street	Putrescible
Total Number in Port Morris, Bronx CD #1 Study Area		**6**
Hunts Point, Bronx CDs #2 and #9		
A.J. Recycling	325 Faile Street	Non-Putrescible
Bronx City Recycling	1390 Viele Avenue	Fill
G. M. Transfer	216-222 Manida Avenue	Non-Putrescible
Kids Waterfront Corp.	1264 Viele Avenue	Non-Putrescible
IESI NY Corp	325 Casanova Street	Putrescible
John Danna and Sons	318 Bryant Avenue	Non-Putrescible
Metropolitan Transfer Station	287 Halleck Street	Putrescible
Paper Fibers Corp.	960 Bronx River Avenue	Putrescible
Waste Management of NY (1)	Oak Point & Barry Avenue	Putrescible (Intermodal)
Waste Management of NY	620 Truxton Street	Non-Putrescible
Waste Management of NY	315 Baretto Street	Non-Putrescible
Total Number in Hunts Point, Bronx CDs #2 and #9 Study Area		**11**

Table ES-1 (Continued)
Permitted Commercial Waste Transfer Stations within Study Areas

Name	Address	Type Of Transfer Station
Brooklyn CD #1		
Point Recycling Ltd	686 Morgan Avenue	Non-Putrescible
Waste Management of NY (2)	75 Thomas Avenue	Non-Putrescible
Waste Management of NY(2)	485 Scott Avenue	Putrescible
Waste Management of NY	215 Varick Avenue	Putrescible
Waste Management of NY	123 Varick Avenue	Non-Putrescible
Waste Management of NY	232 Gardner Avenue	Non-Putrescible
Maspeth Recycling (3)	58-08 48th Street	Fill
IESI NY Corp	548 Varick Avenue	Non-Putrescible
Astoria Carting Company (3)	538-545 Stewart Avenue	Non-Putrescible
City Recycling Corp	151 Anthony Street	Non-Putrescible
Cooper Tank and Welding	222 Maspeth Avenue	Non-Putrescible
Pebble Lane Associates (3)	57-00 47th Street	Fill
Keyspan Energy	287 Maspeth Avenue	Fill
New Style Recycling Corp (2)(3)	49-10 Grand Avenue	Putrescible
New Style Recycling Corp (2)(3)	49-10 Grand Avenue	Non-Putrescible
BFI Waste Systems of NJ (4)	598-636 Scholes Street	Putrescible
BFI Waste Systems of NJ (4)	594 Scholes Street	Non-Putrescible
BFI Waste Systems of NJ (4)	575 Scholes Street	Non-Putrescible
BFI Waste Systems of NJ	115 Thames Street	Putrescible
Hi-Tech Resource Recovery	130 Varick Avenue	Putrescible
Total Number in Brooklyn CD #1 Study Area		**20**

Table ES-1 (Continued)
Permitted Commercial Waste Transfer Stations within Study Areas

Name	Address	Type Of Transfer Station
Jamaica, Queens CD #12		
American Recycling Management [2]	172-33 Douglas Avenue	Putrescible
American Recycling Management [2]	172-33 Douglas Avenue	Non-Putrescible
Regal Recycling [2] [5]	172-06 Douglas Avenue	Putrescible
Regal Recycling [2] [5]	172-06 Douglas Avenue	Non-Putrescible
T. Novelli [2]	94-07 Merrick Avenue	Fill
T. Novelli [2]	94-20 Merrick Avenue	Non-Putrescible
Total Number in Jamaica, Queens CD #12 Study Area		**6**
Total Number of Transfer Stations Evaluated		**43**

Notes:
(1) These two facilities are permitted as intermodal terminals that ship containerized waste by rail. No waste processing is conducted at these sites.
(2) Denotes one facility with two permits.
(3) Four Transfer Stations on the Brooklyn CD #1 list are actually in Queens near the border of Brooklyn but were evaluated as part of the Brooklyn CD #1 Study Area.
(4) These three locations constitute one facility with three DSNY permits under state regulations.
(5) Regal Recycling is enclosing the non-putrescible waste processing operations; therefore, this facility was modeled as an enclosed non-putrescible Transfer Station.

uses typical of current conditions in the Study Area. The off-site effects of these replacement land uses were calculated using trip generation rates published by the Institute of Transportation Engineers (ITE).

Analyses were conducted for: (1) air quality, odor, noise, neighborhood character, public health and water quality from Transfer Stations located within each Study Area; and (2) traffic, off-site air quality and off-site noise at key intersections/locations along major corridors leading to and from the Study Areas. Although this evaluation is not an environmental review, it uses CEQR and other planning and engineering review criteria as the best available measure of the environmental effects of Transfer Stations on the surrounding community. Standard models for air quality (United States Environmental Protection Agency [USEPA]-approved Industrial Source Complex Short Term [ISCST3], CAL3QHCR, MOBILE5b and Part 5), noise (Federal Highway Administration's [FHWA's] Traffic Noise Model [TNM] 2.1) and traffic (Highway Capacity Software [HCS] version 4.1c) were used to predict combined effects of the Transfer Stations.

Criteria were identified for each environmental parameter, as described in the "Summary Report on Four Study Areas with Transfer Stations in Geographical Proximity." If the criteria were not exceeded, the Study Area analysis concludes that the overlapping effects of the Transfer Stations were not considered to be adverse. If these criteria were exceeded, means of reducing environmental effects through operational measures or design modifications were identified and then evaluated. If the current conditions for traffic and its attendant effects still exceeded the applicable criteria, further analysis was undertaken, as more fully described in the Summary Report.

3.1.1.2 Findings and Recommendations

Air quality, odor, noise, traffic, neighborhood character and water quality analyses were conducted to evaluate the potential effects from the geographic proximity of the Transfer Stations within the Study Areas. The analyses modeled areas where the potential effects of Transfer Stations in proximity to each other overlapped (combined effects) and evaluated whether these effects were potentially adverse. It considered combined effects at sensitive receptors in these areas of overlap in manufacturing zones -- for example non-conforming residences, not just contiguous residential zones -- but did not consider new siting actions. The overall results of the Study Area analyses show that the geographical proximity of the existing Transfer Stations in these Study Areas do not cause adverse combined or cumulative effects using reasonable criteria adapted from the CEQR and planning and engineering criteria. There are no findings in the Study Area analyses that indicate there are combined adverse effects to the environment from existing Transfer Stations that would warrant a reduction in the number and capacity of Transfer Stations in the Study Area.

The Study makes certain recommendations for, among other things, better odor control systems at putrescible Transfer Stations to improve the operations and to limit the effects of Transfer Stations. As described in the Volume I, Summary Report, the regulatory regime for siting of new Transfer Stations in the City consists of zoning, operating requirements, siting restrictions, environmental review, the state's detailed Part 360 regulations, the City's Noise and Air Codes, and Vehicle and Traffic Laws. Together the application of these current requirements would tend to mitigate the potential for adverse impacts from a future siting action.

1. ***On-site Air Quality***: The maximum predicted combined contribution of existing Transfer Stations in the Study Area combined with background levels from the closest air quality monitor showed results all below National Ambient Air Quality Standards (NAAQS) for criteria pollutants (carbon monoxide [CO], sulfur dioxide [SO_2], nitrogen dioxide [NO_2] and particulate matter less than 10 microns in diameter [PM_{10}]). For particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), the maximum predicted annual neighborhood average from combined on-site and off-site sources ranges from 1% to 6% of contribution to the latest monitored concentration from the nearest monitoring station within each Study Area.

2. ***On-site Odor:*** Sampling of odors was undertaken in the summer when odor generation from waste decomposition would be at its highest. A review of the controlled and uncontrolled odor emissions from the same facilities revealed that the controlled Transfer Station emissions were no more than 38% lower than the uncontrolled facilities, and in some cases the controlled emissions were deemed higher than the uncontrolled emissions, which is most likely due to the use of scented masking agents instead of more effective neutralizing agents to control odors. The highest frequency of conservatively predicted odor levels exceeding the criteria, assuming no odor controls, was for a receptor in the Brooklyn CD #1 Study Area, where the model predicted an exceedance just under 0.82% of the time (72 non-consecutive hours per year). If more effective (90% efficient) odor controls were implemented at all commercial putrescible waste facilities, the odor levels would be reduced substantially (by 90%), and there would be no overlapping contributions from multiple Transfer Stations in the Study Areas.

3. ***On-site Noise:*** Transfer Stations in the Port Morris, Bronx CD #1 Study Area do not have overlapping noise effects because they are not located in close proximity to each other. However, there were areas of potential overlapping effects from multiple Transfer Stations in Brooklyn CD #1; Jamaica, Queens CD #12; and Hunts Point, Bronx CDs #2 and #9 Study Areas, but the analyses did not predict effects at sensitive receptors located within these Study Area overlap areas. Waste Hauling Vehicles queuing on and off site make the greatest contributions to noise levels. The removal of off-site queuing of Waste Hauling Vehicles reduces noise levels attributable to overlapping effects.

4. ***Traffic:*** Fifty-eight (58) intersections were analyzed in the Study Areas for the traffic analysis. Results indicate that many of the intersections operate at an overall level of service (LOS) C or better under current conditions (six in Port Morris, Bronx CD #1 Study Area; seven in Hunts Point, Bronx CDs #2 and #9 Study Area; 16 in Jamaica, Queens CD #12 Study Area and 23 in Brooklyn CD #1 Study Area). The current conditions at six of the intersections in the Study Areas operate at an overall LOS D, E or F.[5] The percentage of Waste Hauling Vehicles analyzed ranged from 0% to 7% of the total number of vehicles traveling through the intersections during the hours analyzed. Subtracting the Waste Hauling Vehicles from the analysis did not significantly improve the LOS at any intersection analyzed. And when replacement industry trips (that is, traffic that would be generated by other light industrial uses for the Transfer Station sites if the Transfer Stations were absent) were substituted for Waste Hauling Vehicles in the analysis, the LOS remained the same or deteriorated.

5. ***Off-site Air Analysis:*** For the mobile air quality analyses, current conditions were analyzed at two "worst case" links each in the Port Morris, Bronx CD #1 and the Hunts Point, Bronx CDs #2 and #9 Study Areas and at four links each in Brooklyn CD #1 and Jamaica, Queens CD #12. In all instances, results are below NAAQS for all the criteria pollutants. For $PM_{2.5}$, the 24-hour maximum contribution from off-site emission sources ranged from 0.03 to 1 $\mu g/m^3$ (or 0.08% to 2.4% of the latest monitored concentration). The annual neighborhood maximum contribution from off-site emission sources ranges from 0.01 to 0.17 $\mu g/m^3$ (or 0.08% to 0.9% of the latest monitored concentration).

6. ***Off-site Noise:*** Two levels of screening were conducted on 23 locations where sensitive receptors exist near convergence points along truck routes to and from the Study Areas -- eight in Port Morris, Bronx CD #1; four in Hunts Point, Bronx CDs #2 and #9; six in Brooklyn CD #1; and five in Jamaica, Queens, CD #12. The first level of screening used total traffic volumes and axle factors from the New York State Department of

[5] Brooklyn CD #1 Study Area: (1) Meeker Avenue and Union Avenue, and (2) Flushing Avenue/Melrose Street and Varick Avenue/Irving Avenue; Port Morris, Bronx CD #1 Study Area: (1) Bruckner Boulevard and Alexander Street; Hunt's Point, Bronx CDs #2 and #9 Study Area: (1) Hunt's Point Avenue and Bruckner Boulevard, (2) Longwood Avenue and Bruckner Boulevard, and (3) Leggett Avenue and Bruckner Boulevard.

Transportation (NYSDOT) to conservatively estimate the existing traffic volumes, and whether the addition of Waste Hauling Vehicles would have the potential to double passenger car equivalent (PCE) noise levels, requiring a further evaluation of potential effects (first-level screening).[6] Based on this first-level screening, 17 locations (five in Port Morris, Bronx CD #1; four in Hunts Point, Bronx CDs #2 and #9; three in Brooklyn CD #1; and five in Jamaica, Queens, CD #12) were identified for further screening (second-level screening) using actual field traffic classification counts at these locations to determine the potential for doubling PCEs. Based on this second-level screening, five locations (two locations in Brooklyn CD #1 and three locations in Jamaica, Queens, CD #12) were identified for modeling using Federal Highway Administration's (FHWA's) Traffic Noise Model (TNM) version 2.1. Predicted results from TNM modeling at these five locations were compared to the Study noise threshold (an increase in 3dBA or greater attributable to the Waste Hauling Vehicles). The modeled mobile noise from the Waste Hauling Vehicles at the intersections analyzed did not exceed the threshold. Therefore, there are no predicted noise effects from these Waste Hauling Vehicles.

7. ***Water Quality:*** Twenty-nine of the 43 Transfer Stations within the Study Areas are not near or adjacent to surface water. The remaining 14 Transfer Stations that are adjacent to or near surface water do not have adverse individual or combined effects on water quality in the Study Areas.

8. ***Neighborhood Character:*** The neighborhood character analyses in all four Study Areas determined that overlapping effects of Transfer Stations, where such effects exist, do not contribute adversely to the typically industrial neighborhood character of the four Study Areas. Moreover, where the technical analyses compared existing conditions to the replacement scenario, in which reasonably anticipated development were assumed to occur in place of the Transfer Stations, it was found that the conditions studied would not necessarily be better than existing conditions. In certain cases, larger volumes of traffic

[6]See Volume I Summary Report for intersection locations.

predicted under the replacement scenario could potentially result in diminished neighborhood character quality, compared to existing conditions with the Transfer Stations. The assumption used in creating the replacement industry scenario is that all components of neighborhood character conditions (zoning, socioeconomics, etc.) remain fundamentally the same as existing conditions.

9. ***Public Health:*** Using the conservative assumption that commercial waste Transfer Stations do not control odors at all, receptors in two Study Areas were found likely to experience potentially unacceptable odors at times from overlapping effects. These effects were predicted to be infrequent, occurring less than 1% of the time for all receptors (i.e., less than 72 non-consecutive hours per year), and are not likely to generate sustained annoyance or symptoms. With regard to regulated pollutants, cumulative effects on air quality were predicted to be minimal (for $PM_{2.5}$, 1% to 6% of contribution to the latest monitored background values). The Transfer Stations, in aggregate, do not appear to be important determinants of air quality for any of the pollutants regulated by the USEPA on the basis of human health effects.

3.1.2 Engineering and Operations Survey of Selected Transfer Stations

3.1.2.1 Scope of Analysis/Approach

This report supplemented the work undertaken as part of the Study Area evaluations through on-site surveys of 24 of the 43 Transfer Stations located in the Study Areas, including putrescible, non-putrescible and fill material facilities. These surveys involved a review of existing information made available by DSNY from its permit records and environmental review documents, and site visits to observe facility operations and collect data on facility designs and operating performance. The data collection activities included odor (at existing transfer stations) and noise sampling (at nearby receptors) and analysis. These data were evaluated to determine if various design or operational measures could improve the environmental performance of existing Transfer Stations in terms of a reduction in pollutant and odor emissions and noise attenuation. Details are provided in Appendix J of Volume I.

3.1.2.2 Findings and Recommendations

The following recommendations, pertaining to the design and operation of Transfer Stations, are the result of this evaluation.

1. **Ventilation and Odor Control** – The ventilation systems of putrescible Transfer Stations should be upgraded with the addition of state-of-the-art odor control technology to "neutralize" odors in exhaust air, and ventilation capacity should be increased to prevent the escape of odors when facilities are operating with doors open, by maintaining sufficient negative air pressure. The combination of an odor neutralizing system treating exhaust air in conjunction with increased fan capacity, operated correctly, would have synergistic effects to substantially reduce potential odors.

   A number of the putrescible Transfer Stations inspected used rudimentary odor control systems that could be more effective. An example of a state-of-the-art odor control system option is a hard-piped system, suspended above the processing floor, which would introduce an odor-neutralizing agent into exhaust air, as it is ventilated from the building. Implementing this recommendation could include a provision for an equivalent system acceptable to the DSNY Commissioner that is sufficient to meet Zoning Code and Air Code standards.

   The fan capacity recommendation would surpass current Building Code standards. It would require increasing fan capacity from 6 air changes per hour (ach) to 8 to 12 ach and treating the exhaust air. Fans would automatically operate at 8 ach with doors closed and at 12 ach with doors open. The additional fan capacity addresses the practical reality that Transfer Station doors are generally open during operating hours when inbound and outbound traffic is heavy and consequently odors can be more readily released from the building.

2. **Odor Prevention** – DSNY's Permit and Inspection Unit (PIU) staff should continue focusing their enforcement efforts on operating conditions that contribute to odor formation during waste processing operations. Inspectors should take particular care to continue to identify and take enforcement action to correct the following conditions, when observed:

   - Floor-wear conditions that contribute to pooling of leachate on the floor. These conditions may be indicated by exposed rebar.
   - Excessive dust accumulation on facility walls that can become a source of odor formation.
   - Clogged trench drains in the floor drain system or grit and grease traps that are not routinely maintained.

In addition, inspectors should continue to monitor and focus on compliance with a daily ½-hour "clean time" during which the floor is cleared of waste to allow housekeeping functions, such as floor and wall wash-down, cleaning of drains, and maintaining ventilation and odor control systems.

3. **Dust Control** – Both DSNY and New York State Department of Environmental Conservation (NYSDEC) regulations require measures to control dust from waste processing operations. Of the three types of Transfer Stations, non-putrescible and fill material facilities generally operate outdoors, while all waste processing activity at putrescible Transfer Stations must occur in an enclosed building. Dust control should continue to be a focus of PIU's enforcement action, particularly when dust from operations is observed crossing property lines at non-putrescible and fill material Transfer Stations or exiting from the exhaust vents of putrescible Transfer Stations. Persistent enforcement will induce facility operators to use relatively simple and effective dust control measures.

   Different means of controlling dust are applicable to each type of facility:

   - Non-putrescible and fill material facilities – Installation of a sprinkler-type system that sprays water on the working pile will substantially reduce the transport of dust from processing operations more effectively than hand-held hoses currently used at many facilities.

- Putrescible – Installation of a water-misting system for dust suppression within the enclosed processing building is an effective method of minimizing dust in the exhaust air. The system commonly used in the solid waste industry involves pumping water through ¼” to ¾” steel pipe to high-pressure mist nozzles that atomize water, creating a fine mist that reduces dust generation. The atomization process does not cause water to pool on the processing floor. These systems, when operated properly, are effective at reducing as much as 90% of the dust generated at putrescible Transfer Stations.

4. **Stormwater Control** – This issue is specific to non-putrescible and fill material facilities that do not have concrete paved surfaces with appropriate drainage where material is processed. This absence of pavement with appropriately installed stormwater drainage creates two potential problems: (i) runoff into surface water or storm sewers; and (ii) tracking of mud and debris during wet weather onto neighboring streets.

   The first issue is being addressed by NYSDEC under the authority established by Article 27 of the Environmental Conservation Law (ECL) and more specifically by Article 17, Titles 7 and 8 of the ECL. Implementing regulations for Article 17, Titles 7 and 8 are provided under 6 New York Codes, Rules and Regulations (NYCRR) Part 750. These regulations are the basis of the State Pollution Discharge Elimination System (SPDES) program that requires permits for management of stormwater that discharges to surface water or separate storm sewers. Obtaining coverage under the statewide general permit for stormwater associated with industrial activities (GP-98-03) or an individual stormwater permit requires the preparation of a Stormwater Pollution Prevention Plan that would typically entail installation of a paved surface with controlled drainage directed through grit and grease traps or other pretreatment systems prior to discharge to surface waters or storm sewers. Discharge of stormwater containing “leachate” to the sanitary or combined sewer system requires permits from the City Department of Environmental Protection (NYCDEP). NYSDEC is in the process of requiring Transfer Stations in the City to obtain SPDES permits.

   The second issue (tracking of mud and debris during wet weather onto neighboring streets) can be effectively addressed by washing the tires of vehicles as they exit the Transfer Station. This can be accomplished through the installation of an automated tire washing system or using manually operated hoses.

5. **Noise Control** – Noise emissions are regulated under the City's Noise Code §24-243, the Zoning Resolution and Transfer Station Operating Rules. Noise effects may arise at the property boundary where equipment operates outdoors, as is the case with non-putrescible and fill material Transfer Stations (waste processing operations at putrescible Transfer Stations are in an enclosed building), or from Waste Hauling Vehicles queuing in the street in front of these facilities (which was found to be the principal source of noise at Transfer Stations.) However, the Noise Code and Zoning Code do not prohibit the levels of vehicular noise associated with queuing trucks at Transfer Stations. Also, space limitations at many existing facilities limit the options for mitigating this problem. DSNY's operating rules prohibit non-putrescible Transfer Stations from operating between 7:00 p.m. and 6:00 a.m., to limit noise from such facilities. NYSDEC, during its permit renewal process, is focusing on design measures and permit conditions to limit off-site queuing. These combined approaches can mitigate noise problems in areas where they are most likely to affect residential dwellings.

6. **Air Quality** – The primary sources of air pollution from Transfer Stations are the non-road engines, such as front end loaders, used in waste processing operations, not diesel Waste Hauling Vehicles. This issue is discussed more fully in the evaluation reports of the four Study Areas. It is important to note here that: (i) these engines will be subject to increasingly stringent emission standards promulgated by the USEPA that over time will significantly reduce emissions as older equipment is replaced; and (ii) federal law appears to preempt the City from establishing more stringent standards for these non-road engines. The New York Air Code (NYAC) §24-143, contains a prohibition on *"visible air contaminants from an internal combustion engine of (a) a motor vehicle while the vehicle is stationary for longer than 10 consecutive seconds; or (b) a motor vehicle after the vehicle has moved more than 90 yards from a place where the vehicle was stationary."* This regulation provides a basis for enforcement actions by DSNY's PIU inspectors where old or poorly maintained mobile equipment, such as front end loaders or bulldozers, is emitting visible smoke. Air Code §24-109 and §24-142 provide authority to regulate stationary equipment such as crushers. DSNY should institute a training program for its inspectors in the application of USEPA's (40 CFR 60,

Appendix A) Method 9 procedures for opacity testing. (The threshold for human recognition of visible emissions is generally considered to be around 5% opacity.) Certified inspectors issuing citations for opacity violations would induce Transfer Station operators to better maintain or upgrade their equipment.

3.1.3 Effectiveness of Enforcement

3.1.3.1 Scope of Analysis/Approach

Both the City and New York State regulate the privately owned Transfer Stations. DSNY is the primary local agency responsible for permitting, regulating and inspecting Transfer Stations and NYCDEP's Environmental Control Board (ECB) adjudicates notices of violation that DSNY officers write. DSNY derives its powers to control waste Transfer Station operation from the City Charter, Title 16, of the New York City Administrative Code (NYCAC) and Title 16 of the Rules of the City of New York (RCNY). The New York State Department of Environmental Conservation (NYSDEC)'s regulatory authority derives from the Environmental Conservation Law (ECL) and Title 6 of NYCRR, Part 360. The Business Integrity Commission (BIC) does background investigations into character and fitness to operate a Transfer Station and also licenses the vehicles operated by private carters in the City.

As the primary inspector of the City's Transfer Stations, DSNY's PIU conducts most of the on-site inspections. The unit is comprised of twenty-two (22) officers -- 17 Environmental Police Officers and five Environmental Lieutenants. The PIU force conducts a full inspection of each putrescible and non-putrescible Transfer Station at least once per week, and conducts additional, frequent, limited drive-by inspections of such facilities.

During the course of this Study, current management policies governing the City's Transfer Stations were reviewed and evaluated based on infraction statistics gathered from the inspection records at DSNY and NYSDEC to determine the effectiveness of enforcement procedures on the City's Transfer Stations. In addition, other City and state agencies involved with various aspects of enforcement were contacted and the rules and regulations defining their authority reviewed. Details of these analyses can be found in Volume I, Appendix K, Effectiveness of Enforcement. In addition, a review of historical violation records from 1991 to 2002 was completed as well as an in-depth study of inspection reports for Fiscal Year 2003. The pattern of violation issuance and the type of infraction that led to such summonses were evaluated to gain a better understanding of current enforcement measures and to address potential improvements to the system.

Various fine structures exist depending on the type, severity and frequency of a violation. Certain Transfer Station-type violations, such as operating a Transfer Station without a valid permit or being in violation of operational rules, are termed "major ECB violations" for the purpose of this Study and warrant a fine ranging from $2,500 for a first offense, $5,000 for a second offense and up to $10,000 for third and subsequent offenses. Violations that this Study terms "minor ECB violations" relate to sidewalk and street infractions and have lower liability amounts that warrant fines between $100 and $300, while the Study category of "minor action violations," such as illegal dumping or the presence of noxious liquids, has a maximum fine of up to $450. (The "minor" classification used here is not meant to suggest that such violations are less important, merely that the monetary penalties are less than those for "major" Transfer Station violations.)

City enforcement of regulatory standards on Transfer Station operation is guided by the applicable performance standard for the facility under the Zoning Resolution, as supplemented by the Air and Noise Code and DSNY's regulations. The City has established three kinds of industrial districts, each with specific performance standards: Light Manufacturing (M1 - High Performance), Medium Manufacturing (M2 - Medium Performance) and Heavy Manufacturing (M3 - Low Performance). Transfer Stations are considered a Use Group 18 use. Use Group 18 uses are appropriate in M3 districts subject to low performance standards, and are allowed in M1 and M2 districts provided they meet the more stringent performance standards applicable to those zones with respect to odor, noise, vibration, dust and smoke. Additional noise and vibration restrictions apply to a manufacturing district located adjacent to a residential district. M1 districts often serve to buffer residential and commercial districts from heavier industrial M2 or M3 zones. M2 districts occupy the middle ground between light and heavy industrial areas. Performance standards in this district are less stringent than in M1 areas, as more noise, vibration and smoke are permitted. M3 districts are designated for heavy industries (such as foundries, cement plants, salvage yards, chemical manufacturing, asphalt plants) that generate more objectionable influences and hazards, including noise, dust, smoke and odors, as well as heavy traffic. New residences and community facilities may not locate in M3 districts. These districts are usually situated near the waterfront and are buffered -- for example by M1 districts -- from residential areas. With their low performance standards, M3 zones are particularly well-suited for the siting of Transfer Stations

A field observation was conducted to sample the level of compliance with truck route restrictions around Transfer Stations. Trucks must travel on designated routes, except where they deviate to reach their final destination. Truck route violations are important to monitor as they directly affect the quality of life on residential streets in the surrounding community. (The City Department of Transportation [NYCDOT] is currently conducting a Citywide study of truck traffic.) The survey counted Waste Hauling Vehicles using non-truck routes at key intersections in the vicinity of Transfer Stations and compared their number to the number of other trucks and automobile traffic. Intersections with a high potential to be used illegally by Waste Hauling Vehicles -- either key local non-truck route intersections or crossings of local arteries and truck routes -- were selected as observation sites.

3.1.3.2 Findings

1. Only approximately 0.3% to 6% of total traffic at a non-truck route intersection can be attributed to Waste Hauling Vehicles.

2. There has been a 100% increase in DSNY inspection frequency over the last four years following a doubling in inspection staff and an increase in the closure of negligent facilities. In general, the number of Transfer Stations has declined. In 1990, 153 Transfer Stations were in operation, compared to 96 in 1996 and only 69 in 2004.

3. According to DSNY historical summons data, over the past 12 years (1991 to 2002), roughly 15% of putrescible Transfer Stations, 12% of non-putrescible Transfer Stations and 8% of fill material Transfer Stations accrued more than 20 violations each in the 12-year span.

4. The majority of the City's Transfer Stations are sited in M3 zones (68%), thus reducing their potential effect on the residential community.

5. In 1998, DSNY promulgated new Transfer Station Siting Rules (implemented as a new subsection of the existing rules governing Transfer Stations found in 4 RCNY 16) that included restrictions on the locations in which new Transfer Stations could be sited and limitations on their hours of operation. They included the following general provisions:

   - No siting of new putrescible and non-putrescible Transfer Stations in M1 zones;
   - No siting within 400 feet of residential districts and sensitive receptors such as public parks and schools;
   - No siting of a new non-putrescible Transfer Station within 400 feet of an existing non-putrescible Transfer Station; and
   - No operating of non-putrescible Transfer Stations in an M1 zone between 7:00 p.m. and 6:00 a.m.

   Additionally, the rules required Transfer Stations to submit engineering reports and transportation plans with all permit applications. These requirements mean that new facilities would be less likely to be in a location that impacts local residents. The rules apply to applications filed after October 1998, and so did not apply to certain pending applications. Additionally, DSNY promulgated temporary siting restrictions in 2003 that expire later this year and will promulgate new permanent Siting Rules this year.

6. On average, seven "major" DSNY violations were issued at Transfer Stations each month between July of 2002 and June of 2003, and roughly 30 major violations were issued to each type of Transfer Station. Despite the fact that fill material inspections occur much less frequently, fill material violations accounted for roughly 29% of the violations issued by DSNY to Transfer Station operators between July 2002 and June 2003. Putrescible Transfer Stations had the most violations, accounting for 45% of those issued; non-putrescible Transfer Stations accounted for only 26%.

7. According to DSNY violation statistics, on average, 50 "minor" Environmental Control Board (ECB) violations, 351 parking violations and 51 traffic violations were issued per month between July 2002 and June 2003. With an annual count of 5,505 summonses, DSNY issues approximately 460 violation summonses of varying severity each month.

8. According to DSNY statistics for Fiscal Year 2003, pile height/volume over the limit was the most common violation at non-putrescible Transfer Stations; and operating without a permit was the second most common violation. The most common violation reported at putrescible Transfer Stations was an unclean tipping floor.

9. Ten violations were issued by DSNY in Fiscal Year 2003 to persons unlawfully operating a fill material Transfer Station without a permit. This violation results in closing an illegal operation.

10. Spillage from trucks and/or receptacles is a relatively frequent violation. Illegal dumping by both the owner and operator are also relatively common violations issued by DSNY. Causing a street obstruction and the presence of noxious liquids were also reported frequently.

11. The majority of parking violations issued by DSNY are in response to trucks standing or parking without proper equipment, or having a detached trailer. Parking for over three hours in a commercial zone or parking in the wrong direction are also relatively common violations. The transportation of loose cargo without a cover is the most commonly violated traffic rule, with 300 summonses issued by DSNY within Fiscal Year 2003.

3.1.3.3 Conclusions and Recommendations

In summary, Transfer Station enforcement quality has shown major improvements over the last decade due to the increased frequency of inspections. However, further improvements can be made to improve the level of coordination within and between the City agencies responsible for enforcement, by creating a fully computerized system of inspection forms at the agency level. The improvements in productivity over manual collection and input of inspection data, as well as the overall benefit of a multi-agency coordinated enforcement structure, greatly justifies the investment of resources to create this system. An accessible digital database that will heighten inter-agency cooperation and improve information management is the critical path to improving enforcement practices.

3.2 Volume II: Commercial Waste Generation and Projections

Volume II: Commercial Waste Generation and Projections, reports the results of five different evaluations. The reports and appendices providing the analyses and data in support of this Executive Summary are:

Summary Report on Commercial Waste Generation and Projections

Appendices:

A: Facilities Estimate of Putrescible Waste Generation Year 2002
B: Employment-Based Estimate of Putrescible Waste Generation Year 2002
C: Commercial Putrescible Waste Disposed and Recycled: BIC-DSNY Carter Survey
D: Commercial Putrescible Waste 20-Year Forecast
E: Non-Putrescible Commercial Waste Quantification and Projections

This volume examines the quantities of waste generated within the City that is collected and managed by private carters, i.e., the commercial waste stream. DSNY regulates[7] putrescible, non-putrescible and fill material Transfer Stations that are permitted to receive and process these categories of waste materials. The NYSDEC also regulates[8] the design, construction and operation of Transfer Stations.

3.2.1 Scope of Analysis/Approach

The Study employed three different methodologies to develop independent estimates of commercial putrescible waste quantities for the years 2002 and 2003, as described in Appendix A (Facilities Estimate of Putrescible Waste Generation Year 2002), Appendix B (Employment-Based Estimate of Putrescible Waste Generation Year 2002), and Appendix C

[7] DSNY's regulatory authorities derive from Titles 16, 17 and 25 of the NYCAC, Title 16 of RCNY and the CEQR Procedures.
[8] NYSDEC's regulatory authority derives from Title 6 of NYCRR Part 360 and Title 6 NYCRR Part 617 under the state's Environmental Conservation Law (ECL).

(Commercial Putrescible Waste Disposed and Recycled: BIC-DSNY Carter Survey) of Volume II. The independent estimates were compared for reasonableness to the data obtained through DSNY's Quarterly Transfer Station Report system (Quarterly Reports). Quarterly Reports are required to be completed by DSNY-regulated Transfer Station operators/owners. The Quarterly Reports do not account for all of the commercial waste generated in the City. Waste not reflected in the Quarterly Reports includes waste that is disposed out-of-City or recycled commercial waste that does not pass through the City's network of private Transfer Stations. The waste quantity estimates developed from the other estimation methodologies corroborated the Quarterly Report data for quantities processed at City Transfer Stations.

All these data sources were used to establish a new, year 2003 baseline estimate inclusive of the total commercial putrescible waste generated, i.e., disposed in and out of the City, and recycled. The new baseline year 2003 estimate accounts for the job loss effects of 9/11 and the subsequent economic recession, and therefore provides a sound starting point for projecting waste generation for the New SWMP Planning Period.

These data sources were also compared to the year 2000 waste quantity estimates in the Preliminary Report (which did not include recycled material) and used as a basis for adjusting Preliminary Report estimates of putrescible waste disposed to eliminate inconsistencies in waste-type definitions and carter classifications, and to establish a revised year 2000 estimate of 8,381 tpd disposed. Comparing the year 2000 estimate of putrescible waste disposed with the 2003 total net disposed (based on three quarters of DSNY Quarterly Reports and direct export totals estimated from the BIC-DSNY carter survey), shows a decline of 1,131 tpd, or 13.5%, in putrescible waste disposed over that period of time.

The ***Facilities Estimate*** (Appendix A) relies upon DSNY's Quarterly Reports for data on waste quantities delivered to Transfer Stations in the City in 2002. Through an extensive survey effort, new data were collected on waste carted out-of-City for disposal and also on recycled waste from commercial sources in the City that was processed in or out of the City or directly exported to foreign sources. Approximately 31% of the City's commercial putrescible waste was recycled in 2002.

The ***Employment-Based Estimate*** (Appendix B) used post-9/11 estimates of City employment that reflected the effects of the economic recession on employment, and relied on waste generation factors for commercial business sectors developed through a literature search. These data were used to estimate citywide waste generation for the year 2002 as a function of employment in the City.

The ***BIC-DSNY Carter Survey*** (Appendix C) assembled information from a survey of the City's licensed carting industry conducted in the fall of 2003. The surveys collected from all carters collecting in the City and followed up in person or via phone interviews, developed data that resulted in an estimate of commercial putrescible waste disposed and recycled in 2003 that included the quantities processed at in-City and out-of-City locations and quantities collected for recycling. Approximately, 27% of the City's commercial putrescible waste was recycled in 2003, a decline of 4% from the prior year. This decline is consistent with nationally reported data on paper markets.

The 2003 baseline waste estimate was allocated among the five boroughs using collection route data obtained from the BIC-DSNY carter survey. Based on this borough allocation, and using projected employment over this period, the quantity of commercial waste generated (both disposed and recycled) was forecast for the New SWMP Planning Period, for each borough. The relative proportions of waste generated by each borough change as a function of changes in projected employment over time. The forecast assumes that the percentage of materials recycled by each borough, would remain constant at 2003 levels for the New SWMP Planning Period. These projections are discussed in Appendix D: ***Commercial Putrescible Waste 20-Year Forecast***.

Quantities of non-putrescible waste, which include C&D debris and fill material, were estimated based upon waste generation rates derived from a literature search for three types of residential and commercial construction projects: new construction, demolition and renovation. A regression analysis of data obtained from F.W. Dodge on actual and projected construction activity in the City in each of these respective areas over the period of 2000 to 2007 was used to develop projections of the generation of C&D waste over the New SWMP Planning Period. Non-building-related C&D, which would include clean fill, was estimated by obtaining waste generation factors expressed as tons per $1,000 of activity. These factors were applied to the value of this construction in the City obtained from F.W. Dodge. Details of these estimates are discussed in Appendix E: ***Non-Putrescible Commercial Waste Quantification and Projections***.

The estimates of commercial putrescible and non-putrescible waste are relevant in determining the Transfer Station capacity required to serve the City's businesses over the next 20 years.

3.2.2 Findings

- In 2003, approximately 3,085,370 tons, or 9,889 tpd, of putrescible waste and 8,640,840 tons, or 27,695 tpd, of non-putrescible waste and clean fill material were generated by the commercial sector in the City. Quantities of waste generated include that which is disposed and recycled.

- In 2003, approximately 6,209 tpd of commercial putrescible waste[9] were processed for disposal at in-City Transfer Stations and 1,039 tpd were processed at out-of-City facilities. (Although some material is recycled at putrescible Transfer Stations, the vast majority is material destined for disposal.) An estimated 2,641 tpd were recycled directly. The quantities processed out-of-City represent a 21% increase over 2002.

- Of the total commercial putrescible waste generated, 42% is generated in Manhattan[10], 19% in Brooklyn, 13% in the Bronx, 20% in Queens and 5% in Staten Island.[11]

- Overall, approximately 27% of the commercial putrescible waste was recycled in 2003.

- Quantities of commercial putrescible waste generated are anticipated to increase to approximately 3,414,000 tons, or 10,940 tpd by 2024, which represents an annual average rate of increase of 0.5%.

- Quantities of non-putrescible commercial waste and clean fill are more difficult to predict in the future due to the variability in generation from year to year, but are anticipated to range from approximately 8.0 to 10.9 million tons, (25,640 to 34,810 tpd), by the end of the New SWMP Planning Period.

- The City's commercial putrescible waste (disposed and recycled) is collected by approximately 124 licensed carters.

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[9] These quantities do not include DSNY-managed Waste processed at in-City Transfer Stations.
[10] Sixty-one percent (61%) of the City's jobs are located in Manhattan.
[11] Numbers may not add due to rounding.

3.3 Volume III: Converted Marine Transfer Stations – Commercial Waste Processing and Analysis of Potential Impacts

3.3.1 Scope of Analysis/Approach

LL74 requires the Study to consider whether the City's MTS system could accommodate commercial waste as well. When LL74 was adopted, the concept of developing an MTS Conversion Program for containerizing waste for long-term export was not established as a policy objective of the City. Given this policy objective, addressing the issue of processing commercial waste at the Converted MTSs first required, as a foundation, an environmental review of the potential impacts associated with processing DSNY-managed Waste at the new facilities. That environmental review, using CEQR methodologies, is reported in Volume III, Appendix A, MTS Environmental Evaluation, to this report. It concludes that the DSNY-managed Waste generated in the wastesheds that historically delivered to the MTS system can be containerized for export without causing potentially unmitigatible significant adverse environmental impacts. The next step was to analyze what impacts would result from the potential delivery of commercial putrescible waste to the Converted MTSs.

It is important to emphasize that this assessment focuses solely on environmental considerations. It should not be interpreted as a general conclusion that export of commercial waste through the Converted MTSs is feasible. Some of the additional factors that bear on the issue of feasibility that are not addressed in this report are:

- The economics of export through the MTSs, which will be determined in part by proposals from private vendors for transport and disposal of containerized waste from the Converted MTSs. The City has just received and begun evaluating these proposals. Thus the economics of commercial waste export through the Converted MTSs is not yet known.
- The types of business arrangements that the City would enter into with carters for exporting commercial waste through the MTSs are not yet defined.
- Whether further development of the designs for the Converted MTSs will substantiate the operational assumptions or necessitate that the assumed operational capacity be reduced.

- The comparative cost of exporting through the existing private Transfer Stations could be more attractive.
- The potential permit limitations that NYSDEC may place on the operation of the Converted MTSs.
- The location of some MTSs in relation to the sources of commercial waste generation may not provide the same efficiencies and consequently be as attractive to private carters as delivering to private Transfer Stations.

The evaluation of processing commercial putrescible waste at the Converted MTSs is an incremental analysis, complying with the CEQR procedures, that builds on the foundation of the Volume III, Appendix A, MTS Environmental Evaluation report. The analysis of the potential on-site-related impacts associated with processing DSNY-managed Waste is based on the design capacities of the Converted MTSs and concluded that there were no unmitigatible significant adverse impacts. Since commercial putrescible waste deliveries would not exceed these facility design capacities, the potential processing of some quantities of the City's commercial putrescible waste would not cause any incremental significantly adverse impacts attributable to on-site operations.

The analysis of off-site impacts associated with processing putrescible commercial waste required an incremental environmental review of the potential for on-site air quality and off-site (mobile) air quality and noise impacts attributable to delivery of such commercial waste.

The starting point in evaluating the potential capacity available for commercial putrescible waste was defining a scenario for DSNY's capacity requirements that reserved the block of time from 8:00 a.m. to 8:00 p.m. for processing DSNY-managed Waste and assumed that deliveries of DSNY-managed Waste during the 8:00 p.m. to 8:00 a.m. period would have priority over deliveries of commercial waste. Table ES-2 summarizes:

- The design capacity in tpd that each Converted MTS is capable of processing under a normal operations scenario;
- The capacity reserved for DSNY-managed Waste; and
- The potential available excess capacity at each of the Converted MTSs.

The column showing DSNY-managed Waste reserved capacity reflects the historical average peak day generation in the respective MTS wastesheds. Under conditions of high peak generation, the MTSs can be operated to process DSNY-managed Waste in excess of the tpd quantities shown in the table.

Table ES-2
DSNY-managed Waste Reserved Capacity Scenario

Converted MTS Facility	Converted MTS Design Capacity(1) (tpd)	DSNY-managed Waste Reserved Capacity (tpd)	Excess Capacity, 8:00 a.m. to 8:00 p.m. (tons)	Excess Capacity, 8:00 p.m. to 8:00 a.m. (tons)
West 135th Street	4,290	1,180	1,211	1,853
East 91st Street	4,290	880	1,227	2,183
West 59th Street(2)	2,145	880	279	956
South Bronx	4,290	2,190	333	1,732
North Shore	4,290	2,370	622	1,000
Greenpoint	4,290	2,360	575	1,145
Hamilton Avenue	4,290	2,170	630	1,337
Southwest Brooklyn	4,290	1,090	1,418	1,725
Totals	32,175	13,120	6,295	11,931

Notes:
(1) Based on operating MTSs under normal operating conditions. Spare operating lines are not used to process waste.
(2) West 59th Street is a lift and load operation, not an open top-loading slot system.
tpd = tons per day

Given the DSNY-managed Waste Reserved Capacity Scenario, a Commercial Waste Capacity Scenario was defined to determine the potential available capacity that could be used by private carters delivering waste from commercial sources. This scenario identified the potential available capacity on an hourly basis at each Converted MTS, and provided the basis for evaluating the potential on-site air quality, off-site air quality and off-site noise impacts associated with the delivery of commercial waste in nighttime hours. The maximum capacity potentially available for processing commercial waste was evaluated with a spreadsheet model that incorporates both Converted MTS design and operating parameters developed by the DSNY's Consultant design team and arrival profiles for DSNY-managed Waste. It is assumed that, between the hours of 8:00 p.m. and 8:00 a.m., both DSNY-managed Waste and commercial waste could be received and processed at the Converted MTSs. Table ES-3 summarizes the results of this evaluation. As shown in the "Potential Available Capacity, 8:00 p.m. to 8:00 a.m." column, the total capacity potentially available for processing commercial waste during this period totals 11,931 tons, allocated among the eight MTSs. This does not take into account any environmental constraints that may limit the potential delivery of commercial waste.

Table ES-3
Available Potential Excess Capacity at Converted MTSs
Based on the Capacity Reserved for DSNY-managed Waste

Converted MTS Facility	Average Day Design Capacity (1) (tpd)	Potential Available Capacity, Average Peak Day (tpd)	Average Peak Day: Potential Available Capacity, 8:00 a.m. to 8:00 p.m. (tons)	Average Peak Day: Potential Available Capacity, 8:00 p.m. to 8:00 a.m. (tons)	Average Peak Day: Potential Additional Number of Commercial Vehicles, 8:00 p.m. to 8:00 a.m.(2) (per day)	Maximum Number of DSNY Collection Vehicles, 8:00 a.m. to 8:00 p.m. (peak hour)	Potential Range of Maximum Number of Collection Vehicles(3) 8:00 p.m. to 8:00 a.m. (peak hour)
West 135th Street	4,290	3,110	1,211	1,853	175	30	20-22
East 91st Street	4,290	3,410	1,227	2,183	199	28	19-21
West 59th Street (4)	2,145	1,265	279	956	91	21	10-12
South Bronx	4,290	2,100	333	1,732	163	64	21-23
North Shore	4,290	1,920	622	1,000	95	39	24-26
Greenpoint	4,290	1,930	575	1,145	109	61	22-24
Hamilton Avenue	4,290	2,120	630	1,337	129	32	23-25
Southwest Brooklyn	4,290	3,200	1,418	1,725	162	27	21-23
Totals	**32,175**	**19,055**	**6,295**	**11,931**	**1,123**		

Notes:

(1) Based on operating the MTSs under normal operating conditions. Spare operating line is not used to process waste.
(2) Assuming commercial collection vehicles deliver an average of 11 tons per truck. (Field data indicates commercial collection vehicles average between 11 and 13 tons per truck.)
(3) DSNY collection vehicles and commercial Waste Hauling Vehicles.
(4) West 59th Street is a lift and load operation - not an open top-loading slot system.

3.3.2 Findings

3.3.2.1 Processing of Commercial Waste at the Converted MTSs

1. The CEQR analyses in the MTS Environmental Evaluation show there are no potentially significant unmitigatible adverse environmental impacts associated with on-site processing of DSNY-managed Waste. This would also apply to processing of

commercial waste at each converted MTS in the quantities shown in Table ES-3. However, further evaluation of potential on-site air quality, off-site noise and off-site air quality impacts from nighttime deliveries of commercial waste was required.

2. The on-site air quality analysis of processing DSNY-managed Waste at some of the Converted MTS sites showed that using the facility average design capacity (including the processing of commercial waste) to estimate pollutants did not cause an exceedance of annual average standards.

3. The off-site air quality analysis of processing DSNY-managed Waste at some of the Converted MTS sites showed that using the conservative assumption that peak hour conditions occur 24 hours per day (a Tier I analysis) resulted in unmitigatible environmental impacts for PM_{10} and $PM_{2.5}$. (See Section 10 of the individual chapters in the MTS Environmental Evaluation for these analyses.) Therefore, a Tier II air quality analysis was also performed for deliveries of commercial waste at intersections near each of the Converted MTS sites. The analysis used data on actual hourly traffic volumes on routes to and from the site and included the higher number of commercial collection vehicles assumed to deliver to each Converted MTS during the 8:00 p.m. to 8:00 a.m. period. No significant adverse unmitigatible environmental off-site air quality impacts were identified.

4. Evaluating the potential for off-site noise impacts required the use of a second-level noise screening analysis. (See Section 3.14.5.2 of Volume III, Appendix A for a detailed explanation.) The results of this analysis indicate that the number of potential commercial Waste Hauling Vehicles that could be routed to the MTSs during various hours within the 8:00 p.m. to 8:00 a.m. period must be limited to less than the available excess capacity to avoid causing potential impacts at sensitive receptors on the analyzed routes these vehicles might take to the MTSs. The amount of available capacity that can potentially be used to process commercial waste during the hours of 8:00 a.m. to 8:00 p.m. without causing any significant adverse noise impacts is summarized in Table ES-4.

Table ES-4
Converted MTS
Potential Commercial Waste Capacities Summary Table

Location	Converted MTS Design Capacity		DSNY-managed Waste Delivered 8 p.m. to 8 a.m. (tons)	Potential Converted MTS Capacity with Off-Site Noise Constraints	
	Total Potential Commercial Vehicles (per day)	Potential Commercial Waste Tonnage 8 p.m. to 8 a.m. (tons)		Total Potential Commercial Vehicles (per day)	Potential Commercial Waste Tonnage 8 p.m. to 8 a.m. (tons)
West 135th Street	175	1,853	301	95	1,029
East 91st Street(1)	199	2,183	17	71	781
West 59th Street(2)	91	956	114	91	956
South Bronx(1)	163	1,732	433	150	1,611
North Shore(3)	95	1,000	901	95	1,000
Greenpoint(1)	109	1,145	793	109	1,145
Hamilton Avenue(1)	129	1,337	710	124	1,306
Southwest Brooklyn(4)	162	1,725	418	76	828
Total	**1,123**	**11,931**	**3,687**	**811**	**8,656**

Notes:

(1) Need to use different routes for potential commercial Waste Hauling Vehicles to deliver the full amount of excess capacity for commercial waste.

(2) Can take all potential commercial Waste Hauling Vehicles without any noise constraints.

(3) There is a route to the North Shore Converted MTS that does not pass sensitive receptors that must be used from 12:00 a.m. to 6:00 a.m. to deliver the full amount available for commercial capacity. The route should not be used at other times upon request from NYCDOT due to congestion that occurs at certain intersections along the route during daytime traffic hours.

(4) Outbound trucks passing 26th Street between Cropsey Avenue and Shore Road limit the number of inbound commercial Waste Hauling Vehicles that can be accommodated at the Southwest Brooklyn Converted MTS.

Since these results are based on a second-level screening for noise impacts, a detailed off-site noise analysis, utilizing FHWA TNM Version 2.1, is being performed to determine if noise impacts would actually occur at these sensitive receptor locations and/or if additional potential commercial Waste Hauling Vehicles could be routed to the MTS during the 8:00 p.m. to 8:00 a.m. hour, without causing unmitigatible significant adverse off-site noise impacts, to fully utilize the potentially available capacity of the MTSs. The results of the off-site detailed noise analyses will be available at a later date.

5. This evaluation of potential processing commercial waste at the Converted MTSs was limited to an environmental review that focused on traffic, on-site and off-site air quality and noise, and on-site odor impacts.

3.3.2.2 Processing of DSNY-Managed Waste at the Converted MTSs

This section summarizes key findings from Volume III, Appendix A, the MTS Environmental Evaluation, an environmental review of operations for the Converted MTSs in processing DSNY-managed Waste.

1. Table ES-5 summarizes the facility design capacity assumptions and the assumed tons of DSNY-managed Waste processed during average peak days that were the basis of the MTS Environmental Evaluation. The assumed tons of DSNY-managed Waste in this table vary from the tons shown in the DSNY-managed Waste Reserved Capacity Scenario Table ES-2. This reflects a contingency added to DSNY average peak day deliveries to provide a margin of conservatism in the analysis.

2. Based on the design capacity and operating assumption, described in more detail in Volume III, the MTS Environmental Evaluation found there were no unmitigatible significant adverse environmental impacts associated with processing the average peak day deliveries of DSNY-managed Waste. The environmental evaluation demonstrates the Converted MTSs will enable export of DSNY-managed Waste in an efficient and environmentally sound manner. This summary conclusion is supported by the environmental evaluation that addressed: Land Use, Zoning and Public Policy;

Table ES-5
MTS Environmental Analysis Information

Converted MTS Facility	Total Number of Loading Slots	DSNY-managed Waste Average Peak Day Deliveries, (tons)(1)	Number of DSNY-Managed Vehicles, Average Peak Day	Average Day Design Capacity(2) (tpd)	Peak-Hour Number of DSNY Collection Vehicles
West 135th Street	4	1,416	222	4,290	30
East 91st Street	4	1,093	130	4,290	28
West 59th Street(3)	3	1,068	124	2,145	21
South Bronx	4	2,804	363	4,290	64
North Shore	4	2,672	329	4,290	39
Greenpoint	4	3,387	423	4,290	61
Hamilton Avenue	4	2,248	267	4,290	32
Southwest Brooklyn	4	1,388	166	4,290	27
Totals		**16,076**	**2,024**	**32,175**	

Notes:

(1) All MTSs based on scale data from Fiscal Year 1998 received from the DSNY Bureau of Cleaning and Collection with a 20% contingency allowance, except for the South Bronx MTS. South Bronx MTS data is based on Fiscal Year 1997 with a 20% contingency allowance.

(2) Based on operating the MTS under normal operating conditions. Spare operating line is not used to process waste.

(3) West 59th Street is a lift and load operation - not an open top-loading slot system.

Socioeconomic Conditions; Neighborhood Character; Community Facilities and Services; Open Space and Parklands; Cultural Resources; Traffic and Transportation; Air Quality; Noise; Infrastructure and Energy and Solid Waste; Natural Resources (including Endangered Species and Habitats); Water Quality; Waterfront Revitalization Program; Hazardous Materials; and Urban Design and Visual Quality. For the eight MTSs, the following measures were identified to mitigate estimated adverse impacts for traffic and on-site noise.

- Traffic signal timing adjustments would mitigate estimated traffic impacts identified at five intersections near the South Bronx Converted MTS; three intersections near the Southwest Brooklyn Converted MTS; three intersections near the Greenpoint Converted MTS; two intersections near the Hamilton Avenue Converted MTS; one intersection near the West 135th Street Converted MTS; two intersections near the East 91st Street Converted MTS; and two intersections near the North Shore Converted MTS. No traffic impacts were estimated at traffic study intersections identified near the West 59th Street Converted MTS.
- Construction of a 20-foot-tall noise barrier located on the southern property line at the South Bronx Converted MTS would mitigate the potential noise impact on a nearby prison barge. A 20-foot-tall noise barrier located on the southeast property line of the Southwest Brooklyn Converted MTS and a restriction on the number of nighttime arrivals of collection vehicles queuing on trucks and ramps would mitigate the potential noise impact on a nearby residential complex.
- Subsurface site investigations at the Southwest Brooklyn, Greenpoint, and Hamilton Avenue Converted MTS sites are underway. Results will be provided at a later date.

These analyses and findings are detailed in the MTS Environmental Evaluation, the appendix to this volume.

3.4 Volume IV: Evaluation of Waste Disposal Capacity Potentially Available to New York City

This volume provides an assessment of disposal capacity available within seven states (Georgia, New York, New Jersey, Ohio, Pennsylvania, South Carolina and Virginia) for accepting City waste.

3.4.1 Scope of Analysis/Approach

The survey was primarily based on interviews with landfill and waste-to-energy (WTE) operators and municipal solid waste management employees. (The surveyed area includes states that can be reasonably accessed by truck transfer, ocean-going vessel transport, and rail.)

In addition to conducting the surveys, data on historic market prices in the surveyed area were reviewed. Historical market price information was gathered from *Solid Waste Digest* published reports.

An attempt was made to develop a reasonable econometric model based on the survey results. The econometric model approach was formulated and a determination was made that the data gathered was not sufficient to obtain meaningful results, primarily due to the lack of responses from the landfill operators on questions concerning long-term contract tip fees. Though the econometric model was not developed, the data was analyzed to estimate or determine:

- The excess capacity at high-capacity[12] landfills;
- Trends of historical spot market disposal price (i.e., tip fee) levels;
- Ownership of high-capacity landfills with rail access;
- Comparison of tip fees at rail-accessible and non-rail-accessible landfills; and
- Inflation-adjusted, real per ton tip fees.

3.4.2 Findings

The results of this assessment are summarized below:

- In the list of high-capacity[13] disposal sites, there are a number of mega-landfills (landfills with a substantially larger capacity than 1,000 tpd) in states within the mid-Atlantic, Southeast and Midwest regions, exclusive of Pennsylvania and New York, that appear to have sufficient physical capacity to meet the additional demand of both DSNY-managed Waste and commercial waste generated by the City.

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[12] High-capacity landfills are those that accepted at least 1,000 tpd of municipal solid waste (MSW) in 2003.
[13] There were 87 high-capacity landfills identified in this report. Of these 87 landfills, 30 have rail access and one has barge access.

- Dispose of all the DSNY-managed Waste and commercial waste generated by the City over the New SWMP Planning Period. Most of the identified long-term disposal capacity is located more than 400 miles from the City and, therefore, is most likely economically accessible by rail, and to a lesser extent, by barge.

- Assuming the continuation of existing regulatory policies, landfill capacity in Pennsylvania will continue to decrease, and real tip fees should increase. (It is reasonable to assume, however, that some additional landfill capacity will be permitted to accommodate waste generated in Pennsylvania.) Data gathered during 2002 and 2003 indicate that there have been limited expansion/modification permits granted to mega-landfills in Pennsylvania, and while real (inflation-adjusted) spot market tip fee prices decreased over the six-year period of 1997 to 2003, these fees have increased in real dollars during the past two years (2002 to 2003). Part, but not all, of this increase is due to the Pennsylvania Department of Environmental Protection (PaDEP)-imposed $4.00 per ton fee applied to all solid waste disposed of in Pennsylvania municipal solid waste (MSW) landfills, which went into effect in June of 2002.

- Assuming a relatively competitive marketplace, and given that there appears to be a sufficient amount of landfill capacity in the surveyed area, it is reasonable to expect that the long-term real (inflation-adjusted) contract tip fees in the surveyed area (exclusive of New York and Pennsylvania) will remain relatively stable in the near term.

- The above conclusion assumes a relatively competitive marketplace for disposal capacity. Two firms own approximately 70% of the high-capacity landfills with rail access, including 100% of the capacity in both Georgia and South Carolina, and more than 80% of the landfills meeting this criteria in Pennsylvania. The result of this effective duopoly could lead to market conditions and pricing structures that deviate from normal, competitive marketplaces.

3.5 Volume V: Manhattan Transfer Station Siting Report

This study investigates and evaluates potential sites for locating new transfer stations in Manhattan.

3.5.1 Scope of Analysis/Approach

The purpose of this report is to evaluate the potential to develop Manhattan-based truck-to-barge or truck-to-rail transfer stations. Facility conceptual designs and site plans were prepared to determine the feasibility of using each site as a transfer station, and research on land use regulations and applicable laws was also undertaken to identify other obstacles to development.

Five screening criteria were established, which, for further consideration, potential sites were required to meet. These criteria were:

- Technical and operationally feasible transfer station sites with the capability to process at least 1,000 tpd of waste.
- Conformance to the zoning and proximity to sensitive-use criteria outlined in DSNY's Siting Rules.
- Adherence to legislative restrictions on the use of the site for transfer stations.
- Suitability for export of waste by barge or rail.
- Collection vehicle access from nearby truck routes.

Four sites were evaluated: West 140th Street, Pier 42, West 30th Street and West 13th Street (Gansevoort Property). None of these four sites currently serve or are permitted as waste transfer facilities.

- The West 140th Street site was determined to be infeasible due to technical reasons. Specifically, there is insufficient property available to ramp trucks up to the required site level and at an acceptable grade due to the rail elevation. Other operational problems included lack of maneuvering room, traffic problems and limited on-site parking. In addition, the site is zoned M1 and is within 400 feet of Riverbank State Park.

- The Pier 42 site has significant technical disadvantages. Prohibitions against its use as a transfer station agreed to between the City and other parties present serious obstacles to its development as a transfer station. In addition, it is located in an M1-4 zone and is within 400 feet of a playground and park.

- The West 30th Street site was determined to be infeasible for technical reasons. It lies within two zones -- M1-6 and M2-3 -- and the portion located within the compliant M2-3 zone is too small to construct a 1,000 tpd transfer station. In addition, due to the site's limited size, rail operations would not be feasible, there would be insufficient space for storage of waste or for containers, there would be no room for on-site parking, and there would be limited queuing and maneuvering space.

- The West 13th Street site is overseen and operated by the Hudson River Park Trust and is situated within the Hudson River Park. It formerly served as the location of an MTS and is zoned M3-2. In order for it to serve as a site for a new waste transfer facility, the state legislation that created the Hudson River Park would have to be amended. Additionally, federal and state permits issued to allow for the development of the park, in particular those related to development over the water, would have to be modified. Important obstacles exist to making this site a transfer station.

As a result of the considerations noted above, all four Manhattan sites were determined to either be technically infeasible or have significant legislative, zoning, land use and/or technical obstacles for the development of a private putrescible transfer stations.

3.6 Volume VI: Waste Vehicle Technology Assessment

This report consists of a survey of alternative fuels, new engine technologies and vehicle emission retrofit options that are appropriate for use on waste collection vehicles. DSNY's extensive experience in alternative fuels, engine technology and retrofit options research and the results of numerous successful pilot programs implemented by DSNY are highlighted. The report assesses the advantages and disadvantages of the various options in terms of reducing consumption of fossil fuels and/or reducing vehicle emissions.

3.6.1 Scope of Analysis/Approach

The purpose of this evaluation is to explore the different types of alternative and clean fuel technologies available to determine which clean and alternative fuel technologies are most feasible for the unique demands of heavy-duty refuse haulers operating in the City. The review presented in the Waste Vehicle Technology Assessment report weighs the economic, environmental and logistical advantages and disadvantages of various clean and alternative fuel technologies. After thorough research and analysis of all available viable options, including several case studies, options that are best suited for heavy-duty refuse haulers operating in the City are presented.

3.6.2 Findings

The report found that clean diesel technology is best suited for the City's refuse hauling vehicles. It provides substantial emission reduction benefits without having a major impact on fuel efficiency and cost. Natural gas technologies are also well suited for the City's refuse hauling vehicles. However, the use of this technology entails significant infrastructure investment, and, because of high demand for natural gas, has greater cost uncertainties.

Clean Diesel Options

The clean diesel options discussed in the report can cut vehicle emissions by 90% or more.

Engine tune-ups are the least expensive way to reduce particulate matter (PM) emissions. This emission reduction strategy can also lower operating costs, extend engine life and improve fuel economy. However, it should be noted that repairs and maintenance of diesel engines tend to increase nitrogen oxide (NO_X) emissions.

In addition to tune-ups, in certain circumstances, the **replacement of older diesel engines and equipment** may be the most sensible and cost-effective emissions improvement options. When old vehicles are replaced, fleet managers can substitute their oldest and worst emissions performers with new technology present in new diesel engines that are designed to produce much lower emissions.

Sulfur found in fuel degrades the effectiveness and life of after-treatment devices by inhibiting the function of existing filters and catalysts. By using **ultra-low-sulfur diesel** (ULSD) (which has a sulfur content of 15 parts per million [ppm] or less) and/or low-sulfur diesel fuel (sulfur content between 30 ppm and 15 ppm), there can be improvements in the performance of after-treatment technologies seeking to reduce emission levels. However, ULSD fuel only reduces PM and SO_2 emissions. Without after-treatment devices, it does not reduce emissions such as hydrocarbons (HC), CO or NO_X emissions. Some operating and maintenance concerns associated with ULSD fuel include a slightly lower fuel economy as compared with regular diesel, and concerns regarding the lubrication properties of the fuel. DSNY, a leader in experimenting with heavy-duty refuse vehicles, currently has 600 of its 2,040 refuse collection trucks using low-sulfur diesel fuel.

Diesel oxidation catalysts (DOCs) devices are considered the most proven of after-treatment options and can be used with existing or used engines to pollute less by retrofitting them.[14] According to the Diesel Technology Forum, emissions benefits include reductions of total PM by 20% to 50% and CO and HC by 60% to 90%.[15] They do not reduce NO_X emissions.

Diesel particulate filters (DPFs), when used with ULSD fuel, can reduce PM emissions by 50% to 90%, and HC and CO emissions by as much as 90%. However, like oxidation catalysts, these devices do not reduce NO_X emissions.

Although the use of DOCs and DPFs is not yet widely available for waste collection trucks, tests are ongoing that are assessing the use of these after-treatment options. DSNY is taking the lead in testing these technologies.

Another emission reduction strategy is to use **exhaust gas recirculation** to decrease NO_X levels. With the new, lower-sulfur diesel fuels, production of sulfuric acid will be minimized. This technology can reduce NO_X emissions by as much as 40%, and can also be used with engines being retrofitted.

Selective catalytic reduction (SCR) has been used for over 15 years to reduce NO_X emissions from stationary sources. Emission reductions include NO_X by 75% to 90%, HC reductions up to 80% and PM reductions of 20% to 30%.

Currently, **NO_X catalysts** are being experimented with in the United States on retrofitted vehicles. Two NOx catalyst technologies, "lean NO_X catalyst" and "NO_X absorber," are currently being developed, and can reduce NO_X emissions up to 70%.

Natural Gas

The main incentive for choosing natural gas as an alternative fuel for heavy-duty refuse trucks is the emissions benefits. Studies of heavy-duty engines running on compressed natural gas (CNG)

[14] Diesel Technology Forum, *Clean Air, Better Performance*, 2003.

[15] *Ibid.*

and diesel have shown that engines fueled with CNG emit significantly less PM (80% to 90% less) and NO_X (50% to 60% less) emissions than diesel engines. Another benefit of using a CNG engine is the reduction of engine noise, as CNG engines are significantly quieter than diesel engines. Furthermore, investing in CNG facilities now will ease future transitions to hydrogen fuel cells as a vehicle-fueling source.[16]

One of the major disincentives to creating a CNG refuse truck fleet is the cost related to purchasing the trucks and the infrastructure needed for a CNG facility. A CNG trash hauler can cost up to $70,000 more than a conventional diesel truck. In addition, the cost of a CNG facility with fueling, proper ventilation and leakage alarms can cost $500,000 to $1,250,000 to construct.[17] Another disadvantage of CNG is that most of the natural gas used in CNG engines comes from reserves in North America. Due to unmet demand for natural gas in the U.S., natural gas has seen extreme price fluctuations. In addition to the high costs, other issues, such as lower fuel efficiency than conventional diesel garbage trucks (due to heavier weight and longer size of vehicles), limited vehicle range, and high methane (CH_4) and CO_2 emissions, must be considered.

Other Available Technologies

The report also evaluates the costs and benefits of other alternatives, including biodiesel, fuel cells, battery electric, propane, ethanol, methanol, and hybrid electric vehicles (HEVs), but none were deemed as promising and cost effective to DSNY as the clean diesel and natural gas options.

Based on this report, DSNY should consider the following options:

- Continuing to utilize and experiment with ULSD fuel and clean diesel technology in existing vehicles with the goal of all diesel vehicles, currently in operation, utilizing clean diesel technology to meet USEPA 2004 and 2007 emissions standards.

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[16] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*
[17] *Ibid.*

- Continuing to make clean diesel technology the preferred vehicle standard for new heavy-duty refuse vehicle purchases.
- Continuing to test and compare alternative fuel exhaust emissions in order to evaluate hybrid electric refuse vehicles.
- Continuing to pursue its CNG heavy-duty program, so that DSNY will be able to take advantage of potential advancements in CNG technology and fuel cell technology.
- Continuing to develop partnerships with fuel suppliers, original equipment manufacturers (OEMs) and infrastructure providers in order to help reduce the cost of clean fuel implementation.
- For light-duty vehicles, continuing with ethanol purchase and plans for ethanol fueling facilities.
- Utilizing government grants and economic incentives to offset the higher costs associated with natural gas, hybrid electric and ethanol vehicles.

Private waste haulers in the City should consider these options:

- Retrofitting old diesel vehicles with clean diesel technology.
- Beginning to use ULSD ahead of June 2006 mandate.
- Deploying and purchasing clean diesel vehicles now to avoid future expenses that will be needed to meet new strict USEPA emission standards.
- Utilizing government grants and economic incentives to help offset the incremental capital costs associated with natural gas refuse vehicles.
- In conjunction with infrastructure supplier and engine manufacturers, exploring the future option of CNG heavy-duty refuse vehicles.

ATTACHMENT A

LOCAL LAW 74 OF 2000

Int. No. 842/Local Law 74 of 2000

By The Speaker (Council Member Vallone), Council Members Michels, Robles, Fisher, Rodriguez, DiBrienza, Boyland, Carrion, Fiala, Marshall, Provenzano, Quinn, Oddo, Clarke, Dear, Malave-Dilan, Eisland, Espada, Foster, Linares, Moskowitz, Nelson, O'Donovan, Pinkett, Abel, Golden, Stabile and Ognibene (in conjunction with the Mayor)

A Local Law to amend the administrative code of the city of New York, in relation to requiring a comprehensive study of the commercial solid waste management system within New York city.

<u>Be it enacted by the Council as follows:</u>

Section 1. Declaration of Legislative Intent and Findings. The legislatively mandated closure of the Fresh Kills Landfill by January 1, 2002 opens a new era in solid waste management in New York City and affords an opportunity to reexamine all aspects of how solid waste is managed, including that generated by the commercial sector. Moreover, New York City must now begin development of its next Comprehensive Solid Waste Management Plan.

Until the late 1980s, private carters paid a tipping fee to dispose of solid waste in the City's Fresh Kills landfill. In 1988, the tipping fee was raised to discourage private carters from using the Fresh Kills landfill in order to extend the landfill's useful life. This resulted in increased amounts of solid waste being sent to private transfer stations in New York City and the region.

Solid waste transfer stations and the trucks transporting waste to and from those facilities may generate such problems as dust, debris, noise~~,~~ odors, air pollutants, vermin and traffic congestion. The Council is concerned that transfer stations and private carters in New York City may need more regulation in order to protect the communities in which they are located and conduct business and to ensure effective enforcement of the rules governing their operation.

The Council finds that a comprehensive study of the commercial solid waste management system within the City of New York is critical in order to enable the City to assess and plan for management of both the residential and commercial waste streams in the most efficient manner, to minimize the potential adverse impacts on the City's residential and business communities and the environment, and to assist in developing a new comprehensive solid waste management plan.

§2. The administrative code of the city of New York is amended by adding a new section 16-134 to read as follows:

§16-134 Comprehensive study of commercial solid waste management system required. a. 1. "Long haul transport vehicle" shall mean any motor vehicle used to remove solid waste or other material from a putrescible or non-putrescible solid waste transfer station for final disposal, reuse or recycling.

2. "Private carter" shall mean any individual or business entity required to obtain a license from the trade waste commission pursuant to subdivision a of section 16-505 of this title.

3. "Trade waste commission" shall mean the New York city trade waste commission as established by section 16-502 of this title.

b. The department, in consultation with the trade waste commission, shall enter into one or more contracts for the performance of a comprehensive study of the existing commercial solid waste management system within the city of New York. In performing the study, the department and/or the contractor or contractors shall solicit and consider the views of elected officials, the citywide recycling advisory board, the borough solid waste advisory boards and the public, including residents of affected communities, environmental advocacy organizations, transfer station operators, private carters, business entities and academicians, and respond to substantive issues raised. The study shall include, but need not be limited to, an analysis of the following:

1. the effectiveness of procedures employed and the criteria applied by the department for the issuance and renewal of permits for the operation of putrescible and non-putrescible solid waste transfer stations in minimizing potential adverse environmental, economic and public health impacts on the communities in which such transfer stations are located by examining such issues as (i) the effectiveness of the criteria applied by the department to the siting of putrescible and non-putrescible solid waste transfer stations, including the aggregate effect of the geographic proximity of solid waste transfer stations to each other and (ii) the scope and effectiveness of the operational restrictions imposed upon putrescible and non-putrescible solid waste transfer stations, including the hours of operation and any performance standards established in the zoning resolution of the city of New York;

2. the manner in which all applicable laws, rules and regulations relating to the operation of putrescible and non-putrescible solid waste transfer stations, private carters and long haul transport vehicles are enforced, including who should be responsible for such enforcement, and the effectiveness of such enforcement in obtaining compliance with such laws, rules and regulations and in minimizing potential environmental, economic and public health impacts and an analysis of rules relating to routes for transporting material to or from such transfer stations;

3. the means and potential effects of limiting the number and capacity of putrescible and non-putrescible solid waste transfer stations in the city;

4. the size and type of vehicles that should be authorized to transport solid waste to or from putrescible and non-putrescible solid waste transfer stations and fuel-type requirements for such vehicles;

5. whether putrescible and non-putrescible solid waste transfer stations and city-owned marine transfer stations should receive and process both residential and commercial solid waste and the options for transporting such solid waste to and from such transfer stations, including an analysis of potential environmental, economic and public health impacts; and

6. potential environmental, economic and public health impacts on communities in which large numbers of privately-owned putrescible and non-putrescible solid waste transfer stations are located such as, but not limited to,

potential impacts related to air quality, water quality, odors, traffic congestion and noise.

c. The study required by subdivision b of this section, and a report containing a detailed analysis of the findings of such study, as well as recommendations based on such analysis and findings, shall be completed no later than eighteen months after registration of the consultant contract and at least two months before the next draft comprehensive solid waste management plan is submitted to the council or the New York state department of environmental conservation. Such report shall be submitted to the mayor and the council immediately upon its completion. A preliminary report containing data necessary to perform the analyses described in subdivision b of this section shall be submitted by the department to the mayor and the council during or before the last quarter of calendar year two thousand one.

d. Such study shall be performed and such report shall be prepared in a manner designed to assist in the preparation of the next comprehensive solid waste management plan for the city of New York required by section 27-0107 of the New York state environmental conservation law.

§3. This local law shall take effect immediately.

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ATTACHMENT B

FINAL STUDY SCOPE

COMMERCIAL WASTE MANAGEMENT STUDY
FINAL SCOPE OF WORK

New York City Department of Sanitation

JULY 31, 2003

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CITY OF NEW YORK
DEPARTMENT OF SANITATION
COMMERCIAL WASTE MANAGEMENT STUDY
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1.0 INTRODUCTION

The New York City (City) Department of Sanitation (DSNY) collects and/or disposes of waste generated by residences, institutions, not-for-profit organizations, DSNY lot cleaning operations, and other City, state and federal agencies (hereinafter referred to as DSNY-managed Waste[1]). Private waste carting companies collect and dispose of waste from commercial sources in the City. Both DSNY and private companies recycle materials, including paper, cardboard, metal, glass and plastic.

DSNY has the responsibility to manage all of the waste generated in the City and to develop a new Comprehensive Solid Waste Management Plan (New Plan) for both DSNY-managed Waste and commercial waste for the planning period 2004 through 2024. Because the City has no operating landfill, incinerator or resource recovery facilities, pursuant to interim export contracts, all DSNY-Managed Waste is either transferred from private transfer stations within the City or carted out of the City in DSNY collection vehicles for transfer and/or disposal at facilities outside of the City. Except for DSNY-managed Waste transferred out of the Bronx, DSNY's interim export arrangements depend on truck transport. Under its long-term export program, the City is converting its existing Marine Transfer Stations (MTSs), designed to transfer waste in open hopper barges to the now-closed Fresh Kills landfill, into facilities that containerize waste for transport by container barge. It is anticipated that the waste will reach a disposal facility through a combination of barge and/or rail movements. Since 1989, when DSNY raised the fees for private waste disposal at Fresh Kills, the City's commercial waste has been carted or transferred from the City by truck, much of it through private transfer stations located in the City.

[1] DSNY-managed Waste is solid waste that DSNY collects from all residential households in the City and the institutional waste of City, state and federal agencies that DSNY collects and/or for which DSNY arranges disposal.

The Commercial Waste Management Study (Study), described herein, addresses issues related to the management of commercial waste in the City. Private waste transfer stations process three categories of waste: (i) *putrescible waste* (garbage that can cause odors); (ii) *non-putrescible waste* (typically including construction and demolition debris and/or other recyclable materials that do not cause odors); (iii) and *clean fill* (a subset of non-putrescible, but handling only excavated dirt, rock, concrete, gravel, stone, asphalt millings or sand). At *putrescible waste* transfer stations, waste is transferred to long haul trucks or rail cars for export. *Non-putrescible waste* transfer stations and *clean fill* transfer stations typically engage in sorting, crushing and processing of material; therefore, much of the material that they receive is recycled or reused.

Under the City's Zoning Resolution, transfer stations can be sited in the City's industrial zones (manufacturing districts M1, M2, and M3). Zoning performance standards for such districts establish standards for the emission of odors and dust, vibration, heat, glare, and explosive hazard. M1 districts have the highest performance standards, M2 districts have medium performance standards and M3 districts have the least restrictive performance standards. DSNY and the New York State Department of Environmental Conservation (NYSDEC) issue permits regulating the design and operation of private transfer stations in the City. Applicants for permits must also submit an Environmental Assessment Statement, which assesses all impacts the facility and operation would have on the surrounding environment. NYSDEC and DSNY act as co-lead agencies in the environmental review process for such permits. DSNY rules for permitting putrescible waste transfer stations were adopted in 1991. In 1998, the City adopted Siting Rules that increased the restrictions on where transfer stations could be located. There are now 69 operating transfer stations, including 22 stations handling putrescible waste, 25 stations handling non-putrescible waste and 22 stations handling only clean fill.

To help determine whether transfer stations and private carters in the City may need more regulation to ensure effective enforcement of the rules governing their operation, the City Council enacted Local Law 74 (LL 74), effective December 19, 2000, requiring a comprehensive assessment of commercial solid waste management in the City. The Study is intended to enable the City to assess and plan for management of the commercial waste stream in the most efficient manner, to minimize potential adverse impacts on the City's residential and business communities and the environment, and to assist in developing the New Plan.

In June 2002, DSNY published a Preliminary Report, required to be issued in compliance with LL 74, that contained data on the volumes, types, origins and destinations of the commercial waste managed by private companies in the New York Metropolitan area, and included information on residential and institutional waste collected by DSNY and managed through commercial waste transfer stations following the phased closure of Fresh Kills. The Study proposed to be undertaken now, among other things, will analyze and assess the adequacy and impacts of the siting, permitting, operations and regulation of commercial waste transfer stations.

In March 2003, DSNY proposed rules that would temporarily restrict (until July 31, 2004) the permitting of new waste transfer stations, except intermodal facilities. The proposed rules would allow putrescible facility expansions upon the completion of the City Environmental Quality Review process; putrescible expansions would be prohibited in Brooklyn Community Board 1 and Bronx Community Board 2, unless equivalent capacity were closed within the same community board. DSNY held a hearing to receive public comments in April 2003 and expects to publish the final text of the temporary restrictions shortly. DSNY anticipates that it will draft and publish proposed permanent siting rules after the issuance of the Study Report and a review of its recommendations. The proposed rules and the transcript of the April hearing appear on the DSNY website.

In developing the Draft Scope of Work for the Study (Draft Study Scope), DSNY conducted a series of meetings in November and December of 2002 to solicit comments from elected officials, the public, the Citywide Recycling Advisory Board (CRAB), the Borough Solid Waste Advisory Boards (SWABs), Community Boards, environmental organizations, academics and other interested organizations. A public meeting was held in each borough on the following dates:

- Brooklyn – November 18, 2002
- Queens – November 19, 2002
- Staten Island – November 20, 2002
- Manhattan – November 25, 2002
- Bronx – December 2, 2002

DSNY invited the public to speak at these meetings, and to submit written comments through December 16, 2002. The transcripts of the public meeting testimonies were posted on DSNY's website in tandem with the Draft Study Scope.

DSNY and its consultants prepared the Draft Study Scope to reflect public comments and the specific requirements of LL 74, as discussed above. On March 3, 2003, the Draft Study Scope was posted on the DSNY website (www.nyc.gov/sanitation) for further public comment for a period of 21 days, until March 24, 2003. Concurrently, the Draft Study Scope was mailed to all elected officials and Community Boards, the CRAB, the SWABs and to individuals who attended the public meetings held in 2002 and/or submitted comments in connection with the development of the Draft Study Scope. A sample letter enclosing the Study Scope and describing the public comment process established to finalize the Study Scope was posted on DSNY's website in tandem with the Draft Study Scope.

Public Comments on the Draft Study Scope

Public comments received both during and after the established public comment period consisted of nineteen letters (three from elected officials, two from solid waste industry respresentatives, one from a national environmental organization, four from City solid waste advisory boards, six from neighborhood organizations or coalitions and three from special interest representatives). The letters were reviewed and considered by DSNY and the consultant team in preparation for the issuance of this Final Study Scope.

The majority of comments highlighted issues already addressed in the Draft Study Scope. Among these were requests that the consultant team:

- Investigate potential transfer station sites in Manhattan;
- Consider waste management strategies such as flow control and commercial waste franchising;
- Acknowledge the economic value of a robust commercial waste management system;
- Develop data on recyclables destinations;
- Consider the use of bio-diesel as an alternative fuel;

- Consider the decline in waste after the events of September 11th and Preliminary Report data in developing capacity projections for the planning period;
- Consider the economics of the fee structure for accepting commercial waste at the new MTSs;
- Evaluate incentives to barge and rail transfer;
- Consider the value to the City of reserve capacity when evaluating facility impacts;
- Analyze PM10 and PM2.5 air impacts;
- Use, to the extent available, Business Integrity Commission information to develop waste routing, generation and origination data; and
- Solicit and consider community concerns.

As a result of these comments, DSNY and the consultant team are taking specific note of the concerns raised and will amplify the discussion in the Study Report to address these concerns.

The remaining comments contained suggestions that did not result in Study Scope changes; many focused on issues that fall outside the Study Scope, but will be addressed in the development of the New Plan. These comments included suggestions on:

- Proposed alternatives to MTS containerization sites;
- MTS containerization design;
- MTS containerization environmental review;
- Alternative waste processing and disposal technologies;
- Grandfathering existing transfer facilities;
- Performance standards in specific zoning use groups;
- Communities to be considered as additional Study Areas;
- Transfer station site investigations outside of Manhattan;
- A Study advisory panel;
- Targeted outreach to be required in the development of the New Plan;
- Programmatic waste prevention, recycling and composting issues appropriately addressed in the New Plan; and
- Commercial/institutional food waste disposers more appropriate for study by the New York City Department of Environmental Protection.

Scope Changes

In addition to text changes in this Introduction that describe the content and consideration of public comments received, the issuance of the Final Study Scope, updating the definition of clean fill to include asphalt millings, and proposed transfer station temporary siting restrictions, revisions to the Final Study Scope correct formatting and typographical errors and reflect:

- Changes in the availability and form of the base data to be relied on to develop estimates on waste generation, including employment-based estimates of commercial waste generation (see Section 2.0 paragraph 1; Section 3.0 Summary of Task 4.1; Subtasks 4.1.2, 4.1.4 and 4.1.6);
- The addition of neighborhood character as an element of impact assessments (see Section 3.0 Summary of Task 4.2 and Task 4.4; Subtasks 4.2.2, 4.4.1 and 4.4.3);
- Changes in the predictive quality of information to be relied on to develop economic trend analysis on waste transportation and disposal markets and costs (see Section 3.0 Summary of Task 4.3; Task 4.3);
- New survey data to be generated by the City's Business Integrity Commission (see Section 3.0. Summary of Task 4.1; Subtask 4.1.3); and
- DSNY's extensive experience with alternative fuels and engine controls (see Section 3.0 Summary of Task 4.7; Task 4.7).

The Final Study Scope can also be obtained in printed form through a request directed to the DSNY Contact Person:

Harry Szarpanski, Assistant Commissioner
New York City Department of Sanitation
Bureau of Long Term Export
44 Beaver Street, 12th Floor
New York, New York 10004
Fax: (212) 269-0788

It is anticipated that the Study and accompanying report (Study Report) containing findings and recommendations will be issued in March 2004. There will be public involvement in reviewing the draft findings and recommendations that result from the Study. Thereafter, findings and recommendations that DSNY proposes to incorporate in the New Plan will be subject to public comment during the public review process for the New Plan. The environmental impact of the implementation of such recommendations proposed for inclusion in the New Plan will be evaluated in the Draft EIS prepared to support the adoption of the New Plan.

1.1 Summary of Objectives

In assessing the current regulations of commercial transfer stations as mandated by LL 74, the Study will evaluate the need for and may recommend changes in the regulatory system, including the strategies, incentives, new regulations and new legislation necessary to implement these recommendations. These recommendations may address:

- The siting and operation of private transfer stations and waste collection operations;
- The future demand for commercial transfer capacity and evaluating long-term economic trends affecting waste disposal; and
- The means of facilitating a transition from the current mode of truck-based export to export by barge and/or rail.

1.1.1 Requirements of Local Law 74 of 2000, New York Administrative Code §16-134

LL 74 mandates that the Study address the following:

1. Permitting Criteria, Environmental Review and Mitigation

   The effectiveness of DSNY permitting procedures and criteria in minimizing potential adverse environmental, economic and public health impacts on the communities in which privately-owned transfer stations (Transfer Stations) are located by examining such issues as the:

   - Effectiveness of the criteria applied by DSNY to the siting of Transfer Stations [16 RCNY 4-32], including the aggregate effect of the geographic proximity of solid waste transfer stations to each other; and
   - Scope and effectiveness of the operational restrictions imposed upon Transfer Stations, including the hours of operation and any performance standards established in the New York City Zoning Resolution.

2. Regulatory Enforcement; Truck Traffic

   The manner in which all applicable laws, rules and regulations relating to the operation of Transfer Stations, private carters and long haul transport vehicles are enforced, including:

- Who should be responsible for such enforcement;
- The effectiveness of such enforcement in obtaining compliance with such laws, rules and regulations and in minimizing potential environmental, economic and public health impacts; and
- Analysis of rules relating to routes for transporting material to or from such transfer stations.

3. Limits on Transfer Stations

   The means and potential effects of limiting transfer station capacity in the City.

4. Waste Transportation Vehicles

   The size and type of vehicles that should be authorized to transport solid waste and the fuel-type requirements for such vehicles.

5. Processing of DSNY-managed Waste and Commercial Waste in the same Facility

   Whether private Transfer Stations and the City's MTSs should receive and process both residential and commercial solid waste, and the options for transporting such solid waste to and from such Transfer Stations, including an analysis of potential environmental, economic and public health impacts.

6. Impacts of Relative Concentrations of Transfer Stations

   Potential environmental and public health impacts on communities in which concentrations of Transfer Stations are located such as potential impacts related to air quality, water quality, odors, traffic congestion and noise.

1.1.2 Other Study Objectives

Other objectives of the Study are to:

- Provide for the projected need for transfer station capacity over the planning period for the New Plan;
- Further refine information in the Preliminary Report on the quantity of commercial waste generated in the City; and
- Evaluate trends in the supply and cost of waste disposal capacity that will be available to the City.

1.2 Scope Organization

Section 2.0 of this Scope summarizes the issues that will be addressed in the Study. Section 3.0 describes the detailed analyses and methodologies that will be applied by DSNY's Consultant Team to evaluate these issues.

2.0 SUMMARY OF ISSUES TO BE ADDRESSED

The following summarizes the issues to be evaluated in the Study:

1. In June 2002, DSNY published a Preliminary Report in accordance with the requirements of LL 74 that contained information on commercial waste quantities by type and borough of origin that had been collected and analyzed by DSNY and its consultants from sources such as available reporting systems and interviews with waste management companies involved in aspects of the commercial waste management business. As noted in the Preliminary Report, there is no single comprehensive system for recording data on commercial waste generation in the City. Furthermore, the data in the Preliminary Report were for the calendar year 2000, and the events of September 11, 2001 and the subsequent decline in business activity in the City since 2000 have all affected commercial waste generation. The Study will apply methods to adjust the year 2000 data to year 2002 to account for these economic effects. Additionally, the Study will evaluate and apply alternative methods to those used in the Preliminary Report to supplement existing estimates of commercial waste generation. The recycled material in the commercial waste stream that is not accounted for in the Preliminary Report data will also be quantified. The Study will project changes in commercial waste generation over the New Plan period based on an employment forecast for the same period.

2. The Study will assess: (i) the means and potential effects of limiting the number of privately owned/managed putrescible and non-putrescible commercial waste transfer capacity in the City over the 20-year New Plan horizon; and (ii) the potential effects of converting the City's Marine Transfer Stations (MTSs) to containerization facilities for the export of commercial waste. The assessment of MTS conversion to commercial waste export will consider technical feasibility, the potential for environmental impacts, and economic viability. Beyond the use of converted MTSs, the Study will assess the potential for additional barge or rail-based waste transfer capacity for the commercial waste generated in midtown and downtown Manhattan.

3. The Study will evaluate the volume of out-of-City waste disposal capacity that is economically accessible by export in transfer trailers from the City. If the Study projects a decline, the Study will also identify the means to encourage a shift in commercial waste transport operations to barge or rail modes to ensure access to more remote disposal sites.

4. The Study will identify Community Districts in which commercial waste transfer stations are currently most concentrated, evaluate whether the types of potential impacts referenced in LL 74 may be attributable to the operation of these facilities, and, if so, evaluate remedial measures.

5. The Study will evaluate the effectiveness of existing regulations and the potential need for improved enforcement practices and/or new regulations that could prevent or minimize impacts on the City's residents and businesses that are attributable to

transfer operations. As appropriate, the Study will recommend means of improving enforcement of existing regulations or the adoption of new regulations to address identified problems.

6. The Study will identify and evaluate the effectiveness of potential new policy initiatives that could improve the overall long-term utility of the commercial waste transfer system to the City and mitigate or minimize impacts associated with commercial waste transfer operations.

7. The Study will assess means of reducing the potential for impacts, such as air emissions and noise, associated with the operation of private collection and long haul vehicles.

The Study will produce a summary of findings and recommendations from the evaluations of the issues defined above. These findings and recommendations, with associated technical analyses, will provide a framework for consideration of the policies proposed for the management of commercial waste in the New Draft Plan.

3.0 TASK OVERVIEW

This Section 3.0 summarizes the objective and content of the detailed Task descriptions and methodologies presented in Section 4.0.

Summary of Task 4.1 Quantification of Commercial Waste

The waste quantification effort includes six Subtasks that focus on refining the commercial waste data contained in the Preliminary Report. The approach involves making certain updates to the Preliminary Report data and applying alternative methods of estimating waste generation. The information obtained will be compared to the Preliminary Report estimates, and will supplement or refine the information contained therein. These Subtasks include the following:

- The Preliminary Report data was from the calendar year 2000. In the intervening period, the events of September 11, 2001 and the economic decline of the City's economy are assumed to have affected commercial waste generation. Additionally, some of the data in the Preliminary Report reflect the fact that, at that time, the City was still disposing of some waste at Fresh Kills. Subtask 4.1.1 describes the method that will be used to update and/or adjust the Preliminary Report data to provide a foundation for forecasting future year commercial waste generation.

- Subtask 4.1.2 will apply an alternative waste estimation methodology. Employment-based waste generation factors derived from multiple sources, year 2000 Census data on employment categorized in two-digit SIC codes, and adjusted employment forecast data through 2025 will be used to develop a long-term forecast of commercial waste generation. Additionally, similar factors applicable to commercially-generated recyclables will be used to characterize and quantify the recycled fraction of commercial waste. Estimates of recycled quantities will be supplemented and refined through contact with large generators, recyclers, and end users (i.e., paper mills and dealers) in the region.

- To develop Subtask 4.1.3 data, DSNY and the consultant team will rely on a survey being performed by the Business Integrity Commission (BIC), which regulates the commercial waste carting industry in the City, for information on carter collection routes and types of businesses served. Additionally, information will be sought on the garaging and dispatching of collection vehicles by carters serving the Manhattan business districts and the City as a whole.

- The Preliminary Report relied on the DSNY Transfer Station Reports and interviews with carters operating in the City to estimate total waste generated. Subtask 4.1.4 will focus on supplementing this information by contacting out-of-City operators of waste-to-energy facilities and commercial waste transfer stations in the New York Metropolitan area to obtain information on quantities of commercial waste generated in the City and delivered to these facilities.

- As reported in the Preliminary Report, Construction and Demolition Waste (C&D) is the largest component of waste and recycled material. The variability in generation of C&D waste over time is influenced by different factors than that of the putrescible category of commercial waste. Subtask 4.1.5 will focus on developing factors that can predict how the C&D stream will vary as a function of construction activity in the City and, on this basis, estimate the City's need for transfer/recycling capacity for this material.

- Information developed in Subtasks 4.1.1 through 4.1.4 will be used to project quantities of commercial waste generated, disposed and recycled over the Plan period of 2004 through 2023.

Summary of Task 4.2 Needs Assessment for Commercial Transfer Station Capacity

The potential need for new commercial waste transfer station capacity will be investigated in two areas:

- Subtask 4.2.1 will investigate potential sites for truck-to-barge or truck-to-rail transfer stations in lower and midtown Manhattan. This analysis will define facility design criteria, identify any sites that conform to these criteria, conduct a fatal flaw analysis of factors that would preclude siting at these locations, and, if no such flaws are identified, summarize the advantages and disadvantages of the sites that appear feasible.

- The Mayor, in his announcement of the MTS conversion program for DSNY-managed Waste, indicated that the using of these converted facilities to containerize and transfer commercial putrescible waste by barge would be considered, as well. Subtask 4.2.2 will: (i) assess the MTS conversion designs to determine if significant quantities of commercial putrescible waste, in addition to DSNY-managed Waste, can be transferred from the converted MTSs; and, (ii) if there is a potential for commercial transfer capacity at an MTS site, the potential incremental impacts of receiving and transferring commercial putrescible waste will be evaluated to determine if any unmitigatable adverse impacts might result. These environmental analyses will assess potential traffic, air quality, water quality, noise, odor and public health and neighborhood character impacts that might result from the transfer of an increment of commercial putrescible waste through the converted MTSs.

Summary of Task 4.3 **Evaluation of Waste Disposal Capacity Potentially Available to the City**

To better understand the City's requirements for a commercial waste transfer infrastructure over the 20-year period of the New Plan, an economic study will be performed in Task 4.3 that will seek to develop information on the economic market for transport and disposal of waste exported from the City. The assessment will survey existing and proposed landfill and waste to energy facility capacity, identify available historical data on disposal costs and capacity, and develop estimates of the economics of waste transport and disposal by truck, rail and barge. This information will be organized to define the service area in which the City is one of many buyers of remote disposal, and to develop approaches for estimating long-term waste transport and disposal costs in this marketplace.

Summary of Task 4.4 **Assessment of the Potential Impacts of Relative Concentrations of Commercial Waste Transfer Capacity**

As mandated in LL 74, Study Task 4.4 will assess the environmental, economic and public health impacts from the relative concentration of commercial transfer stations in four selected Study Areas. The assessment will address both on-site and off-site related impacts. The purpose of this assessment is to evaluate whether and how the total volume of waste processing activity in areas with relative concentrations of transfer stations may cause potentially adverse air quality, odor, traffic, noise, water quality public health and neighborhood character impacts. This Task, in combination with the enforcement effectiveness evaluation (Task 4.6), will also evaluate whether new or revised regulations and ordinances applicable to the siting, design and operation of transfer stations would significantly diminish the potential for adverse impacts.

Summary of Task 4.5 **Assessment of the Design and Operation of Existing Commercial Transfer Stations**

A field survey will be conducted in Study Task 4.5 to assess the design and operation of a select sample of existing putrescible, C&D and fill material commercial waste transfer stations. The purpose of the field survey is to assess and identify potential changes to facility designs (i.e., perimeter fencing, on-site queuing space, exhaust controls, etc.) and/or operational practices (waste storage and handling, locations of equipment, hours of operation, etc.) that would mitigate the potential for impacts to nearby communities. The recommended design and/or operational changes may be incorporated into the policy strategies that are the outcome of this Study, as changes to regulatory requirements for permitting existing, modified or new transfer stations in the City.

Summary of Task 4.6 Evaluation of Permitting and Enforcement Effectiveness in Regulating Commercial Waste Collection and Transfer Operations

The focus of this Task is the detailed analysis of existing City and New York State controls on transfer station development and the evaluation of the effectiveness of current enforcement policies. The Consultant Team will research current policies governing the issuance of permits and existing practices regarding the evaluation of their impacts. The Consultants will prepare an inventory of the responsible agencies and their respective permitting and enforcement authorities that apply to the construction and operation of transfer stations in the City. This work is intended to plot the scope of the regulations governing transfer stations. The principal regulatory mechanisms are: (i) DSNY Siting Rule requirements and NYSDEC Part 360 permitting requirements for new and expanded or modified transfer stations; (ii) Zoning Performance Standard requirements; (iii) DSNY Permitting Regulations; and (iv) City DOT Traffic Regulations. Studies in the effectiveness of the enforcement of applicable regulations will be performed to identify gaps in enforcement coverage. If deficiencies are identified through a review of community complaints and notices of violation issued, the extent of impacts due to deficiencies in existing regulations and enforcement practices will be tested, and an Enforcement Effectiveness Report will be prepared.

Summary of Task 4.7 Evaluation of Alternative Collection Vehicles

Under almost any scenario for the future, the movement of solid waste in the City will remain heavily dependent upon diesel-powered trucks. The ideal and most effective measures to reduce air pollution would be to reduce the emissions by these trucks. The main objective of this Task is to determine if alternate fuels, fuel-efficient engine technologies or truck types might be feasible means of reducing truck emissions.

Summary of Task 4.8 Findings and Recommendations

Findings from each of the Tasks completed in the Study will be summarized in the Study Report. The Report will also identify recommendations for policy strategies that may be implemented by the DSNY or proposed for adoption in the New Plan. Results of the Study and recommended policy strategies will be included in the Study Report.

4.0 DETAILED SCOPE OF WORK

This section describes the Study Tasks corresponding to the items enumerated, including the proposed methodologies that will be used in performing the Study.

Task 4.1 Quantification of Commercial Waste

The following six Subtasks describe various methods that will be used to adjust, refine and cross-reference the estimates of commercial waste generation presented in the Preliminary Report and also to develop estimates of the major recycled components of commercial waste that are not accounted for in the Preliminary Report data.

4.1.1 Adjustment of Preliminary Report Data

The database used to prepare the Preliminary Report will be updated to reflect 2002 waste disposal volumes in order to account for the potentially significant effects on waste generation attributable to the September 11 event and the decline in the City's economy since the data were originally collected. The update will only use information available from the DSNY Transfer Station Quarterly Reports for calendar year 2002 and compare this more current information to the data from the same source for 2000. These current reports will be entered into the database according to the type of waste collected and disposal destination. The change in reported quantities between 2000 and 2002 will be evaluated to derive adjustment factors for change in commercial waste in each borough. These adjustment factors will be applied to the origin patterns of waste that were obtained in the 2000 survey of private carters to re-estimate the pattern of 2002 waste origins. The changes over the elapsed two-year period in volume, type and destination of waste will be compared.

4.1.2 Employment-Based Waste Estimation Model

A methodology originally developed for the U. S. Environmental Protection Agency (USEPA) by a member of the Consultant Team will be used to estimate the quantity and composition of the commercial putrescible waste stream. This methodology has been modified for application at the local level. Generation estimates, presented at the Borough and Community District levels, will be developed with available employment data. The employment data is derived from year 2000 Census Tract level projections prepared by the New York Metropolitan Transportation Council (NYMTC), which was subsequently adjusted for the effects of the September 11, 2001 disaster and the decline in business activity in the City. These adjusted data will be used in projecting commercial waste volumes over the planning period for the New Plan. Waste generation estimates will be categorized by type of business, depending on the level of detail in the available employment data.

Waste composition factors derived from specific commercial subsector studies – office sector, health providers, manufacturers (other than waste byproducts from manufacturing processes), food establishments (restaurants and supermarkets), retail and wholesale stores – will also be used to:

- Adjust components based on the City-specific characterizations derived by the model; and
- Adjust components to reflect national trends in the intervening decade using available historical data – for example, the increase in plastics and the relative decrease in glass as a packaging material.

The characterization and quantification of waste generation provide a basis for estimating the quantity of commercial materials that are recycled. Recovery estimates will be developed from data in the Preliminary Report combined with new information obtained from large generators, recyclers, and end users (i.e., paper mills and dealers).

4.1.3 Collection Operations Assessments

The Preliminary Report estimated total tonnage from interviews with commercial carters. These interviews did not provide information on the number of collection vehicles dispatched by carters to the various boroughs or on the amount of waste generated in specific Community Districts. In this Subtask, the Consultant Team will use the results of a new survey now being conducted by BIC of commercial carters operating in the City. The results will be evaluated to identify relevant information of collection route patterns, types of business served, quantities of waste collected and the location of garages from which vehicles are dispatched into the City.

The Consultant Team will seek similar information for all major carters operating in the City, identifying, for example, the location of vehicle staging areas (i.e., garages, yards), the number of vehicles operated, the time spent and the number of stops en route. The information obtained will be summarized in the Study.

Information regarding collection services in midtown and downtown Manhattan will be correlated with data regarding the type of business and level of employment in order to more accurately estimate waste generation. The goals of this approach are twofold: (i) to obtain an additional aggregate estimate of commercial waste and recyclables generated in Manhattan's business districts; and (ii) to obtain information concerning the routing of collection vehicles in these districts. The data collected in this Subtask will provide another source of verification of the waste generation estimates for the applicable Manhattan Community Districts developed in Subtask 4.1.2.

This Task will also seek to develop information on the quantity of commercial recyclables hauled by recyclers from commercial generators directly to local markets and/or dealers. These recyclers are not categorized as waste collection companies and their activities are neither regulated by DSNY nor recorded in DSNY reports.

4.1.4 Facilities Method

To develop more complete estimates of commercial waste carted out of the City for transfer or disposal, the Consultant Team will gather information from facilities located outside of the City that receive commercial waste. Transfer stations and waste-to-energy facilities in New Jersey, along with nearby facilities in Long Island and Connecticut, will be contacted. Data obtained from these contacts will be correlated with reports produced by the relevant state regulatory agencies to estimate the total in-City generated waste that is transferred or disposed of at out-of-City facilities.

4.1.5 Quantification of Construction and Demolition Waste and Fill

The Preliminary Report shows that C&D and fill material comprise the majority of commercially generated waste in the City. To effectively plan for adequate capacity for these materials over time, it is necessary to formulate a methodology to predict quantities of C&D and fill material. The Consultant Team will incorporate specific plans for major reconstruction, such as that which is planned for Lower Manhattan, in projecting levels of activity and consequent generation levels for C&D debris and fill material.

The Consultant Team will: (i) contact facilities that receive C&D and fill material, and obtain historic data to enable a calibration of the relationship between the level of construction activity and the quantity of materials generated; and (ii) interview officials of relevant organizations, including local organizations, such as the Associated General Contractors, regarding C&D generation. Data from non-City sources will also be collected to assess differences in generation rates between the City and other communities.

4.1.6 Projections of Commercial Waste for 2004 through 2024

The Consultant Team will use the data derived from Subtasks 4.1.1 through 4.1.5 as a base for the projections. Changes in total quantities generated and waste composition will be projected through 2024, based on best judgment, reasonable extrapolations of observed trends, and an assumed level of success in policies, such as waste reduction.

Forecasts of population and employment by Census Tract from 2000-2025 (in five year intervals) based on the 2000 Census are available from NYMTC, the Metropolitan Planning Organization (MPO) for the New York Region. The data have been adjusted by NYMTC to account for the shift in employment resulting from the disaster on September 11, 2001 and will be aggregated to Community Districts for use in projections of commercial waste. Note that work on NYMTC's expanded 2025 forecast (of age cohorts, labor rates, household size, and employment based on the North American Industrial Classification Standard code) will begin in mid-2003, but the forecast results will not be available for this Study. C&D debris and other inert wastes will be projected separately over the 20-year horizon based on economic projections, incorporating expected variances resulting from, for example, reconstruction of the World Trade Center site, economic cycles, and expected regional growth.

Task 4.2 Assessments of Commercial Transfer Station Capacity

4.2.1 Siting Investigations in Lower and Midtown Manhattan for Additional Commercial Waste Transfer Capacity

To address public comments on the scope of the Study, an investigation will be conducted to identify and evaluate potential sites in lower and midtown Manhattan where commercial waste transfer facilities could be sited. Criteria for siting such facilities will be defined based on zoning, design and operational criteria, DSNY's Siting Rules (taking into account the potential for revision of these rules), consideration of potential environmental impacts and other applicable requirements. The Consultant Team will identify the minimum site size and related throughput capacity required for efficient waste containerization and transfer by barge or rail to out-of-City disposal facilities. Proximity and accessibility to intermodal yards will be considered. The Consultant Team will identify sites below 80th Street in Manhattan that meet these minimum criteria and will prepare conceptual designs to determine the additional transfer capacity potentially available at these sites. If no fatal flaws (that would prohibit such siting) are identified, an analysis of the advantages/disadvantages of potential sites will be performed.

4.2.2 Assessment of Containerizing Commercial Waste at the City's MTSs

As designs are developed to convert the City's eight MTSs (South Bronx, West 59th Street, East 91st Street, West 135th Street, Hamilton Avenue, Greenpoint, Southwest Brooklyn and North Shore) to containerization and container barge transfer facilities, the design capacity and site-specific conditions of the planned conversions will be evaluated for the potential to also process commercial waste. The Consultant Team will evaluate the potential quantity of commercial waste that could be accepted at each of the converted MTSs, in addition to DSNY-managed Waste, without causing unmitigatable adverse environmental impacts. The waste quantity data developed in the Study (see Task 4.1) and the information developed for the Study Area Analysis (see Task 4.5) will be used to perform this analysis. Using updated methodologies and information from the 2000 Final Environmental Impact Statement (2000 FEIS) for the 2001 Comprehensive Solid Waste Management Plan Modification (2001 Plan), site-specific environmental reviews (traffic, on-site and off-site air quality and noise, on-site odor public health and neighborhood character) consistent with current SEQRA/CEQR requirements will be conducted at the eight MTS locations to identify the capacity of each MTS to accept an increment of commercial waste, without causing unmitigatable adverse environmental impacts. This environmental evaluation will have the following elements:

Engineering Capacity Analysis:

The capacity of each MTS to accept an assumed increment of commercial putrescible waste will be evaluated. An engineering analysis that is focused on design and operating constraints and site limitations will be performed for each of the eight MTSs to determine whether processing waste in excess of the quantities that are anticipated to be delivered by DSNY would be feasible. Based on DSNY's historical waste delivery patterns to the MTSs and assumptions on the delivery patterns of commercial waste and equipment throughput, the analysis will assess the hours of MTS operation during which the increment of commercial waste could be processed to avoid off-site queuing of waste delivery vehicles. Sufficient time will be allowed to containerize and load all waste received each day, considering available container storage capacity and barge shift time.

Site-specific environmental reviews (traffic, on-site and off-site air quality and noise and on-site odor) will be conducted at the MTSs to determine whether this increment of commercial waste would cause unmitigatable adverse environmental impacts. Existing conditions will be defined for 2003 (the year in which data is collected). Future no-build conditions will be characterized, including deliveries of DSNY-managed Waste to the MTSs under the long-term export program. Future build year conditions will be characterized by deliveries of commercial waste to the MTSs (in addition to DSNY-managed Waste).

Traffic:

The Consultant Team will perform a traffic analysis at key intersections to establish the impact of shifting private waste disposal to the MTSs. The traffic analysis will be performed as follows:

- Establish baseline conditions;
- Project numbers of commercial vehicles that would deliver waste to each MTS (based on available excess capacity);
- Assign trucks to the street network (commercial waste vehicles will be assigned to existing truck routes providing access to the MTSs – these commercial waste vehicle trucks will be added to the baseline traffic volumes at the Study intersections identified for each MTS); and
- Analyze the impact of the additional commercial waste vehicles. (The impact of sending commercial waste to the MTS will be quantitatively evaluated by performing a Highway Capacity Manual Software (HCMS) analysis at each of the study intersections, per CEQR criteria. Shift variability will be included in a qualitative discussion of potential reduction of private transfer station numbers and capacity.)

Air Quality (On-Site and Off-Site):

The on-site air quality impacts of the converted MTSs will be evaluated to address the additional equipment and modified facility operations required to accept commercial waste using the methodologies employed in the 2000 FEIS. On-site air quality sources will include: wheel loaders and forklifts from waste handling operations; tugboats delivering barges to and from the MTS; DSNY and commercial waste delivery vehicles queuing on-site; and waste delivery vehicles unloading in the MTS. Off-site air quality sources will be waste delivery vehicles (including both DSNY and commercial collection vehicles) that exceed screening criteria identified in the City CEQR Manual.

Odor (On-Site):

On-site odor sources will be limited to emissions from the addition of commercial waste handling operations in the MTS. Off-site odor sources will not be evaluated; vehicles will not idle at off-site locations for extended periods of time.

Water Quality:

For each proposed site, pollutant loadings for selected water quality parameters will be calculated for the addition of commercial waste. Runoff pollutant concentrations of pollutants will be determined through a review of available literature concerning solid waste management facilities or other industrial facilities and/or stormwater quality databases (e.g., USEPA's National Urban Runoff Program (NURP) database, etc.).

Noise (On-Site and Off-Site):

On-site noise sources will include: wheel loaders and forklifts from waste handling operations; tugboats delivering container barges to and from the MTS; compactors, gantry cranes, car pullers; and commercial waste delivery vehicles queuing on-site and operating in the MTS during unloading operations. Off-site noise sources will be waste delivery vehicles (including DSNY and commercial vehicles) that exceed screening criteria identified in the City CEQR Manual.

Public Health:

The Consultant Team will compare the potential public health impacts of MTS operations under no-build (i.e. without commercial waste) and build scenarios, preparing a non-site-specific analysis based on available published data and literature to describe the MTSs. The public health assessment will be performed in the same manner as the Study Area analyses. (See Section 4.5.1.)

Neighborhood Character:

Using available data from the current MTS EIS, neighborhood character will be described based on the area's characteristics, including: Land Use, Population Characteristics, Urban Design and Visual Quality, Parks and other Community Facilities and Cultural Resources. Neighborhood character will be further defined based on data and findings collected in the previous subtasks.

The overall effect on surrounding neighborhoods of commercial waste deliveries at the MTSs on the surrounding neighborhoods will be assessed based on the impact findings of the traffic, air quality, odor, water quality and public health studies. Consequences predicted as the result of work performed in Task 4.5 for Study Areas where the re-assigned commercial waste had been previously handled, will be discussed qualitatively, drawing on the conclusions identified during the traffic, air quality, odor, water quality and public health evaluations. These conditions will be compared to predicted conditions with only DSNY-managed waste handling at the MTSs.

Economic Factors:

The qualitative and, to the extent practical based on available data, quantitative economic impacts of the proposed regulatory and/or economic incentive mechanisms to encourage or require commercial carters to deliver waste to the MTS facilities will be assessed. Such mechanisms would include, under Section 16-201 of the New York Administrative Code, consideration of regulatory changes, such as transfer station permit sunset provisions or permit renewal/modification provisions that entail the concept of offsets; new legislation, such as "flow control;" a text amendment to the Zoning Resolution and application of the principle of "termination upon amortization," as embodied in the Zoning Resolution. The assessment will also consider the possible effects of processing commercial waste at the converted MTSs on the commercial carting industry and its customers.

These findings will be reported in the Study.

Task 4.3 Evaluation of Waste Disposal Capacity Potentially Available to the City

At present, approximately two-thirds of DSNY-managed Waste that is exported from the City is disposed of in Pennsylvania. Using available data from state regulatory agencies, along with information from prior DSNY surveys, the Consultant Team will survey current trends in utilization rates, newly proposed facilities and permit renewal policies, in Pennsylvania and other states, to assess the potential volume and location of disposal capacity that could be available for disposal of both DSNY-managed and commercial waste generated in the City, during the 20-year New Plan period. The assessment will also consider competing demands for this capacity.

For the purpose of this assessment, the availability of landfill and waste to energy capacity is defined as the volume of out-of-City waste disposal capacity that is economically accessible by export from the City. Estimates of the available disposal capacity, supply, demand and prevailing market prices within a defined service area will be made. This analysis will be used to project the waste disposal capacity available to the City over the planning period and to estimate the cost of transporting and disposing of commercial waste generated within the City.

The service area to be studied will be defined to limit the assessment to states that can be reasonably accessed from the City by truck transfer, ocean-going vessel transport and rail. The results of prior DSNY surveys will initially define a "preliminary" Study Area. Potential redefinition of the service area will be evaluated throughout the Study and will be based upon reasonable truck, rail and shipping routes and expected economic breakpoints.

Disposal capacity available to the market area may increase over time as demand increases. The trend in the industry has been for the major waste companies to develop mega-regional landfills. These landfills are usually located in remote areas. The assessment will evaluate, within the service area, the balance of the supply and demand for disposal capacity.

Estimates of the cost of exporting commercial waste will be developed, if sufficient data is available, using the following three methods: (i) reviewing historical market price survey data; (ii) estimating the "willingness to pay" of competing users for this disposal capacity; and (iii) conducting an econometric model study of supply and demand relationships in the service area.

Available data on historic market prices in the survey area will be reviewed. Although historical market prices may not reflect future prices, the data obtained may reveal some simple trends and will form a basis for the more detailed analyses. This information will be used to estimate the amount each major demand center would be "willing to pay" for disposal capacity.

Econometric analyses (e.g., multi-linear regression) are routinely used to project future market prices as supply, demand or other exogenous variables change. To obtain statistically significant results, this approach requires a relatively large and reliable database. An econometric model approach will be formulated and an assessment made of whether the reasonably available data can be used to obtain meaningful results. If so, the econometric model will be used to project future market conditions.

The findings from this investigation will be reported in the Study. Based on these findings, the Consultant Team will also assess the need and related timing for development of additional intermodal waste transfer capacity in or readily accessible to the City to achieve more favorable waste transport economics to remote disposal capacity.

Task 4.4 Assessment of the Potential Impacts of the Relative Concentrations of Commercial Waste Transfer Capacity

In up to four locations in the City (two in the Bronx and one each in Brooklyn and Queens) where commercial waste transfer stations are currently most concentrated, a "Study Area" Analysis will be performed. A "top down" evaluation methodology will be use to determine existing conditions for: (i) traffic, mobile air quality and mobile noise at key intersections along major corridors leading to and from Study Area locations; and (ii) odor and noise from transfer stations located within each Study Area at nearby sensitive receptors.

Existing conditions will be defined through data collection during 2003. Reference may also be made to criteria based upon CEQR thresholds for traffic, noise, air quality and odor as a possible means of assessing whether potentially adverse impacts can be attributed to the concentrations of transfer stations in the Study Areas. As background information, the Study will provide an inventory of as-of-right land uses in manufacturing zones (M-zones).

This assessment will evaluate the impacts of the transfer stations on the Study Area as compared to impacts from alternative industrial uses on the transfer station sites. Existing conditions will be evaluated in the Study Area (with the transfer stations in place) in terms of traffic, air quality and the other applicable Study Area criteria. A hypothetical existing condition would then be defined by "backing out" the transfer station's impacts from the Study Area, assuming that the existing transfer station sites would be occupied by other M-zone land uses typical of existing conditions in the Study Area. The traffic, air quality and other analyses would then be recalculated. The comparative effects on Study Areas with existing transfer stations and with alternative, as-of-right, M-zoned land uses would be determined by comparing the two analyses.

4.4.1 Study Area Evaluations

The Consultant Team has identified those areas where transfer stations are currently most concentrated; Hunts Point and Port Morris in the Bronx, Greenpoint/Williamsburg in Brooklyn and Jamaica in Queens. These will constitute the Study Areas. The Consultant Team will also identify the locations of commercial waste hauling vehicle storage yards and garages through information provided by the Business Integrity Commission.

Traffic Evaluations:

A traffic analysis will be performed at key intersections in each of the Study Areas to establish the impact of transfer station concentrations on the Levels of Service (LOS) on major roadways. A traffic analysis methodology will be developed for the following areas:

- Agreement on operational standards: CEQR traffic assessments typically measure an individual's incremental impact on average driver delay. However, when evaluating the combined effect that transfer stations have, criteria designed around the incremental impacts of a single event are inappropriate. The development of an absolute standard will thus be attempted to assess the traffic impact on acceptable LOS for an intersection approach and individual movements that have a significant adverse impact.
- Select study locations: Analysis intersections will be selected on major truck routes accessing the Study Area locations.
- Classifications for counts: Turning movement counts will be performed at each analysis intersection. At 16 of the 20 intersections, vehicle classifications will consist of auto, non-waste truck and two categories of waste-related trucks (packer and long distance). Six of each set of 20 intersections are assumed to be air quality study locations. At these intersections, the traditional seven-way classification will be supplemented by the two categories of waste-related trucks.

- Hours for counts: The counts will be performed for one weekday with Automatic Traffic Recorder (ATR) counts or three weekdays (Tuesday through Thursday) with one two- to three-hour period in the morning and one two- to three-hour period midday or evening/night.
- Analysis of existing conditions: Existing conditions will be analyzed using the Highway Capacity Manual Software (HCMS). This condition will represent the "impacted" condition for the transfer station Study Areas.
- Analysis of effects of commercial waste vehicles: Based on the detailed classification counts performed, the effects of adding back the commercial waste vehicles (net of the vehicles resulting from the replacement of the assumed land uses) will be analyzed.

Air Quality Evaluations:

Off-Site Operations – The modeling procedures used in the 2000 FEIS will be used for this analysis. Critical intersections will be selected in the four Study Areas for air quality analysis based on traffic volumes, LOS, and locations of sensitive land uses. Air quality levels, based on regulatory standards, will be estimated near each of the critical intersections using actual traffic data and roadway configurations.

Pollutant concentrations estimated at selected intersections within each geographic area will be compared with applicable ambient air quality standards.

On-Site Operations – Analyses will be conducted for facilities located within a specified distance of other transfer stations at four Study Area locations. Up to three facilities per Study Area will be evaluated. Site-specific emission-related data (i.e., stack emission rates and parameters, truck operations, etc.) will be developed from a combination of available information (e.g., owner or vendor information, and NYSDEC or New York City Department of Environmental Protection records for permitted facilities, etc.) and assumptions based on each facility's size and operations. Assumptions will be made regarding the simultaneous operation of all applicable emission sources. Air quality levels at receptor sites (i.e., site boundary locations and sensitive receptor locations identified from land use maps and field observations) potentially affected by the combined emissions of adjacent facilities will be calculated. Following CEQR guidelines, emissions from other major commercial or industrial sources (i.e., other than transfer stations) located within 400 feet of these Study Areas will be considered in these analyses.

Odor Evaluations:

Emission factors for the major odor sources will be developed using the same procedures that were used in the 2000 FEIS (i.e., sampling at source locations representative of emissions from each type of transfer station [putrescible, non-putrescible, fill material], as appropriate, dispersion modeling based on data developed through odor assessment methodologies. Assumptions will be made as to the simultaneous operation of emission sources from more than one facility, and these sources will be considered in the same modeling runs. Odor levels at receptor sites (i.e., site boundary locations and sensitive receptor locations identified from land use maps and field observations) that may be affected by the combined emissions of adjacent facilities will be estimated. The distance between facilities within a Study Area will be the same as that established for the on-site air quality analysis.

Water Quality Evaluations:

Cumulative impacts to water quality due to the grouping of commercial waste transfer stations will be evaluated. Individual transfer stations within a Study Area will be evaluated using readily available information from DSNY or the facilities (if directed by DSNY), to determine the disposition of wastewater and stormwater at these sites. A conservative analysis will then be conducted to evaluate the potential impact of transfer station operations in these Study Areas upon surface water quality. For each facility evaluated within a Study Area: (i) The volume of stormwater runoff and the associated pollutant loading from the facility will be calculated using precipitation data and available databases on stormwater pollution concentration; and (ii) the estimated pollutant loading for each site within a Study Area will be developed by calculating the runoff flow and assigning an average stormwater concentration for each water quality parameter of concern. For each site evaluated, pollutant loadings for selected water quality parameters will be calculated by assigning a pollutant concentration to the runoff flow, as determined through a review of available literature concerning solid waste management facilities or other industrial facilities and/or stormwater quality databases (e.g., NURP database, etc.). The estimated pollutant loading for each site within a Study Area will be developed by calculating the runoff flow and assigning an average stormwater concentration for each water quality parameter of concern. Runoff flow will be calculated from the facility footprint, the average rainfall intensity (inches/hour) and an applicable runoff coefficient. Estimates of the footprints of the individual transfer stations within each Study Area will be prepared from available drawings, permit applications submitted to the DSNY or aerial photographs.

The impacts to water quality associated with the transfer stations within these Study Areas will then be determined through an evaluation of the total pollutant loading associated with all of the facilities within a Study Area and their discharge to surface waters. Potential cumulative impacts due to the operation of multiple facilities within a given Study Area will be estimated by combining the incremental difference in water quality calculated by the model with existing water quality data, comparing these with NYSDEC water quality standards and discussing whether the pollutant loading is significant.

Noise Evaluations:

Off-Site Operations – Off-site operations are principally related to noise generated from transportation of waste material by heavy trucks to and from the facilities. The potential noise sensitivity of receptors located along Study Area-related routes will determine the magnitude and extent of the noise impacts from heavy truck operations. The noise analysis approach will include performing noise monitoring at selected sites and making detailed noise predictions at a number of other sensitive sites to establish baseline conditions. The noise predictions will utilize the latest Federal Highway Administration (FHWA) TNM 2.0 model. The results from monitoring and modeling will be used in the noise impact assessment, which will follow CEQR and FHWA procedures and regulations. Noise monitoring will be performed at the selected sensitive sites during the peak truck traffic hour using calibrated noise measuring equipment. Noise readings will be taken at the free flowing sections of roadways under low wind speed and dry road surface conditions.

Standard procedures will be followed during noise monitoring. Following standard practice, traffic noise impacts will be assessed when the vehicle/roadway noise emission levels are at their maximum and the roadway noise includes noise contribution from Study Area-related trucks. Major truck routes leading to the Study Areas will be identified and traffic counts near sensitive land uses where monitoring and modeling were performed will be utilized. The traffic counts will include total vehicle counts and specific data on DSNY and commercial waste transfer trucks, speeds, and classification of the type of vehicle (i.e., cars, medium trucks with two axles and six wheels, and heavy trucks with more than two axles). The noise contribution from Study Area-related trucks will be calculated based on monitored and modeled data and from existing truck traffic volume data.

On-Site Operations – On-site noise is generated largely from stationary equipment operations within each facility. The potential impact of transfer stations within a Study Area depends on the types and number of stationary sources operating within the Study Area. As there are no screening procedures available to evaluate noise from the transfer stations within a Study Area, the noise model previously developed by the Consultant Team, and utilized to predict stationary source noise levels from containerization facilities in the 2000 FEIS, will also be employed here. An inventory of equipment from each facility in the Study Area will be obtained or assumed. Noise emission levels of each equipment type within each facility will be obtained either from on-site measurement or from manufacturer's data. The noise model will be used to plot 55 dBA noise contours around each facility, taking into account existing screening, the contours from all of the facilities in a Study Area will be combined to obtain cumulative noise from the entire Study Area. Impact determination will be based on the size of the composite contour, the Noise Code and the Zoning Code Standards and the sensitivity of encompassed land uses.

Public Health Evaluation:

Health impacts of data collected during earlier phases of this Subtask and other publicly available data for the Study Areas and in the published literature will be synthesized and assessed. Specifically, the analysis will on a non-site specific basis will address the dilution of odors with distance from transfer stations at the nearest sensitive receptor, the modeled incremental contributions of vehicle emissions to ambient carbon monoxide and particulate matter concentrations in air along major thoroughfares near and/or in each Study Area, and the modeled incremental noise levels along routes and at the nearest sensitive receptor. Impacts of on-site operations on air quality, modeled by each facility, will also be collected.

Measured and modeled impacts of transfer station operations will be evaluated in light of: (i) local, state, or federal standards (where available); and (ii) scientific literature pertaining to the health effects associated with ambient carbon monoxide and particulate matter, obnoxious odors, noise and MSW.

Neighborhood Character Evaluations:

Using available sources (including the SWMP FEIS) generalized data will be gathered for each Community District where the concentrations are located. Contributing factors include: Land Use, Population Characteristics, Urban Design and Visual Quality, Parks and other Community Facilities and Cultural Resources. Neighborhood character will further be defined based on existing traffic, air quality, odor, water quality and public health findings defined in the previous subtasks. The distance of each transfer station from the nearest residential district will be presented.

Potential changes to neighborhood character will then be qualitatively evaluated under various conditions (as described in the Traffic Evaluation Scope above) such as: with operational adjustments made to existing transfer stations; with commercial waste trucks removed and replaced with other hypothetical trucks generated by non-waste uses that could be potentially developed under current zoning; and with some of the commercial waste trucks and operations removed, as may be required to ensure Study Areas operate within CEQR impact thresholds and performance standards). Given these conditions, the neighborhood character will be described as to whether it would likely change or improve, or remain the same as with existing conditions and how these conditions compare to CEQR standards.

4.4.2 DSNY Siting Rules Assessment

The results of the Study Area Analysis will be further evaluated to determine what, if any, revisions should be considered in DSNY's 1998 Transfer Station Siting Rules and permitting requirements. This assessment will focus on ascertaining the potential effects of modifying the Siting Rules or permit requirements to mitigate potential adverse impacts associated with the future siting of new transfer stations. This assessment will consider the findings of the Study

Area Evaluations Tasks in formulating and testing the applicability of siting policies that would: (i) mitigate the potential for an undue concentration of facilities in a given community; and (ii) achieve a more equitable distribution of facilities in manufacturing zones consistent with zoning and other applicable regulatory standards, taking into account the purpose of the zoning resolution to site industrial uses in defined districts.

The evaluation for the potential siting of new commercial waste transfer stations in the City will require the generation and incorporation of numerous data layers into the GIS database. These layers include, but are not limited to, zoning, parks and sensitive receptors. The Consultant Team will use numerous public and private data sources and, as necessary, verify data through field investigations as appropriate for applicability of siting rule restrictions. The Siting Rules will be used as the basis to develop specific criteria to buffer, edit, analyze and query the GIS database. This analysis will allow a visual representation of how the Siting Rules affect the existing transfer stations and what potential areas would accept development of new commercial waste stations without violating existing Siting Rule restrictions and will note factors that typically drive siting decisions, such as access to rail and highways.

4.4.3 Mitigation Summary

The Consultant Team will summarize the results of the Study Area analyses to determine the need for new mitigation policies. The Consultant Team will summarize findings from air, odor, noise, water quality, traffic, economic impact, public health, and neighborhood character evaluations in the Study Area analyses. Possible mitigation strategies will be outlined and evaluated to develop measures that can be instituted by modifying existing policies, practices and regulations.

Mitigation strategies that might be considered for re-permitting of existing or siting of new commercial waste transfer station permits or expansions may include: (i) requiring new transfer station owners to make or fund certain improvements (i.e., intersection improvements, such as lane striping, signals and signs) in the immediate vicinity of the proposed facility or within the Study Area prior to development of a new transfer station; (ii) obtaining air quality offsets by closing other existing commercial waste transfer stations under the same ownership or by other offsets resulting in an overall zero net air quality impact; (iii) limiting the number of waste hauling vehicles along specific roadways during certain periods of time; and (iv) designating specific intersections or routes to be avoided.

Task 4.5 Assessment of the Design and Operation of Existing Commercial Transfer Stations

A field survey will be conducted to assess the design and operation and compliance with applicable zoning standards of a select sample of existing putrescible, C&D and fill material commercial waste transfer stations. The purpose of the field survey is to identify potential changes to facility designs (i.e., perimeter fencing, on-site queuing space, exhaust controls, etc.) and/or operational practices (waste storage and handling, locations of equipment, hours of operation, etc.) that would mitigate the potential for impacts to nearby communities. The recommended design and/or operational changes may be proposed for consideration as recommended policy measures that would modify the regulatory requirements for permitting existing, modified or new transfer stations in the City.

A survey checklist will be prepared to identify design and operational parameters to be reviewed during each visit. The survey checklist will include parameters that are required by City and State regulations governing solid waste and C&D transfer stations, including zoning standards, and additional parameters that, if implemented, would improve the conditions of the facility and its potential impact on the surrounding community. During the field survey, information reported on the Department's Quarterly Reports will be compared to observed conditions (e.g., use of scales) and scale records maintained by the facility to assess the relative accuracy of reported information. Up to 20 transfer stations will be visited with DSNY Permit Inspection Unit personnel. Once checklists are completed for each location, the data will be summarized and assessed to identify common design or operational parameters that are present at each type of facility, and those that are not present, that could result in an improvement to the community. Unit pricing and a range of comparative costs for improvements will be prepared.

Task 4.6 Evaluation of Permitting and Enforcement Effectiveness in Regulating Commercial Waste Collection and Transfer Operations

This Subtask focuses on the detailed analysis of existing State, City and DSNY controls on commercial carting and transfer station development and evaluation of the enforcement of current policies. The Consultant Team will research current policies governing the issuance of permits and the existing practices regarding the evaluation of their impacts. This work will initially inventory the responsible agencies and the respective authority they exercise over the commercial carting industry, waste set-out, and the siting, design, construction and operation of transfer stations. The key regulatory mechanisms are: (i) DSNY Siting Rule requirements and NYSDEC's Part 360 Solid Waste Facility Permits for new and expanded or modified transfer stations; (ii) Zoning Performance Standard requirements; (iii) DSNY Permitting Regulations; and (iv) City DOT Traffic Regulations.

Studies of the effectiveness of enforcement of applicable regulations will be performed to identify gaps in enforcement coverage. The Consultant Team will describe the existing enforcement structure, including: (i) lines of responsibility for enforcement activity within an agency and among several agencies within similar enforcement responsibilities (including DSNY, the City Departments of Buildings, Transportation, and Health, the Business Integrity Commission, and the Police Department – the areas of responsibility and the extent of coordination with other agencies will be noted); (ii) offenses for which summonses may be issued (for each agency, the specific regulations enforced will be listed along with the types of penalties that are associated with particular violations); (iii) analysis of DSNY summons history; and (iv) complaints received from the public. (A limited research effort of DSNY and Environmental Control Board records will be undertaken. The purpose will be to determine the most common types of summonses issued to commercial waste generators, carters and transfer stations, the frequency of violations averaged at transfer stations, and the number of violations typically issued during a single inspection by DSNY personnel.)

The Consultant Team will evaluate enforcement practices, for deficiencies, which may include: (i) gaps in line of responsibility or offenses not addressed; (ii) the need for in-the-field monitoring and measurement technology (i.e., noise meters) to document violations; and (iii) the lack of deterrence resulting in repeat offenders. The Consultant Team will test the extent of impacts due to the limitations of the enforcement program (e.g., agent training in use of noise meters and dust sampling equipment) and a lack of enforcement in the field at select locations. The testing program will be structured as follows:

- Select Test Criteria: In consultation with DSNY, the Consultant Team will select criteria (grouped according to regulatory agency) to be finalized in consultation with DSNY. The recommended criteria should include: (i) conformance to limits on hours and operating requirements; (ii) compliance with enclosure restrictions; (iii) noise levels; (iv) adherence to truck routes; and (iv) compliance with restrictions on off-site queuing, idling and parking.
- Select Test Locations: Test locations will be based on a review of the violation data compiled as a result of this Task.
- Sample Transfer Station-Related Violations: Visits will be made on two separate days to each of the sample transfer stations. Notes will be made if previously cited violations still exist.
- Sample Truck Route Violations: Along major roads leading from the Study Area into or through a residentially zoned area, but which are not designated truck routes, classification counts will be performed to determine the presence of commercial waste-related trucks and other industry trucks. One day of traffic counts will be performed at five intersections per Study Area. The counts will be performed at the two major approaches of each intersection.

An Enforcement Effectiveness Report will be prepared with findings regarding any perceived gaps in enforcement procedures and the extent and nature of any other enforcement deficiencies. Potential modifications to enforcement procedures will be identified, including procedures that may be directed at facility owners/operators who have carter customers with a significant history of repeated violations by, for example, restricting the receipt of waste from these carters.

Task 4.7 Evaluation of Alternative Collection Vehicles

Under almost any scenario for the future, the movement of solid waste in the City will remain heavily dependent upon diesel-powered trucks. The ideal and most effective measure to reduce air pollution would be to reduce the emissions by these trucks. The main objective of this Task is to determine if particulate traps, alternate fuels or truck types might be feasible and lawful means of reducing truck emissions. In consultation with DSNY, which has extensive experience in testing alternative fuels and emissions control equipment on its collection fleet, the Consultant Team will provide an overview of the different options for alternative fuels and vehicle types/retrofits. The focus will be on proven technologies and vehicle types. If regulations are to be imposed or incentives provided, they must represent realistic emission reduction technology and options that would not create undue hardship for truck fleet operators. The two initial review components are as follows:

- Alternative Fuel Options: At the present time, all of the vehicles transporting private waste in the City are powered by either gasoline or diesel fuel produced from petroleum. In recent years, several alternate fuels have been explored; none, however, have been found to be acceptable replacements for gasoline and diesel-fueled vehicles. The options with the most potential for efficient and cost effective emission reductions will be evaluated. The Consultant Team will review the: (i) ability of existing vehicles to be retrofitted with devices that reduce emissions; (ii) safety; (iii) ease of use; (iv) power output of alternative fuels, such as natural gas, methanol, ethanol; (v) the impact of USEPA-proposed and promulgated regulations mandating cleaner burning diesel engines and the use of certain fuels in vehicles; and (vi) the availability of alternative fuel stations. The Consultant Team will also address the use of biodiesel fuels, including the potential generation of biodiesel from putrescible waste.

- Vehicle Size Alternatives: Currently, vehicles hauling private waste in the City vary in size from small, two-axle, six-wheel vehicles to large, articulated 18-wheelers. This alternative will seek to evaluate if one or a variety of sizes of trucks could better serve communities by balancing air quality, noise, and congestion issues with economic feasibility. The analysis will focus on whether regulation of carter vehicle fleets, much like the regulation of City taxi fleets, would yield any environmental or economic benefits over the present system. If standard fleets are used, they may facilitate regulation and streamline inspection of vehicles, which may, in turn, yield a cost savings to the City.

- Noise Suppression Technology: The availability of equipment designed into vehicles and add-on devices that reduce vehicle noise in collection and transfer operations will be investigated. The effectiveness and cost of using this equipment in waste collection and transfer operations will also be assessed.

An evaluation will be performed to determine if a particular type or types of vehicle would be more economically and environmentally feasible. To assess whether alternatives can be implemented, the following will be examined:

- Regulatory Options: The regulatory framework presently in place to license and inspect vehicles and operators hauling trade waste in the City will be analyzed to determine where regulations on fuel type could best be introduced and the procedures for the introduction of those changes.

- Institutional Barriers: The Consultant Team will explore institutional barriers that may pose problems with introducing new legislation or rules.

Task 4.8 Findings and Recommendations

Findings from each of the Tasks completed in the Study will be summarized in a detailed Report. This Report will also identify recommendations for policy strategies that may be implemented by DSNY or proposed for adoption in the New Plan. Results of the Study and recommended policy strategies will be included in the Study Report.

COMMERCIAL WASTE MANAGEMENT STUDY

VOLUME I

PRIVATE TRANSFER STATION EVALUATIONS:

- **Four Study Areas with Transfer Stations in Geographical Proximity**
- **Engineering and Operations Survey of Selected Transfer Stations**
- **Effectiveness of Enforcement**

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Prepared for:

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PREFACE

Local Law 74 of 2000 (LL74) mandated a comprehensive study of commercial waste management (Commercial Waste Management Study or Study) in New York City (City) by a Consultant funded by the City Department of Sanitation (DSNY). This Study undertaken to comply with LL74 will assist the City in managing the commercial waste stream in the most efficient and environmentally sound manner, and assist in the development of the City's Solid Waste Management Plan (New SWMP) for the New SWMP Planning Period.

Volume I addresses the following topics, as specified in LL74:

1. *"the effectiveness of procedures employed and the criteria applied by the department for the issuance and renewal of permits for the operation of putrescible and non-putrescible solid waste transfer stations in minimizing potential adverse environmental, economic and public health impacts on the communities in which such transfer stations are located by examining such issues as (i) the effectiveness of the criteria applied by the department to the siting of putrescible and non-putrescible solid waste transfer stations, including the aggregate effect of the geographic proximity of solid waste transfer stations to each other and (ii) the scope and effectiveness of the operational restrictions imposed upon putrescible and non-putrescible solid waste transfer stations, including the hours of operation and any performance standards established in the zoning resolution of the city of New York;*

2. *the manner in which all applicable laws, rules and regulations relating to the operation of putrescible and non-putrescible solid waste transfer stations, private carters and long haul transport vehicles are enforced, including who should be responsible for such enforcement, and the effectiveness of such enforcement in obtaining compliance with such laws, rules and regulations and in minimizing potential environmental, economic and public health impacts and an analysis of rules relating to routes for transporting material to or from such transfer stations; . . . and*

3. *potential environmental, economic and public health impacts on communities in which large numbers of privately-owned putrescible and non-putrescible solid waste transfer stations are located such as, but not limited to, potential impacts related to air quality, water quality, odors, traffic congestion and noise."*

In addition to this Volume I, the Study consists of five other volumes:

- Volume II: Commercial Waste Generation and Projections;
- Volume III: Converted Marine Transfer Stations – Commercial Waste Processing and Analysis of Potential Impacts;
- Volume IV: Evaluation of Waste Disposal Capacity Potentially Available to New York City;
- Volume V: Manhattan Transfer Station Siting Study; and
- Volume VI: Waste Vehicle Technology Assessment.

This volume, Volume I: Private Transfer Station Evaluations, reports the results of three inter-related evaluations focused on privately owned and operated Transfer Stations:

- **Four Study Areas with Transfer Stations in Geographical Proximity** – which examines potential areas of overlapping effects from Transfer Stations in geographical proximity to each other within four Study Areas.

- **Engineering and Operations Survey of Selected Transfer Stations** – which surveyed selected Transfer Stations to identify means and measures to improve their environmental performance.

- **Effectiveness of Enforcement –** which evaluates the existing enforcement activities that govern Transfer Stations under City and state rules and regulations.

The reports and appendices that provide the analyses and data in support of this Executive Summary are:

"Summary Report on Four Study Areas with Transfer Stations in Geographical Proximity," and its **Appendices and Attachments:**

Appendix A: Neighborhood Character Summary

Appendix B: On-Site Prototype Designs

Appendix C: On- and Off-Site Air Quality Protocol

Appendix D: Odor Sampling

Appendix E: Odor Modeling Methodology

Appendix F: On- and Off -Site Noise Protocol

Appendix G: Water Quality Assessment Summary

Appendix H: Traffic Protocol

Appendix I: Public Health Evaluation of Multi-Facility Effects

Appendix J: Engineering and Operations Survey of Selected Transfer Stations

Appendix K: Effectiveness of Enforcement

Attachment: Technical Backup Data (Available on Request from DSNY Bureau of Long Term Export, Assistant Commissioner, Harry Szarpanski, P.E., (917) 237-5501)

DSNY regulates[1] the privately owned putrescible, non-putrescible and fill material Transfer Stations that are authorized to receive and process these categories of waste materials. The New York State Department of Environmental Conservation (NYSDEC) also regulates[2] the design, construction and operation of Transfer Stations. These Transfer Stations process three types of waste, as defined in DSNY rules:

1. *"Putrescible waste" is solid waste containing organic matter having the tendency to decompose with the formation of malodorous by-products. Putrescible waste generated by the City's businesses is principally office and retail waste with small quantities of putrescible material, but also includes restaurant and other waste. Significant amounts*

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[1] DSNY's regulatory authorities derive from Titles 16, 17 and 25 of the New York City Administrative Code (NYCAC), Title 16 of the Rules of the City of New York (RCNY) and the City Environmental Quality Review (CEQR) Procedures.

[2] NYSDEC's regulatory authority derives from Title 6 of New York Codes, Rules and Regulations (NYCRR), Part 360 and Title 6 NYCRR Part 617 under the state's Environmental Conservation Law (ECL).

of office waste are recycled directly at the source by carters that primarily collect recyclable office paper from commercial buildings and deliver it to recyclers, exporters or paper manufacturers. Consistent with DSNY rules, putrescible waste referred to in this report includes the portions of commercial putrescible waste that are both disposed and recycled (such as office paper).

2. *"Non-putrescible" waste is waste that does not contain organic matter having the tendency to decompose with the formation of malodorous by-products, including but not limited to dirt, earth, plaster, concrete, rock, rubble, slag, ashes, waste timber, lumber, Plexiglas, fiberglass, ceramic tiles, asphalt, sheetrock, tar paper, tree stumps, wood, window frames, metal, steel, glass, plastic pipes and tubes, rubber hoses and tubes, electric wires and cables, paper and cardboard.*

3. *"Fill material" is a subset of non-putrescible waste and, as defined in DSNY rules, is clean material consisting of earth, ashes, dirt, concrete, rock, gravel, asphalt millings, stone or sand.*

EXECUTIVE SUMMARY

Privately owned and operated commercial waste Transfer Stations play a vital role in the City's solid waste management system. Putrescible Transfer Stations currently transfer approximately 6,200 tons per day (tpd)[3] of commercial waste and 7,250 tpd of DSNY-managed Waste disposed by City residents, agencies and not-for-profit institutions to disposal facilities outside the City. Non-putrescible and fill material Transfer Stations play a similarly important role in the recycling and disposal of C&D debris and excavation material, with approximately 8,630 tpd and 19,070 tpd handled at these facilities in 2003, respectively. While critical to the City's waste infrastructure, these facilities must operate and be maintained in an environmentally sound manner, and in accordance with City and state rules and regulations. This volume consists of three independent but inter-related studies on Transfer Stations located throughout the City that examine the effects of geographical proximity in four Study Areas, assess whether the enforcement of existing regulations and the permitting procedures and criteria are effective, and recommend practical means to improve the operation of these facilities which may impact upon the quality of life in the surrounding communities.

It is important to note in this Study that DSNY's Marine Transfer Station (MTS) Conversion Program relies on shipping DSNY-managed Waste by barge and rail, and so is expected to reduce the numbers of trucks currently hauling DSNY-managed Waste from private Transfer Stations for disposal. Moreover, DSNY has taken the initiative to issue three Requests for Proposals (RFPs) solicitations to private vendors that may result in the award of a contract that would have the effect of reducing transfer trailer truck traffic associated with the transport of commercial waste in the Study Areas. Specifically, DSNY long-term export RFPs seek vendor proposals to containerize DSNY-managed Waste at private transfer facilities and transport it out of the City by barge or rail. These RFPs seek alternatives to the rebuilding of the Greenpoint and Bronx MTSs, and a contract entered into by the City would specify that all waste (not just DSNY-managed Waste) accepted at Transfer Stations on which proposals are based be containerized and transported out of the City by barge or rail. This would have the potential effect of significantly reducing the volume of outbound traffic from Transfer Stations in portions of Brooklyn, Queens and the Bronx.

The approach taken and findings for each of these studies is summarized below.

Four Study Areas with Transfer Stations in Geographical Proximity

Scope of Analysis/Approach

The objective of the Study Area analysis was to evaluate whether areas with a number of Transfer Stations in geographical proximity have the potential of producing overlapping environmental effects on air quality, odor, noise, neighborhood character and water quality. In addition, the off-site effects of these facilities on traffic, air quality and noise from mobile sources (Waste Hauling Vehicles) were analyzed. The potential public health effects of the findings of these evaluations were also considered.

The Study Areas were selected based upon a review of the location and geographical proximity of the 69 operating private Transfer Station in the five boroughs. Four Study Areas encompassing 43 of the facilities were identified for analysis: Port Morris, Bronx Community District (CD) #1; Hunts Point, Bronx CDs #2 and #9; Jamaica, Queens CD #12; and Brooklyn CD #1 (primarily East Williamsburg, but including three facilities with four permits in Queens). Table ES-1 shows the names, locations and types of Transfer Stations in each Study Area.

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[3] Tons per day are calculated on the basis of a six-day week, 312-day year.

Table ES-1
Permitted Commercial Waste Transfer Stations within Study Areas

Name	Address	Type Of Transfer Station
Port Morris, Bronx CD #1		
Bronx County Recycling	475 Exterior Street	Fill
Felix Equities	290 East 132^{nd} Street	Fill
Tilcon NY	980 East 149^{th} Street	Fill
USA Waste Services of NY (Waste Management)	98 Lincoln Avenue	Putrescible
USA Waste Services of NY (Waste Management) (1)	132^{nd} Street & Saint Ann's Avenue	Putrescible (Intermodal)
Waste Services of NY	920 East 132^{nd} Street	Putrescible
Total Number in Port Morris, Bronx CD #1 Study Area		**6**
Hunts Point, Bronx CDs #2 and #9		
A.J. Recycling	325 Faile Street	Non-Putrescible
Bronx City Recycling	1390 Viele Avenue	Fill
G. M. Transfer	216-222 Manida Avenue	Non-Putrescible
Kids Waterfront Corp.	1264 Viele Avenue	Non-Putrescible
IESI NY Corp	325 Casanova Street	Putrescible
John Danna and Sons	318 Bryant Avenue	Non-Putrescible
Metropolitan Transfer Station	287 Halleck Street	Putrescible
Paper Fibers Corp.	960 Bronx River Avenue	Putrescible
Waste Management of NY (1)	Oak Point & Barry Avenue	Putrescible (Intermodal)
Waste Management of NY	620 Truxton Street	Non-Putrescible
Waste Management of NY	315 Baretto Street	Non-Putrescible
Total Number in Hunts Point, Bronx CDs #2 and #9 Study Area		**11**

Table ES-1 (Continued)
Permitted Commercial Waste Transfer Stations within Study Areas

Name	Address	Type Of Transfer Station
Brooklyn CD #1		
Point Recycling Ltd	686 Morgan Avenue	Non-Putrescible
Waste Management of NY (2)	75 Thomas Avenue	Non-Putrescible
Waste Management of NY(2)	485 Scott Avenue	Putrescible
Waste Management of NY	215 Varick Avenue	Putrescible
Waste Management of NY	123 Varick Avenue	Non-Putrescible
Waste Management of NY	232 Gardner Avenue	Non-Putrescible
Maspeth Recycling (3)	58-08 48th Street	Fill
IESI NY Corp	548 Varick Avenue	Non-Putrescible
Astoria Carting Company (3)	538-545 Stewart Avenue	Non-Putrescible
City Recycling Corp	151 Anthony Street	Non-Putrescible
Cooper Tank and Welding	222 Maspeth Avenue	Non-Putrescible
Pebble Lane Associates (3)	57-00 47th Street	Fill
Keyspan Energy	287 Maspeth Avenue	Fill
New Style Recycling Corp (2)(3)	49-10 Grand Avenue	Putrescible
New Style Recycling Corp (2)(3)	49-10 Grand Avenue	Non-Putrescible
BFI Waste Systems of NJ (4)	598-636 Scholes Street	Putrescible
BFI Waste Systems of NJ (4)	594 Scholes Street	Non-Putrescible
BFI Waste Systems of NJ (4)	575 Scholes Street	Non-Putrescible
BFI Waste Systems of NJ	115 Thames Street	Putrescible
Hi-Tech Resource Recovery	130 Varick Avenue	Putrescible
Total Number in Brooklyn CD #1 Study Area		**20**

Table ES-1 (Continued)
Permitted Commercial Waste Transfer Stations within Study Areas

Name	Address	Type Of Transfer Station
Jamaica, Queens CD #12		
American Recycling Management [2]	172-33 Douglas Avenue	Putrescible
American Recycling Management [2]	172-33 Douglas Avenue	Non-Putrescible
Regal Recycling [2] [5]	172-06 Douglas Avenue	Putrescible
Regal Recycling [2] [5]	172-06 Douglas Avenue	Non-Putrescible
T. Novelli [2]	94-07 Merrick Avenue	Fill
T. Novelli [2]	94-20 Merrick Avenue	Non-Putrescible
Total Number in Jamaica, Queens CD #12 Study Area		**6**
Total Number of Transfer Stations Evaluated		**43**

Notes:

(1) These two facilities are permitted as intermodal terminals that ship containerized waste by rail. No waste processing is conducted at these sites.

(2) Denotes one facility with two permits.

(3) Four Transfer Stations on the Brooklyn CD #1 list are actually in Queens near the border of Brooklyn but were evaluated as part of the Brooklyn CD #1 Study Area.

(4) These three locations constitute one facility with three DSNY permits under state regulations.

(5) Regal Recycling is enclosing the non-putrescible waste processing operations; therefore, this facility was modeled as an enclosed non-putrescible Transfer Station.

First, current conditions (including the presence of the Transfer Stations) in each of the Study Areas were evaluated. Second, the conditions without the Transfer Stations were evaluated to determine the net contribution of the Transfer Stations. Third, the conditions without the Transfer Stations, but with assumed other industrial uses occupying the same sites, were evaluated assuming the Transfer Stations were replaced by as-of-right general light industrial land uses (e.g., printing plants, laboratories) in the Study Area. This land use replacement scenario assumed that the Transfer Station land uses would be occupied by other M-zone land uses typical of current conditions in the Study Area. The off-site effects of these replacement land uses were calculated using trip generation rates published by the Institute of Transportation Engineers (ITE).

Analyses were conducted for: (1) air quality, odor, noise, neighborhood character, public health and water quality from Transfer Stations located within each Study Area; and (2) traffic, off-site air quality and off-site noise at key intersections/locations along major corridors leading to and from the Study Areas. Although this evaluation is not an environmental review, it uses City

Environmental Quality Review (CEQR) and other planning and engineering review criteria as the best available measure of the environmental effects of Transfer Stations on the surrounding community. Standard models for air quality (United States Environmental Protection Agency [USEPA]-approved Industrial Source Complex Short Term [ISCST3], CAL3QHCR, MOBILE5b and Part 5), noise (Federal Highway Administration's [FHWA's] Traffic Noise Model [TNM] 2.1) and traffic (Highway Capacity Software [HCS] version 4.1c) were used to predict combined effects of the Transfer Stations.

Criteria were identified for each environmental parameter, as described in the "Summary Report on Four Study Areas with Transfer Stations in Geographical Proximity." If the criteria were not exceeded, the Study Area analysis concludes that the overlapping effects of the Transfer Stations were not considered to be adverse. If these criteria were exceeded, means of reducing environmental effects through operational measures or design modifications were identified and then evaluated. If the current conditions for traffic and its attendant effects still exceeded the applicable criteria, further analysis was undertaken, as more fully described in the Summary Report.

Findings and Recommendations

Air quality, odor, noise, traffic, neighborhood character and water quality analyses were conducted to evaluate the potential effects from the geographic proximity of the Transfer Stations within the Study Areas. The analyses modeled areas where the potential effects of Transfer Stations in proximity to each other overlapped (combined effects) and evaluated whether these effects were potentially adverse. It considered combined effects at sensitive receptors in these areas of overlap in manufacturing zones -- for example non-conforming residences, not just contiguous residential zones -- but did not consider new siting actions. The overall results of the Study Area analyses show that the geographical proximity of the existing Transfer Stations in these Study Areas do not cause adverse combined or cumulative effects using reasonable criteria adapted from the CEQR and planning and engineering criteria. There are no findings in the Study Area analyses that indicate there are combined adverse effects to the environment from existing Transfer Stations that would warrant a reduction in the number and capacity of Transfer Stations in the Study Area.

The Study makes certain recommendations for, among other things, better odor control systems at putrescible Transfer Stations to improve the operations and to limit the effects of Transfer Stations. As described in the Volume I, Summary Report, the regulatory regime for siting of new Transfer Stations in the City consists of zoning, operating requirements, siting restrictions, environmental review, the state's detailed Part 360 regulations, the City's Noise and Air Codes, and Vehicle and Traffic Laws. Together the application of these current requirements would tend to mitigate the potential for adverse impacts from a future siting action.

1. ***On-site Air Quality***: The maximum predicted combined contribution of existing Transfer Stations in the Study Area combined with background levels from the closest air quality monitor showed results all below National Ambient Air Quality Standards (NAAQS) for criteria pollutants (carbon monoxide [CO], sulfur dioxide [SO_2], nitrogen dioxide [NO_2] and particulate matter less than 10 microns in diameter [PM_{10}]). For particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), the maximum predicted annual neighborhood average from combined on-site and off-site sources ranges from 1% to 6% of contribution to the latest monitored concentration from the nearest monitoring station within each Study Area.

2. ***On-site Odor:*** Sampling of odors was undertaken in the summer when odor generation from waste decomposition would be at its highest. A review of the controlled and uncontrolled odor emissions from the same facilities revealed that the controlled Transfer Station emissions were no more than 38% lower than the uncontrolled facilities, and in some cases the controlled emissions were deemed higher than the uncontrolled emissions, which is most likely due to the use of scented masking agents instead of more effective neutralizing agents to control odors. The highest frequency of conservatively predicted odor levels exceeding the criteria, assuming no odor controls, was for a receptor in the Brooklyn CD #1 Study Area, where the model predicted an exceedance just under 0.82% of the time (72 non-consecutive hours per year). If more effective (90% efficient) odor controls were implemented at all commercial putrescible waste facilities, the odor levels would be reduced substantially (by 90%), and there would be no overlapping contributions from multiple Transfer Stations in the Study Areas.

3. ***On-site Noise:*** Transfer Stations in the Port Morris, Bronx CD #1 Study Area do not have overlapping noise effects because they are not located in close proximity to each other. However, there were areas of potential overlapping effects from multiple Transfer Stations in Brooklyn CD #1; Jamaica, Queens CD #12; and Hunts Point, Bronx CDs #2 and #9 Study Areas, but the analyses did not predict effects at sensitive receptors located within these Study Area overlap areas. Waste Hauling Vehicles queuing on and off site make the greatest contributions to noise levels. The removal of off-site queuing of Waste Hauling Vehicles reduces noise levels attributable to overlapping effects.

4. ***Traffic:*** Fifty-eight (58) intersections were analyzed in the Study Areas for the traffic analysis. Results indicate that many of the intersections operate at an overall level of service (LOS) C or better under current conditions (six in Port Morris, Bronx CD #1 Study Area; seven in Hunts Point, Bronx CDs #2 and #9 Study Area; 16 in Jamaica, Queens CD #12 Study Area and 23 in Brooklyn CD #1 Study Area). The current conditions at six of the intersections in the Study Areas operate at an overall LOS D, E or F.[4] The percentage of Waste Hauling Vehicles analyzed ranged from 0% to 7% of the total number of vehicles traveling through the intersections during the hours analyzed. Subtracting the Waste Hauling Vehicles from the analysis did not significantly improve the LOS at any intersection analyzed. And when replacement industry trips (that is, traffic that would be generated by other light industrial uses for the Transfer Station sites if the Transfer Stations were absent) were substituted for Waste Hauling Vehicles in the analysis, the LOS remained the same or deteriorated.

5. ***Off-site Air Analysis:*** For the mobile air quality analyses, current conditions were analyzed at two "worst case" links each in the Port Morris, Bronx CD #1 and the Hunts Point, Bronx CDs #2 and #9 Study Areas and at four links each in Brooklyn CD #1 and Jamaica, Queens CD #12. In all instances, results are below NAAQS for all the criteria pollutants. For $PM_{2.5}$, the 24-hour maximum contribution from off-site emission sources

[4] Brooklyn CD #1 Study Area: (1) Meeker Avenue and Union Avenue, and (2) Flushing Avenue/Melrose Street and Varick Avenue/Irving Avenue; Port Morris, Bronx CD #1 Study Area: (1) Bruckner Boulevard and Alexander Street; Hunt's Point, Bronx CDs #2 and #9 Study Area: (1) Hunt's Point Avenue and Bruckner Boulevard, (2) Longwood Avenue and Bruckner Boulevard, and (3) Leggett Avenue and Bruckner Boulevard.

ranged from 0.03 to 1 μg/m^3 (or 0.08% to 2.4% of the latest monitored concentration). The annual neighborhood maximum contribution from off-site emission sources ranges from 0.01 to 0.17 μg/m^3 (or 0.08% to 0.9% of the latest monitored concentration).

7. ***Off-site Noise:*** Two levels of screening were conducted on 23 locations where sensitive receptors exist near convergence points along truck routes to and from the Study Areas -- eight in Port Morris, Bronx CD #1; four in Hunts Point, Bronx CDs #2 and #9; six in Brooklyn CD #1; and five in Jamaica, Queens, CD #12. The first level of screening used total traffic volumes and axle factors from the New York State Department of Transportation (NYSDOT) to conservatively estimate the existing traffic volumes, and whether the addition of Waste Hauling Vehicles would have the potential to double passenger car equivalent (PCE) noise levels, requiring a further evaluation of potential effects (first-level screening).[5] Based on this first-level screening, 17 locations (five in Port Morris, Bronx CD #1; four in Hunts Point, Bronx CDs #2 and #9; three in Brooklyn CD #1; and five in Jamaica, Queens, CD #12) were identified for further screening (second-level screening) using actual field traffic classification counts at these locations to determine the potential for doubling PCEs. Based on this second-level screening, five locations (two locations in Brooklyn CD #1 and three locations in Jamaica, Queens, CD #12) were identified for modeling using Federal Highway Administration's (FHWA's) Traffic Noise Model (TNM) version 2.1. Predicted results from TNM modeling at these five locations were compared to the Study noise threshold (an increase in 3dBA or greater attributable to the Waste Hauling Vehicles). The modeled mobile noise from the Waste Hauling Vehicles at the intersections analyzed did not exceed the threshold. Therefore, there are no predicted noise effects from these Waste Hauling Vehicles.

8. ***Water Quality:*** Twenty-nine of the 43 Transfer Stations within the Study Areas are not near or adjacent to surface water. The remaining 14 Transfer Stations that are adjacent to or near surface water do not have adverse individual or combined effects on water quality in the Study Areas.

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[5]See Volume I Summary Report for intersection locations.

9. ***Neighborhood Character:*** The neighborhood character analyses in all four Study Areas determined that overlapping effects of Transfer Stations, where such effects exist, do not contribute adversely to the typically industrial neighborhood character of the four Study Areas. Moreover, where the technical analyses compared existing conditions to the replacement scenario, in which reasonably anticipated development were assumed to occur in place of the Transfer Stations, it was found that the conditions studied would not necessarily be better than existing conditions. In certain cases, larger volumes of traffic predicted under the replacement scenario could potentially result in diminished neighborhood character quality, compared to existing conditions with the Transfer Stations. The assumption used in creating the replacement industry scenario is that all components of neighborhood character conditions (zoning, socioeconomics, etc.) remain fundamentally the same as existing conditions.

10. ***Public Health:*** Using the conservative assumption that commercial waste Transfer Stations do not control odors at all, receptors in two Study Areas were found likely to experience potentially unacceptable odors at times from overlapping effects. These effects were predicted to be infrequent, occurring less than 1% of the time for all receptors (i.e., less than 72 non-consecutive hours per year), and are not likely to generate sustained annoyance or symptoms. With regard to regulated pollutants, cumulative effects on air quality were predicted to be minimal (for $PM_{2.5}$, 1% to 6% of contribution to the latest monitored background values). The Transfer Stations, in aggregate, do not appear to be important determinants of air quality for any of the pollutants regulated by the USEPA on the basis of human health effects.

Engineering and Operations Survey of Selected Transfer Stations

Scope of Analysis/Approach

This report supplemented the work undertaken as part of the Study Area evaluations through on-site surveys of 24 of the 43 Transfer Stations located in the Study Areas, including putrescible, non-putrescible and fill material facilities. These surveys involved a review of existing information made available by DSNY from its permit records and environmental review documents, and site visits to observe facility operations and collect data on facility designs and operating performance. The data collection activities included odor (at existing transfer stations) and noise sampling (at nearby receptors) and analysis. These data were evaluated to determine if various design or operational measures could improve the environmental performance of existing Transfer Stations in terms of a reduction in pollutant and odor emissions and noise attenuation. Details are provided in Appendix J of Volume I.

Findings and Recommendations

The following recommendations, pertaining to the design and operation of Transfer Stations, are the result of this evaluation.

1. **Ventilation and Odor Control** – The ventilation systems of putrescible Transfer Stations should be upgraded with the addition of state-of-the-art odor control technology to "neutralize" odors in exhaust air, and ventilation capacity should be increased to prevent the escape of odors when facilities are operating with doors open, by maintaining sufficient negative air pressure. The combination of an odor neutralizing system treating exhaust air in conjunction with increased fan capacity, operated correctly, would have synergistic effects to substantially reduce potential odors.

   A number of the putrescible Transfer Stations inspected used rudimentary odor control systems that could be more effective. An example of a state-of-the-art odor control system option is a hard-piped system, suspended above the processing floor, which would introduce an odor-neutralizing agent into exhaust air, as it is ventilated from the building. Implementing this recommendation could include a provision for an equivalent system acceptable to the DSNY Commissioner that is sufficient to meet Zoning Code and Air Code standards.

The fan capacity recommendation would surpass current Building Code standards. It would require increasing fan capacity from 6 air changes per hour (ach) to 8 to 12 ach and treating the exhaust air. Fans would automatically operate at 8 ach with doors closed and at 12 ach with doors open. The additional fan capacity addresses the practical reality that Transfer Station doors are generally open during operating hours when inbound and outbound traffic is heavy and consequently odors can be more readily released from the building.

2. **Odor Prevention** – DSNY's Permit and Inspection Unit (PIU) staff should continue focusing their enforcement efforts on operating conditions that contribute to odor formation during waste processing operations. Inspectors should take particular care to continue to identify and take enforcement action to correct the following conditions, when observed:

    - Floor-wear conditions that contribute to pooling of leachate on the floor. These conditions may be indicated by exposed rebar.
    - Excessive dust accumulation on facility walls that can become a source of odor formation.
    - Clogged trench drains in the floor drain system or grit and grease traps that are not routinely maintained.

    In addition, inspectors should continue to monitor and focus on compliance with a daily ½-hour "clean time" during which the floor is cleared of waste to allow housekeeping functions, such as floor and wall wash-down, cleaning of drains, and maintaining ventilation and odor control systems.

3. **Dust Control** – Both DSNY and NYSDEC regulations require measures to control dust from waste processing operations. Of the three types of Transfer Stations, non-putrescible and fill material facilities generally operate outdoors, while all waste processing activity at putrescible Transfer Stations must occur in an enclosed building. Dust control should continue to be a focus of PIU's enforcement action, particularly when dust from operations is observed crossing property lines at non-putrescible and fill material Transfer Stations or exiting from the exhaust vents of putrescible Transfer Stations. Persistent enforcement will induce facility operators to use relatively simple and effective dust control measures.

   Different means of controlling dust are applicable to each type of facility:

   - Non-putrescible and fill material facilities – Installation of a sprinkler-type system that sprays water on the working pile will substantially reduce the transport of dust from processing operations more effectively than hand-held hoses currently used at many facilities.
   - Putrescible – Installation of a water-misting system for dust suppression within the enclosed processing building is an effective method of minimizing dust in the exhaust air. The system commonly used in the solid waste industry involves pumping water through ¼" to ¾" steel pipe to high-pressure mist nozzles that atomize water, creating a fine mist that reduces dust generation. The atomization process does not cause water to pool on the processing floor. These systems, when operated properly, are effective at reducing as much as 90% of the dust generated at putrescible Transfer Stations.

4. **Stormwater Control** – This issue is specific to non-putrescible and fill material facilities that do not have concrete paved surfaces with appropriate drainage where material is processed. This absence of pavement with appropriately installed stormwater drainage creates two potential problems: (i) runoff into surface water or storm sewers; and (ii) tracking of mud and debris during wet weather onto neighboring streets.

   The first issue is being addressed by NYSDEC under the authority established by Article 27 of the Environmental Conservation Law (ECL) and more specifically by Article 17, Titles 7 and 8 of the ECL. Implementing regulations for Article 17, Titles 7 and 8 are provided under 6 New York Codes, Rules and Regulations (NYCRR) Part 750. These regulations are the basis of the State Pollution Discharge Elimination System (SPDES) program that requires permits for management of stormwater that discharges to surface water or separate storm sewers. Obtaining coverage under the statewide general permit for stormwater associated with industrial activities (GP-98-03) or an individual stormwater permit requires the preparation of a Stormwater Pollution Prevention Plan that would typically entail installation of a paved surface with controlled drainage directed through grit and grease traps or other pretreatment systems prior to discharge to surface waters or storm sewers. Discharge of stormwater containing “leachate” to the sanitary or combined sewer system requires permits from the City Department of Environmental Protection (NYCDEP). NYSDEC is in the process of requiring Transfer Stations in the City to obtain SPDES permits.

The second issue (tracking of mud and debris during wet weather onto neighboring streets) can be effectively addressed by washing the tires of vehicles as they exit the Transfer Station. This can be accomplished through the installation of an automated tire washing system or using manually operated hoses.

5. **Noise Control** – Noise emissions are regulated under the City’s Noise Code §24-243, the Zoning Resolution and Transfer Station Operating Rules. Noise effects may arise at the property boundary where equipment operates outdoors, as is the case with non-putrescible and fill material Transfer Stations (waste processing operations at putrescible Transfer Stations are in an enclosed building), or from Waste Hauling Vehicles queuing in the street in front of these facilities (which was found to be the principal source of noise at Transfer Stations.) However, the Noise Code and Zoning Code do not prohibit the levels of vehicular noise associated with queuing trucks at Transfer Stations. Also, space limitations at many existing facilities limit the options for mitigating this problem. DSNY’s operating rules prohibit non-putrescible Transfer Stations from operating between 7:00 p.m. and 6:00 a.m., to limit noise from such facilities. NYSDEC, during its permit renewal process, is focusing on design measures and permit conditions to limit off-site queuing. These combined approaches can mitigate noise problems in areas where they are most likely to affect residential dwellings.

6. **Air Quality** – The primary sources of air pollution from Transfer Stations are the non-road engines, such as front end loaders, used in waste processing operations, not diesel Waste Hauling Vehicles. This issue is discussed more fully in the evaluation reports of the four Study Areas. It is important to note here that: (i) these engines will be subject to increasingly stringent emission standards promulgated by the USEPA that over time will significantly reduce emissions as older equipment is replaced; and (ii) federal law appears to preempt the City from establishing more stringent standards for these non-road engines. The New York Air Code (NYAC) §24-143, contains a prohibition on *"visible air contaminants from an internal combustion engine of (a) a motor vehicle while the vehicle is stationary for longer than 10 consecutive seconds; or (b) a motor vehicle after the vehicle has moved more than 90 yards from a place where the vehicle was stationary."* This regulation provides a basis for enforcement actions by DSNY's PIU inspectors where old or poorly maintained mobile equipment, such as front end loaders or bulldozers, is emitting visible smoke. Air Code §24-109 and §24-142 provide authority to regulate stationary equipment such as crushers. DSNY should institute a training program for its inspectors in the application of USEPA's (40 CFR 60, Appendix A) Method 9 procedures for opacity testing. (The threshold for human recognition of visible emissions is generally considered to be around 5% opacity.) Certified inspectors issuing citations for opacity violations would induce Transfer Station operators to better maintain or upgrade their equipment.

Effectiveness of Enforcement

Scope of Analysis/Approach

Both the City and New York State regulate the privately owned Transfer Stations. DSNY is the primary local agency responsible for permitting, regulating and inspecting Transfer Stations and NYCDEP's Environmental Control Board (ECB) adjudicates notices of violation that DSNY officers write. DSNY derives its powers to control waste Transfer Station operation from the

City Charter, Title 16, of the New York City Administrative Code (NYCAC) and Title 16 of the Rules of the City of New York (RCNY). The NYSDEC's regulatory authority derives from the Environmental Conservation Law (ECL) and Title 6 of NYCRR, Part 360. The Business Integrity Commission (BIC) does background investigations into character and fitness to operate a Transfer Station and also licenses the vehicles operated by private carters in the City.

As the primary inspector of the City's Transfer Stations, DSNY's PIU conducts most of the on-site inspections. The unit is comprised of twenty-two (22) officers -- 17 Environmental Police Officers and five Environmental Lieutenants. The PIU force conducts a full inspection of each putrescible and non-putrescible Transfer Station at least once per week, and conducts additional, frequent, limited drive-by inspections of such facilities.

During the course of this Study, current management policies governing the City's Transfer Stations were reviewed and evaluated based on infraction statistics gathered from the inspection records at DSNY and NYSDEC to determine the effectiveness of enforcement procedures on the City's Transfer Stations. In addition, other City and state agencies involved with various aspects of enforcement were contacted and the rules and regulations defining their authority reviewed. Details of these analyses can be found in Volume I, Appendix K, Effectiveness of Enforcement.

In addition, a review of historical violation records from 1991 to 2002 was completed as well as an in-depth study of inspection reports for Fiscal Year 2003. The pattern of violation issuance and the type of infraction that led to such summonses were evaluated to gain a better understanding of current enforcement measures and to address potential improvements to the system.

Various fine structures exist depending on the type, severity and frequency of a violation. Certain Transfer Station-type violations, such as operating a Transfer Station without a valid permit or being in violation of operational rules, are termed "major ECB violations" for the purpose of this Study and warrant a fine ranging from $2,500 for a first offense, $5,000 for a second offense and up to $10,000 for third and subsequent offenses. Violations that this Study terms "minor ECB violations" relate to sidewalk and street infractions and have lower liability amounts that warrant fines between $100 and $300, while the Study category of "minor action violations," such as illegal dumping or the presence of noxious liquids, has a maximum fine of up to $450. (The "minor" classification used here is not meant to suggest that such violations are less important, merely that the monetary penalties are less than those for "major" Transfer Station violations.)

City enforcement of regulatory standards on Transfer Station operation is guided by the applicable performance standard for the facility under the Zoning Resolution, as supplemented by the Air and Noise Code and DSNY's regulations. The City has established three kinds of industrial districts, each with specific performance standards: Light Manufacturing (M1 - High Performance), Medium Manufacturing (M2 - Medium Performance) and Heavy Manufacturing (M3 - Low Performance). Transfer Stations are considered a Use Group 18 use. Use Group 18 uses are appropriate in M3 districts subject to low performance standards, and are allowed in M1 and M2 districts provided they meet the more stringent performance standards applicable to those zones with respect to odor, noise, vibration, dust and smoke. Additional noise and vibration restrictions apply to a manufacturing district located adjacent to a residential district. M1 districts often serve to buffer residential and commercial districts from heavier industrial M2 or M3 zones. M2 districts occupy the middle ground between light and heavy industrial areas. Performance standards in this district are less stringent than in M1 areas, as more noise, vibration and smoke are permitted. M3 districts are designated for heavy industries (such as foundries, cement plants, salvage yards, chemical manufacturing, asphalt plants) that generate more objectionable influences and hazards, including noise, dust, smoke and odors, as well as heavy traffic. New residences and community facilities may not locate in M3 districts. These districts are usually situated near the waterfront and are buffered -- for example by M1 districts -- from residential areas. With their low performance standards, M3 zones are particularly well-suited for the siting of Transfer Stations

A field observation was conducted to sample the level of compliance with truck route restrictions around Transfer Stations. Trucks must travel on designated routes, except where they deviate to reach their final destination. Truck route violations are important to monitor as they directly affect the quality of life on residential streets in the surrounding community. (The City Department of Transportation [NYCDOT] is currently conducting a citywide study of truck traffic.) The survey counted Waste Hauling Vehicles using non-truck routes at key intersections in the vicinity of Transfer Stations and compared their number to the number of other trucks and automobile traffic. Intersections with a high potential to be used illegally by Waste Hauling Vehicles -- either key local non-truck route intersections or crossings of local arteries and truck routes -- were selected as observation sites.

Findings

1. Only approximately 0.3% to 6% of total traffic at a non-truck route intersection can be attributed to Waste Hauling Vehicles.

2. There has been a 100% increase in DSNY inspection frequency over the last four years following a doubling in inspection staff and an increase in the closure of negligent facilities. In general, the number of Transfer Stations has declined. In 1990, 153 Transfer Stations were in operation, compared to 96 in 1996 and only 69 in 2004.

3. According to DSNY historical summons data, over the past 12 years (1991 to 2002), roughly 15% of putrescible Transfer Stations, 12% of non-putrescible Transfer Stations and 8% of fill material Transfer Stations accrued more than 20 violations each in the 12-year span.

4. The majority of the City's Transfer Stations are sited in M3 zones (68%), thus reducing their potential effect on the residential community.

5. In 1998, DSNY promulgated new Transfer Station Siting Rules (implemented as a new subsection of the existing rules governing Transfer Stations found in 4 RCNY 16) that included restrictions on the locations in which new Transfer Stations could be sited and limitations on their hours of operation. They included the following general provisions:

    - No siting of new putrescible and non-putrescible Transfer Stations in M1 zones;
    - No siting within 400 feet of residential districts and sensitive receptors such as public parks and schools;
    - No siting of a new non-putrescible Transfer Station within 400 feet of an existing non-putrescible Transfer Station; and
    - No operating of non-putrescible Transfer Stations in an M1 zone between 7:00 p.m. and 6:00 a.m.

Additionally, the rules required Transfer Stations to submit engineering reports and transportation plans with all permit applications. These requirements mean that new facilities would be less likely to be in a location that impacts local residents. The rules apply to applications filed after October 1998, and so did not apply to certain pending applications. Additionally, DSNY promulgated temporary siting restrictions in 2003 that expire later this year and will promulgate new permanent Siting Rules this year.

6. On average, seven "major" DSNY violations were issued at Transfer Stations each month between July of 2002 and June of 2003, and roughly 30 major violations were issued to each type of Transfer Station. Despite the fact that fill material inspections occur much less frequently, fill material violations accounted for roughly 29% of the violations issued by DSNY to Transfer Station operators between July 2002 and June 2003. Putrescible Transfer Stations had the most violations, accounting for 45% of those issued; non-putrescible Transfer Stations accounted for only 26%.

7. According to DSNY violation statistics, on average, 50 "minor" Environmental Control Board (ECB) violations, 351 parking violations and 51 traffic violations were issued per month between July 2002 and June 2003. With an annual count of 5,505 summonses, DSNY issues approximately 460 violation summonses of varying severity each month.

8. According to DSNY statistics for Fiscal Year 2003, pile height/volume over the limit was the most common violation at non-putrescible Transfer Stations; and operating without a permit was the second most common violation. The most common violation reported at putrescible Transfer Stations was an unclean tipping floor.

9. Ten violations were issued by DSNY in Fiscal Year 2003 to persons unlawfully operating a fill material Transfer Station without a permit. This violation results in closing an illegal operation.

10. Spillage from trucks and/or receptacles is a relatively frequent violation. Illegal dumping by both the owner and operator are also relatively common violations issued by DSNY. Causing a street obstruction and the presence of noxious liquids were also reported frequently.

11. The majority of parking violations issued by DSNY are in response to trucks standing or parking without proper equipment, or having a detached trailer. Parking for over three hours in a commercial zone or parking in the wrong direction are also relatively common violations. The transportation of loose cargo without a cover is the most commonly violated traffic rule, with 300 summonses issued by DSNY within Fiscal Year 2003.

Conclusions and Recommendations

In summary, Transfer Station enforcement quality has shown major improvements over the last decade due to the increased frequency of inspections. However, further improvements can be made to improve the level of coordination within and between the City agencies responsible for enforcement, by creating a fully computerized system of inspection forms at the agency level. The improvements in productivity over manual collection and input of inspection data, as well as the overall benefit of a multi-agency coordinated enforcement structure, greatly justifies the investment of resources to create this system. An accessible digital database that will heighten inter-agency cooperation and improve information management is the critical path to improving enforcement practices.

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1.0 OBJECTIVE

As defined in Local Law 74 (LL74) and in the Final Scope of Work for the Commercial Waste Management Study (Study), dated July 31, 2003, the objective of the Study Area Evaluations is to identify:

> Potential areas of overlapping effects from multiple Transfer Stations in the Study Areas for: (1) air quality, odor, noise, neighborhood character, public health and water quality from Transfer Stations located within each Study Area; and (2) traffic, off-site air quality and off-site noise at key intersections along major corridors leading to and from Study Areas; and the potential public health effects from the analyses conducted.

The Study Areas were selected based upon a review of the location and geographical proximity of the 69 operating private Transfer Stations in each of the five boroughs. Attachment A lists these facilities by address, type, community district (CD) location, applicable zoning and permitted capacity. Study Areas were not identified in Manhattan or Staten Island -- there is only one fill material Transfer Station in Manhattan that services Con Edison, and there are six Transfer Stations in Staten Island that are not located in close geographical proximity to each other. The following four Study Areas with concentrations of Transfer Stations were identified for analysis: the Port Morris area, in CD #1, and the Hunts Point area, including portions of CDs #2 and #9 in the Bronx; Brooklyn CD #1; and the Jamaica area, in Queens, CD #12. Forty-three (43) of the 69 operating Transfer Stations are located in these Study Areas. Table 1-1 shows the name, location and type of Transfer Station in each Study Area.

As noted in Table 1-1, there are:

- Six (6) Transfer Stations in the Port Morris, Bronx CD # 1 Study Area: three putrescible waste and three fill material;
- Eleven (11) Transfer Stations in the Hunts Point, Bronx CDs #2 and #9 Study Area: four putrescible waste, six non-putrescible waste and one fill material;
- Twenty (20) Transfer Stations in the Brooklyn CD #1 Study Area: six putrescible waste, 11 non-putrescible waste and three fill material; and
- Six (6) Transfer Stations in the Jamaica, Queens CD #12 Study Area: two putrescible waste, three non-putrescible waste and one fill material.

Figures 1-1 through 1-4 show the location of the Transfer Stations, the major transportation routes to and from the facilities, and the CDs in which the four Study Areas are located.

Table 1-1
Permitted Commercial Waste Transfer Stations within Study Areas

Name	**Address**	**Type of Transfer Station**
Port Morris, Bronx CD #1		
Bronx County Recycling	475 Exterior Street	Fill
Felix Equities	290 East 132nd Street	Fill
Tilcon NY	980 East 149th Street	Fill
USA Waste Services of NY (Waste Management)	98 Lincoln Avenue	Putrescible
USA Waste Services of NY (Waste Management) (1)	132nd St & Saint Ann's Avenue	Putrescible (Intermodal)
Waste Services of NY	920 East 132nd Street	Putrescible
Total Number in Port Morris, Bronx CD #1 Study Area		**6**
Hunts Point, Bronx CDs #2 and #9		
A.J. Recycling	325 Faile Street	Non-Putrescible
Bronx City Recycling	1390 Viele Avenue	Fill
G. M. Transfer	216-222 Manida Avenue	Non-Putrescible
Kids Waterfront Corp.	1264 Viele Avenue	Non-Putrescible
IESI NY Corp	325 Casanova Street	Putrescible
John Danna and Sons	318 Bryant Avenue	Non-Putrescible
Metropolitan Transfer Station	287 Halleck Street	Putrescible
Paper Fibers Corp.	960 Bronx River Avenue	Putrescible
Waste Management of NY (1)	Oak Point & Barry Avenue	Putrescible (Intermodal)
Waste Management of NY	620 Truxton Street	Non-Putrescible
Waste Management of NY	315 Baretto Street	Non-Putrescible
Total Number in Hunts Point, Bronx CDs #2 and #9 Study Area		**11**

Table 1-1 (Continued)
Permitted Commercial Waste Transfer Stations within Study Areas

Name	Address	Type of Transfer Station
Brooklyn CD#1		
Point Recycling Ltd	686 Morgan Avenue	Non-Putrescible
Waste Management of NY (2)	75 Thomas Avenue	Non-Putrescible
Waste Management of NY	232 Gardner Avenue	Non-Putrescible
Waste Management of NY	215 Varick Avenue	Putrescible
Waste Management of NY	123 Varick Avenue	Non-Putrescible
Waste Management of NY (2)	485 Scott Avenue	Putrescible
Maspeth Recycling (3)	58-08 48th Street	Fill
IESI NY Corp	548 Varick Avenue	Non-Putrescible
Astoria Carting Company (3)	538-545 Stewart Avenue	Non-Putrescible
City Recycling Corp	151 Anthony Street	Non-Putrescible
Cooper Tank and Welding	222 Maspeth Avenue	Non-Putrescible
Pebble Lane Associates (3)	57-00 47th Street	Fill
Keyspan Energy	287 Maspeth Avenue	Fill
New Style Recycling Corp (2) (3)	49-10 Grand Avenue	Putrescible
New Style Recycling Corp (2) (3)	49-10 Grand Avenue	Non-Putrescible
BFI Waste Systems of NJ (4)	598-636 Scholes Street	Putrescible
BFI Waste Systems of NJ (4)	594 Scholes Street	Non-Putrescible
BFI Waste Systems of NJ (4)	575 Scholes Street	Non-Putrescible
BFI Waste Systems of NJ	115 Thames Street	Putrescible
Hi-Tech Resource Recovery	130 Varick Avenue	Putrescible
Total Number in Brooklyn CD#1 Study Area		**20**

Table 1-1 (Continued)
Permitted Commercial Waste Transfer Stations within Study Areas

Name	Address	Type of Transfer Station
Jamaica, Queens CD #12		
American Recycling Management [2]	172-33 Douglas Avenue	Putrescible
American Recycling Management [2]	172-33 Douglas Avenue	Non-Putrescible
Regal Recycling [2] [5]	172-06 Douglas Avenue	Putrescible
Regal Recycling [2] [5]	172-06 Douglas Avenue	Non-Putrescible
T. Novelli [2]	94-07 Merrick Avenue	Fill
T. Novelli [2]	94-20 Merrick Avenue	Non-Putrescible
Total Number in Jamaica, Queens CD #12 Study Area		**6**
Total Number of Transfer Stations Evaluated		**43**

Notes:

(1) These two facilities are permitted as intermodal terminals that ship containerized waste by rail. No waste processing is conducted at these sites.

(2) Denotes one facility with two permits.

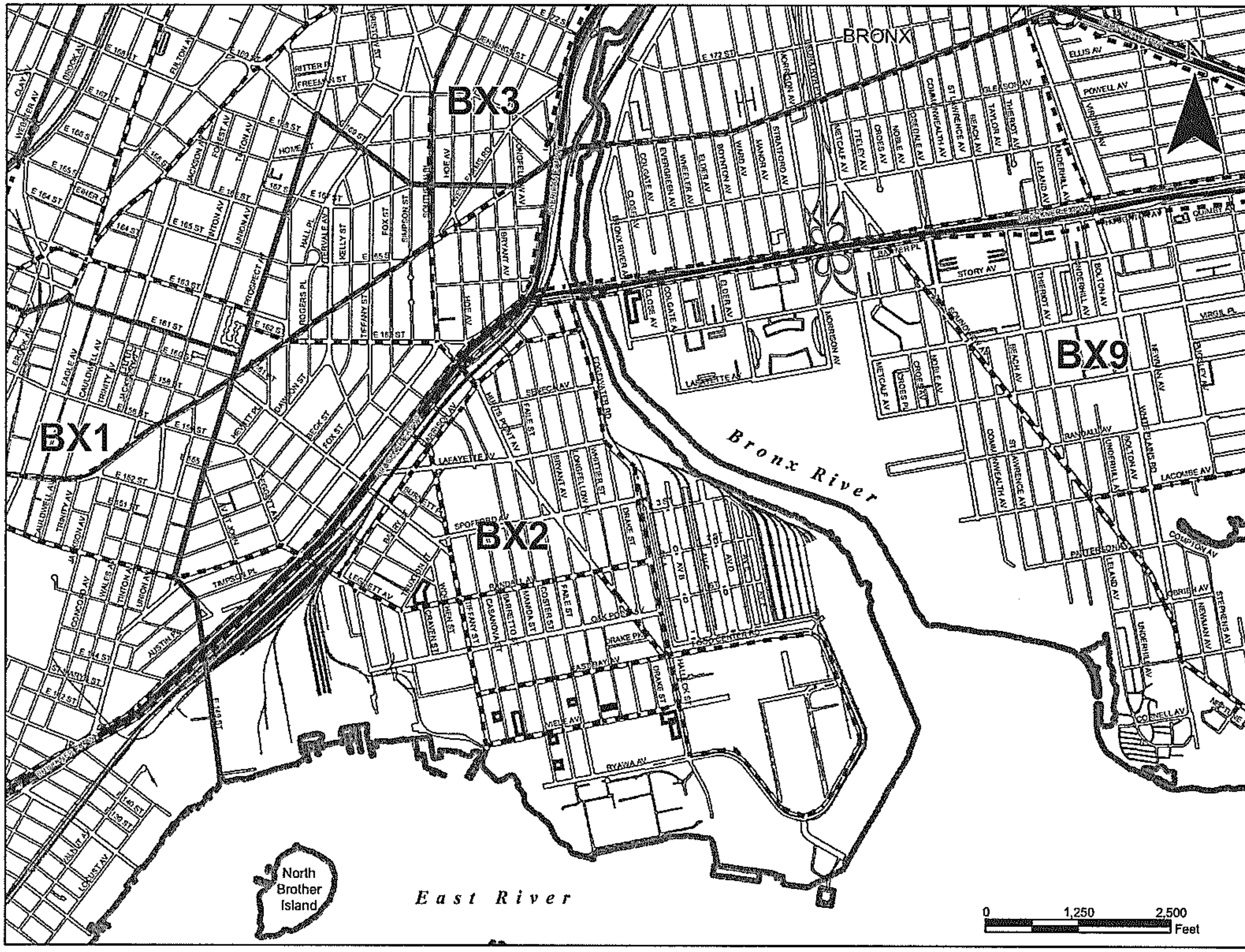
(3) Four Transfer Stations on the Brooklyn CD #1 list are actually in Queens near the border of Brooklyn but were evaluated as part of the Brooklyn CD #1 Study Area.

(4) These three locations constitute one facility with three New York City (City) Department of Sanitation (DSNY) permits under state regulations.

(5) Regal Recycling is enclosing the non-putrescible waste processing operations; therefore, this facility was modeled as an enclosed non-putrescible waste Transfer Station.

Figure 1-1
Truck Routes
Hunts Point, Bronx CDs #2 and #9
Study Area

City of New York
Department of Sanitation



Legend
Community Boards
Truck Routes
Through Truck Route
Local Truck Route

Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

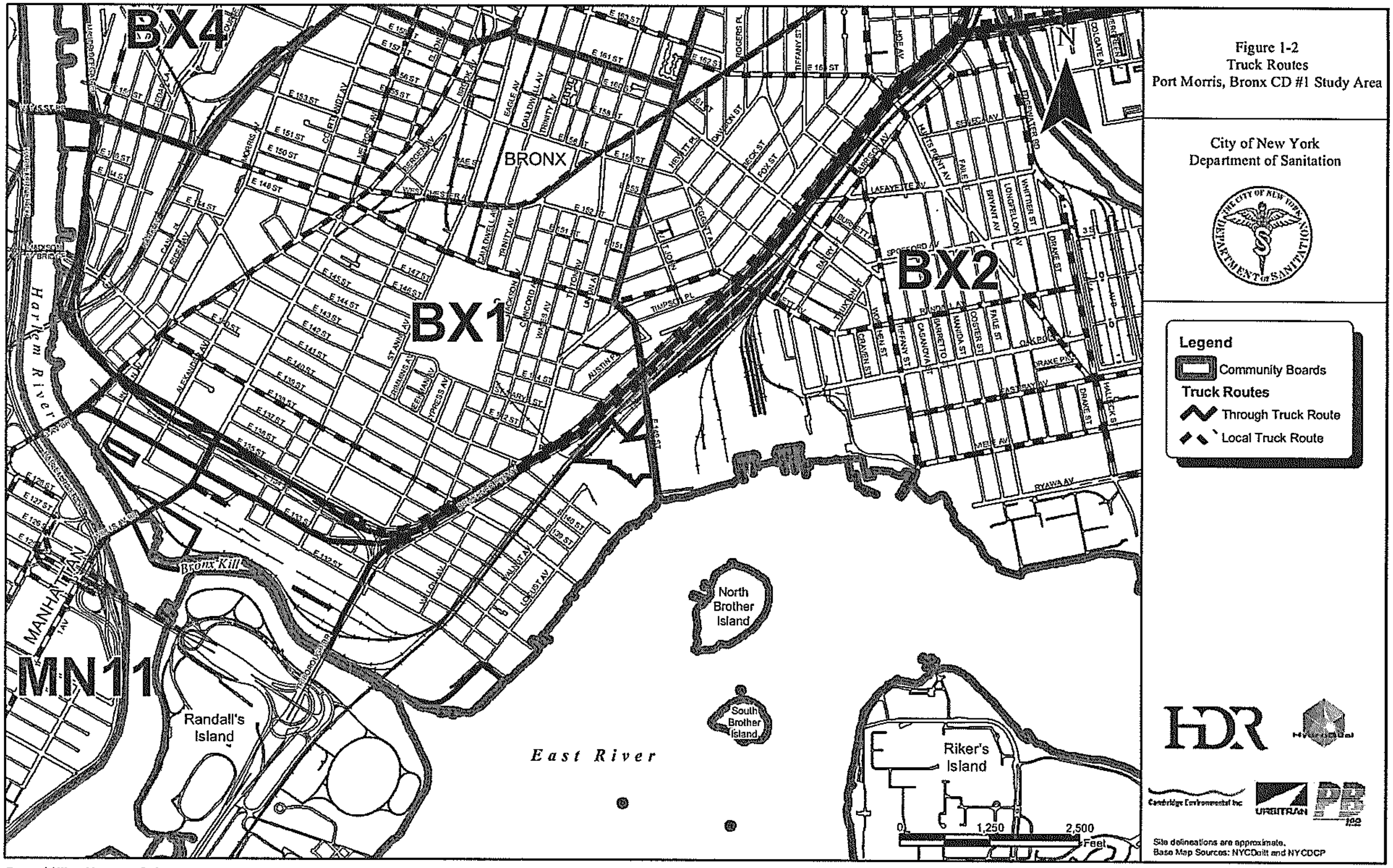


Figure 1-2
Truck Routes
Port Morris, Bronx CD #1 Study Area

City of New York
Department of Sanitation

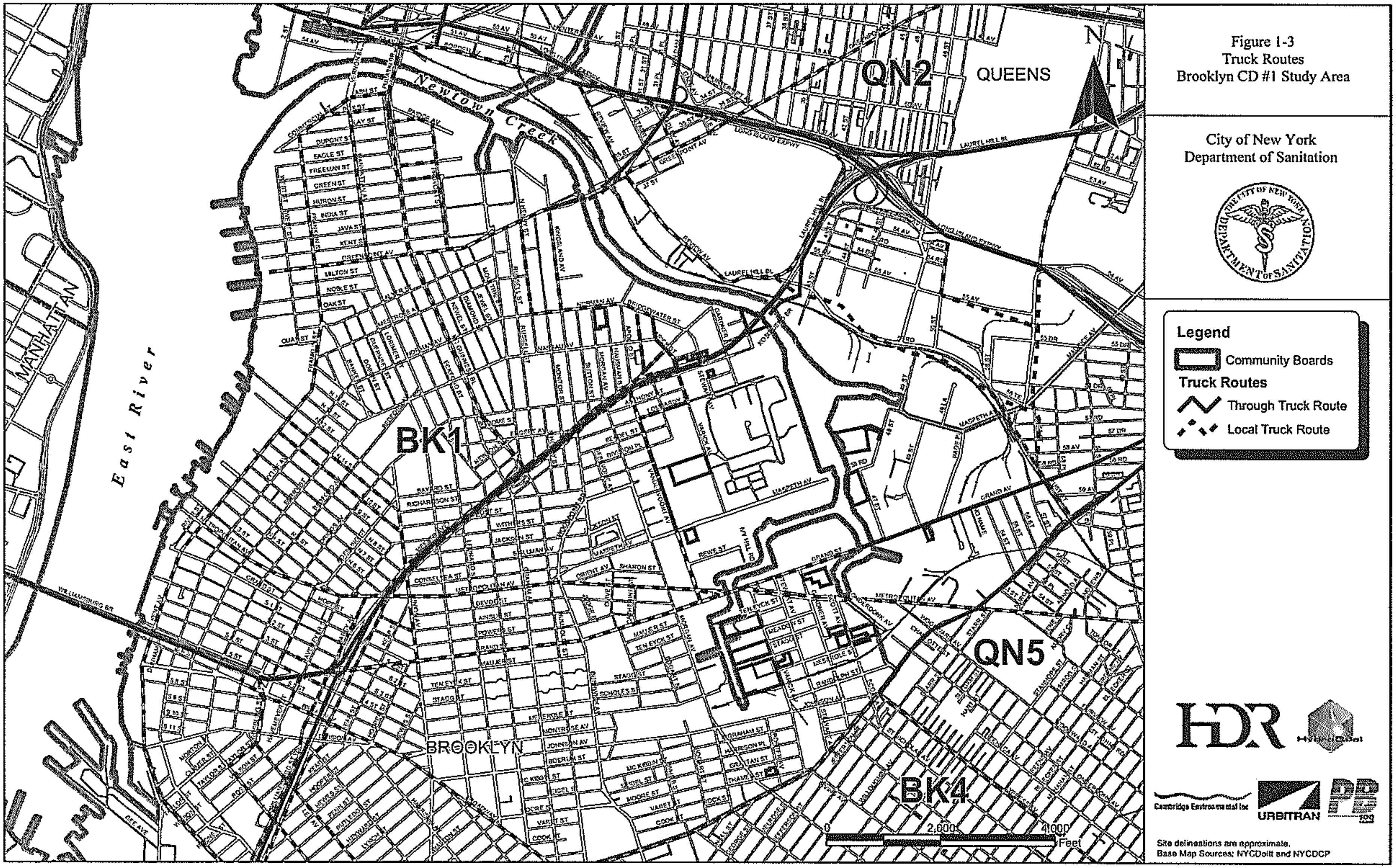


Figure 1-3
Truck Routes
Brooklyn CD #1 Study Area

City of New York
Department of Sanitation

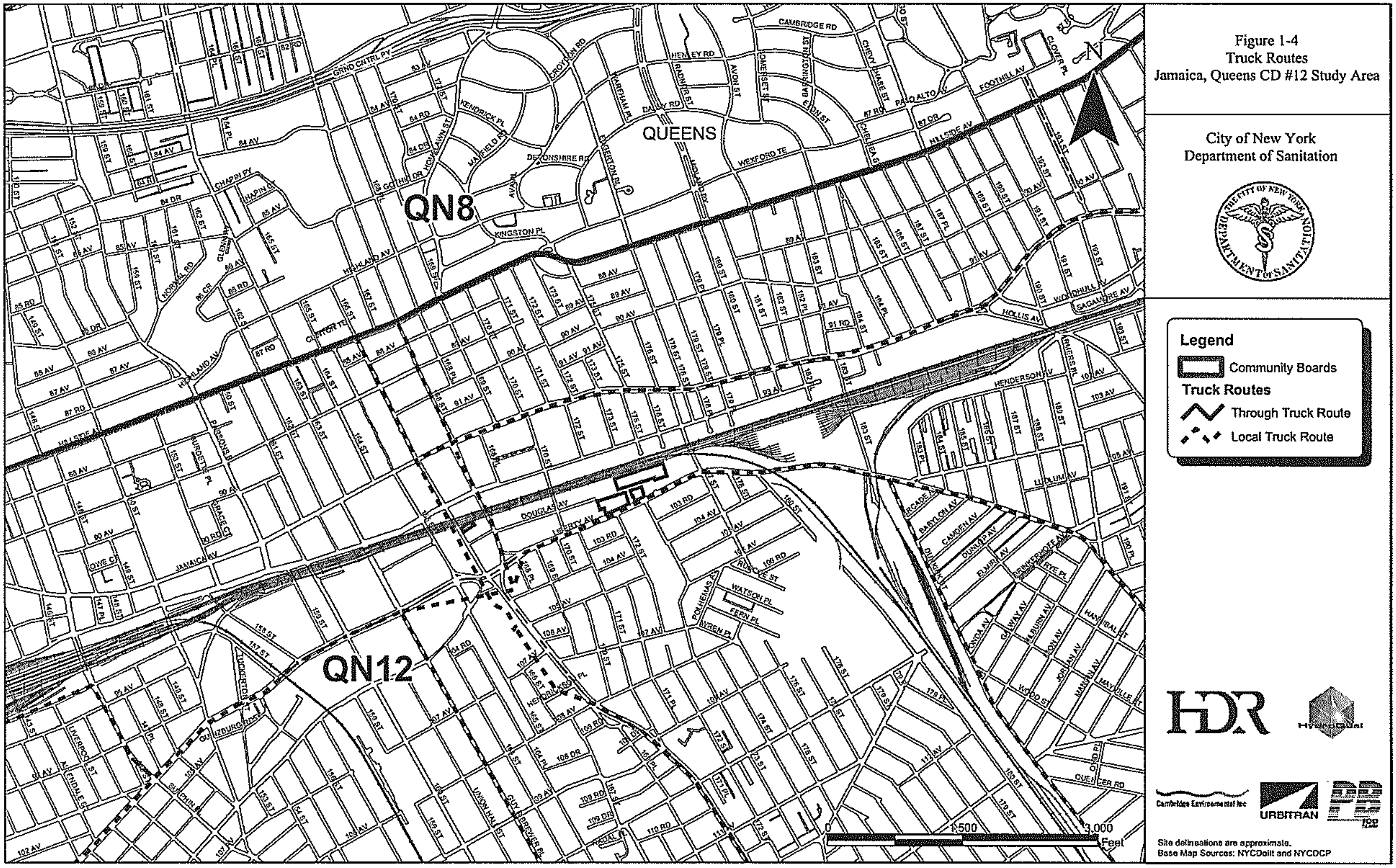


Figure 1-4
Truck Routes
Jamaica, Queens CD #12 Study Area

2.0 HISTORICAL/LEGISLATIVE OVERVIEW OF TRANSFER STATION REGULATION

One of the objectives of LL74 is to assess the effectiveness of the permitting procedures and current criteria applied by the New York City (City) Department of Sanitation (DSNY) to the siting of Transfer Stations in minimizing potential adverse impacts on the communities in which such Transfer Stations are located, including any aggregate impact of the geographic proximity of Transfer Stations to each other. This section provides background on Transfer Station regulations, explains how applications undergo environmental review and discusses DSNY's current siting rules and permitting procedures.

2.1 Background on DSNY and New York State Department of Environmental Conservation (NYSDEC) Transfer Station Permitting

There have always been Transfer Stations in the City. Transfer Stations locate where suitable zoning, transportation access, proximity to wastesheds and economics are favorable. The regulation of private Transfer Stations has evolved over time and become increasingly stringent. In addition to ensuring that Transfer Stations are sited in industrial districts established by law, the City's criteria for siting Transfer Stations include certain restrictions promulgated in 1998 (discussed below), and the completion of an environmental review.

Prior to 1990, putrescible waste Transfer Stations were regulated locally by the City Department of Health, while non-putrescible waste Transfer Stations required permits from DSNY. Such facilities were (and are) required to meet certain performance standards required by the Zoning Resolution with respect to odor, noise, dust, smoke and enclosure, and comply with the City's Noise Code and Air Code. Both types of facilities also required permits from the NYSDEC, which promulgated additional detailed regulations (Title 6 of the New York Codes, Rules and Regulations [NYCRR], Part 360) under the State's Solid Waste Management Act in 1988.

2.1.1 City Regulation of Transfer Stations

DSNY was given additional authority to promulgate regulations to control and supervise non-putrescible waste Transfer Stations pursuant to Local Law 49 of 1989. In 1990, the City had 153 Transfer Stations (159 permits): six dual putrescible and non-putrescible waste, 39 putrescible waste, 70 non-putrescible waste and 38 fill material. Local Law 40 of 1990 transferred to DSNY the responsibility for regulating putrescible waste Transfer Stations and required DSNY to promulgate more detailed rules for the transfer station industry. DSNY adopted rules for putrescible waste Transfer Stations in 1990 and additional rules in 1991, requiring facilities previously permitted by the City Department of Health to apply for new DSNY permits. A substantial number of operating Transfer Stations were initially unable to obtain a new DSNY permit, due to one or more problems: inability to obtain a Certificate of Occupancy indicating a Use Group 18 use; inability to operate with the doors closed (many facilities lacked doors); or failure to operate within a fully enclosed structure. To force such facilities to come into compliance, DSNY issued notices of violation of $10,000 or more for such facilities, and entered into a series of compliance agreements giving the operators a limited amount of time to come into compliance or cease operating.

The NYSDEC revised its 6 NYCRR Part 360 Transfer Station regulations in 1993. DSNY adopted additional rules for non-putrescible waste Transfer Stations and fill material Transfer Stations in 1994. Among other things, these rules provided new limits on pile heights and new fence requirements for unenclosed non-putrescible waste and fill material Transfer Station operations in proximity to residential districts. Within 300 feet of a residential zone, an unenclosed construction and demolition (C&D) debris pile cannot exceed eight feet in height. If an unenclosed non-putrescible waste Transfer Station is more than 300 feet from a residential zone, the maximum pile height is 40 feet for separated concrete, rock, gravel, asphalt, brick, dirt or metal; 30 feet for separated, chipped wood; and eight feet for all other non-putrescible waste. Similarly, the maximum pile height at unenclosed fill material Transfer Stations is eight feet within 300 feet of a residential zone, and 40 feet if more than 300 feet from a residential zone. In addition, for both no-putrescible waste and fill material Transfer Stations, unenclosed operations conducted within 300 feet of a residential zone require an opaque perimeter fence at least 15 feet high, while such facilities operating more than 300 feet from a residential zone require a minimum fence height of 10 feet high.

In 1996, the City Council enacted Local Law 42, which created a Trade Waste Commission (TWC) (now named the Business Integrity Commission [BIC]) to regulate the commercial carting industry in the City. This law also required Transfer Station applicants to undergo review by the TWC. During the period from 1990 to 1996, the combination of increased regulatory requirements, enforcement and consolidation in the industry led to a decline in the number of Transfer Stations in the City from 153 (including six dual facilities) to 96.

2.1.2 NYSDEC Permitting Criteria

A Transfer Station permit issued by NYSDEC must assure, to the maximum extent practicable, that the permitted activity will pose no significant adverse impact on public health, safety or welfare or environmental or natural resources, and that the activity will comply with the provisions of Part 360 and with other applicable laws and regulations. State regulations require an environmental review for NYSDEC putrescible and non-putrescible waste Transfer Station permits, but not for fill material Transfer Stations. NYSDEC is empowered to impose conditions on Transfer Station permits, including but not limited to inspection, financial assurance, technical data gathering and reporting, data analysis, quality control, quality assurance, sampling, monitoring (including the imposition of on-site environmental monitors), reporting and verification.

2.2 Environmental Review of Transfer Station Applications

DSNY requires an environmental review for all new Transfer Stations (including fill material Transfer Stations), and for Transfer Stations seeking an increase in permitted capacity. DSNY's environmental review is guided by the City Environmental Quality Review (CEQR) Technical Manual, which was revised in 2001, in addition to supplemental technical guidance employed by City agencies such as the City Department of Environmental Protection (NYCDEP) (e.g., for fine particulate air emissions). DSNY's environmental review for new Transfer Stations and for Transfer Station increases in capacity includes, as appropriate, a consideration of the standard CEQR categories, namely: land use, zoning and public policy; socioeconomic conditions; community facilities and services; open space; shadows; historic resources; urban design/visual resources; neighborhood character; natural resources; hazardous materials; waterfront revitalization program; infrastructure; solid waste and sanitation services; energy; traffic and parking; transit and pedestrians; air quality; noise; construction impacts; and public health. Since 2001, the analysis of air impacts must include a consideration of fine particulate matter 2.5 microns and smaller in diameter ($PM_{2.5}$), using methodology approved by the NYCDEP.

In particular, the study area for neighborhood character is typically 400 feet from the facility boundary, pursuant to the 2001 CEQR Technical Manual. Preliminary thresholds used to determine if a detailed assessment is appropriate include any of the following conditions: a conflict with surrounding land uses or land use policy; a substantial change in urban design, building bulk or streetscape; impact upon visual features or views, historic resources or socioeconomic conditions (direct or indirect displacement of population or businesses or substantial change in character in businesses); a substantial worsening of traffic together with a change in the local type of vehicles (where the amount of traffic and type of vehicle contributes to neighborhood character); and significant adverse noise impacts together with a change in the noise acceptability category.

DSNY files and circulates its environmental review documents and determination of significance with community boards, appropriate elected officials and interested parties. In addition, beginning in March 2003, the NYSDEC adopted an Environmental Justice policy, which potentially affects applicants for NYSDEC Transfer Station permits and permit modifications. NYSDEC now reviews such applications to determine whether they are subject to this policy, and, if they are, the applicant may be required to take additional procedural steps to ensure compliance with the Environmental Justice policy in the application.

DSNY's review of Transfer Station applications includes a consideration of detailed documents, including an engineering report, site plan, odor control plan, drainage details, traffic quantity and routes, and other matters. An Environmental Assessment Statement (EAS) must be submitted that discusses each of the environmental impact categories, and whether the proposed action would reasonably be expected to result in a significant adverse environmental impact based on established thresholds and criteria in the 2001 CEQR Technical Manual. DSNY staff review the majority of the required impact categories, while the NYCDEP reviews air quality, noise and odor studies, and the City Department of Transportation (NYCDOT) reviews any required traffic studies. In addition to a complete environmental assessment form and any related studies, DSNY requires certain other information from applicants, as detailed in a DSNY memorandum to applicants (see Attachment B). In particular, applicants must provide to DSNY copies of their Part 360 NYSDEC application. DSNY issues permits to operate, while NYSDEC typically requires both a permit to construct and a permit to operate a facility. Therefore, DSNY generally issues its permit only after NYSDEC issues its permit.

2.2.1 Coordination With NYSDEC on Environmental Reviews

The joint environmental review responsibilities for Transfer Station permits involving both DSNY and the NYSDEC were set forth in a consent order in City of New York v. New York State Department of Environmental Conservation, Supreme Court, Albany County, Index No. 7218/91 (Consent Order). Pursuant to this Consent Order, since 1992 DSNY and NYSDEC have served as co-lead agencies in conducting the necessary environmental review for new putrescible and non-putrescible waste Transfer Stations, and for certain operating Transfer Stations that had never received a NYSDEC permit. For permit modifications, DSNY and NYSDEC determine on a case-by-case basis which agency is appropriate to serve as lead agency, or whether a co-lead agency designation is appropriate. For fill material Transfer Station permits, DSNY requires an environmental review, but NYSDEC does not. DSNY permit renewals are not subject to an environmental review, unless significant modifications are proposed.

In addition to compliance with environmental review and other NYSDEC and DSNY permitting procedures, Transfer Station operators are required to comply with the City's Zoning Resolution performance standards for the relevant zoning classification (M3, M2 or M1), as well as the more detailed Air Code (including odor) and Noise Code provisions. Commercial waste vehicle operators must abide by relevant Vehicle and Traffic laws, including restrictions on vehicle idling and parking and requirements to use designated truck routes; Waste Hauling Vehicles must meet certain operational requirements.

2.3 Closure of Fresh Kills Landfill and Interim Export

In 1996, the state enacted a law that required the City's Fresh Kills Landfill to close by December 31, 2001. The City then began an intergovernmental process to plan for alternative transfer, transport and disposal of the approximately 11,000 tons per day (tpd) of DSNY-managed Waste then disposed of at Fresh Kills. The City moved forward quickly to begin to phase out disposal at Fresh Kills through the implementation of Interim Export contracts with private Transfer Stations and out-of-City disposal facilities for the transfer and/or disposal of DSNY-managed Waste. Interim Export contracts began with Bronx waste in 1997, resulted in the closure of Fresh Kills in March 2001 and are proposed to be replaced with long-term service contracts pursuant to the new Solid Waste Management Plan (New SWMP) now being prepared for submission to the City Council.

2.4 Evolution of DSNY Siting Rules

The following reports on events leading to changes in DSNY Siting Rules over time.

2.4.1 Neighbors Against Garbage Case

In an lawsuit filed in May, 1996, Neighbors Against Garbage v. Doherty, Index No. 10923/96 (Supreme Ct. NY County, March 16, 1997), a coalition of community groups brought suit to require DSNY to promulgate additional rules governing the siting of Transfer Stations. The case involved an interpretation of the language of Local Law 40 of 1990 requiring DSNY to promulgate rules concerning the siting of Transfer Stations in relation to other such facilities, residential premises and/or other premises as may be appropriate. The suit did not seek to establish what the appropriate siting rules should be. The trial court found, and the Appellate Division affirmed, 245 AD2d 81 (1st Dept. 1997)**,** that the City's 1991 and 1994 rules addressed the permitting, design, operation and maintenance of Transfer Stations, but did not sufficiently address their proximity to residences, schools and parks and other Transfer Stations, as required by Local Law 40.

2.4.2 Zoning and DSNY 1998 Siting Rules

Until 1998, Transfer Stations could be located in M1, M2 and M3 zones (designated for light, medium and heavy industry, respectively), provided they met the respective performance standards for such zones, notably with respect to odor, noise, dust and enclosure. As anticipated by the Zoning Resolution, the areas of the City with the largest number of Transfer Stations are the districts with large areas of industrial zoning, notably including the South Bronx and Brooklyn East Williamsburg/Newtown Creek areas. Brooklyn's CD #1, which abuts Newtown Creek and includes the Brooklyn Study Area, has 38% of its area zoned for industry (M1, M2 and M3). In the South Bronx, CD #1, which includes the Port Morris Study Area, and CD#2, which includes the Hunts Point Study Area, have approximately 20% of their areas zoned for industry. Queens CD #2, also abutting Newtown Creek and containing several Transfer Stations, has 31% of its area zoned for industry. These are the largest percentages of industrial-zoned land in the City's 59 CDs. The City has designated certain industrial districts, long reserved for heavy industrial use, as Significant Maritime/Industrial Areas and Waterfront Manufacturing Zoning Districts. For example, both designations apply to the South Bronx industrial waterfront, and to the Newtown Creek and English Kills industrial area near the Brooklyn-Queens border, at the edges of Brooklyn CD #1 and Queens CD #2 and CD #5.

In October 1998, DSNY promulgated additional regulations governing the siting of new Transfer Stations and the expansion of existing Transfer Stations. The 1998 siting rules prohibit new non-putrescible waste and fill material Transfer Stations from locating in an M1 district or less than 400 feet from a residential district, public park, school or other non-putrescible waste

Transfer Station. The rules also prohibit existing non-putrescible waste Transfer Stations from expanding into an M1 district or within 400 feet of a residential district, public park, school or other non-putrescible waste Transfer Station. Further, the rules prohibit existing non-putrescible waste Transfer Stations that are lawfully operating within 400 feet of a residential district, public park, school or other non-putrescible waste Transfer Station from expanding closer to such residential district, park, school or other non-putrescible waste Transfer Station. A non-putrescible waste Transfer Station that receives and removes all solid waste by rail or barge would be prohibited from locating in an M1 district but would be exempt from the 400-foot-buffer requirement, provided all solid waste processing is enclosed. The rules measure the distance to the residential district, public park, school or other non-putrescible waste Transfer Station from the site boundary of the non-putrescible waste Transfer Station.

For putrescible waste Transfer Stations, the 1998 rules contain restrictions that are identical to those for non-putrescible waste Transfer Stations, except that they do not require a buffer distance between a putrescible waste and any other Transfer Station, and the distance between the Transfer Station and residential district, public park or school is measured from the structure enclosing waste handling operations, rather than from the Transfer Station site boundary. (These differences in rules are due to the fact that putrescible waste Transfer Stations are fully enclosed, unlike the non-putrescible waste Transfer Stations.) Under the 1998 rules, non-putrescible waste Transfer Stations located in an M1 zone may not operate between 7:00 p.m. and 6:00 a.m. Putrescible waste Transfer Stations may not receive solid waste on Sunday mornings between 4:00 a.m. and noon.

The 1998 rules also require all Transfer Station operators to submit an annual engineering report certifying that the facility complies with all applicable performance standards of the Zoning Resolution and the applicable provisions of the City Health Code. In addition, all applicants for Transfer Station permits must submit a truck transportation plan that specifies the route that trucks will take when transporting solid waste or other material out of the facility for final disposal, reuse or recycling. DSNY may require as a condition for issuing a permit that the Transfer Station operator establish a system to require such trucks exiting the facility to use specific transport routes. The rules require a Transfer Station operating under an interim authority in an M1 district to obtain a full permit within five years. The rules provide for the possibility of a variance from the buffer distance and other requirements, upon a showing that the granting of a variance would not produce a significant adverse environmental impact. Notably, the 1998 rules exempted from the new siting requirements existing operations and applications for new facilities for which environmental assessments had been submitted to DSNY prior to October 1998. As a result of public comments received on the draft rules, the final 1998 rules were modified in several respects, including increasing the proposed buffer from 300 feet to 400 feet.

The 1998 rules were the subject of an environmental assessment. DSNY found that the rules would not cause a significant adverse impact on the environment and would not lead to Transfer Stations located within geographical proximity that would result in transportation, air quality or noise impacts. DSNY found that the 1998 rules would offer greater environmental protection to the surrounding community than did then-existing requirements. By prohibiting new Transfer Stations in M1 zones, the 1998 rules were estimated to reduce by half the geographic area in which Transfer Stations could potentially be sited, while continuing to allow any new Transfer Stations in M2 and M3 zones with substantial buffers to residences, schools and parks.

2.4.3 Challenge to 1998 Siting Rules

A coalition of community organizations and others filed suit challenging the 1998 siting rules as insufficiently restrictive, in Organization of Waterfront Neighborhoods (OWN) v. Carpinello, Supreme Court, New York County, Index 103661/99). In a ruling, the Court noted that it had certain concerns about the 1998 rules. Following a lengthy attempt to resolve the dispute through mediation, DSNY committed to promulgate revised siting rules, while the Court retained jurisdiction of the lawsuit. The 1998 siting rules remain in effect pending the promulgation of revised siting rules. Meanwhile, DSNY was directed to provide the plaintiffs with 40 days notice prior to any substantive DSNY Transfer Station permit approval.

2.4.4 The 2003 Interim Siting Rules

In 2003, DSNY adopted interim siting rules designed to remain in place pending completion of the Study. These interim siting rules prohibit new non-putrescible waste and fill material Transfer Stations or expansions, prohibit new putrescible waste Transfer Stations to be permitted, and allow expansions of putrescible waste Transfer Stations in Brooklyn CD #1 and Bronx CD #2 only upon a showing that the requested capacity would be offset by closing permitted capacity at another Transfer Station within the same CD. DSNY identified these two CDs as appropriate for an offset requirement under the interim siting restrictions as they currently have the highest number of Transfer Stations in the City. In addition, pursuant to the interim rules, DSNY could authorize the operation of an intermodal facility at which waste arrives and remains in sealed containers and is transloaded onto a rail car or vessel for further transport. DSNY expects to replace the Interim Siting Rules with permanent rules in 2004. DSNY's Interim Siting Rules have been challenged by a Transfer Station applicant in a pending lawsuit.

In early 2004, DSNY published additional proposed rules, currently pending before the City Council for comment, concerning sites used for the transloading of sealed intermodal containers of solid waste from one type of transportation mode to another, such as from truck to rail, or from truck to barge.

3.0 EVOLUTION OF STUDY AREA LAND USE

A review of land uses over the past 100 years in the Study Areas indicates that:

- The Port Morris, Bronx CD #1 Study Area has primarily developed as an industrial area;
- The Hunts Point, Bronx CDs #2 and #9 and Brooklyn CD #1 Study Areas have developed with industry and residential uses simultaneously; and
- The Jamaica, Queens CD #12 Study Area appears to have developed as a residential area that was eventually replaced with industrial uses, though some residential use continues today.

Port Morris, Bronx CD #1 Study Area

The southern and eastern sections of Port Morris that host commercial waste Transfer Stations are today largely non-residential. Four apartment buildings are marked on 1996 maps for these areas. The map record indicates that the southwestern area where these buildings are located experienced industrial and residential growth together. However, residential uses declined in the 1960s, as occurred through much of the South Bronx, particularly with the construction of the Cross Bronx Expressway. The other commercial waste portions of the Study Area either never experienced residential uses after 1896 or experienced a brief period at the turn of the century, which was rapidly replaced with power and light manufacturing uses.

Hunts Point, Bronx CDs #2 and #9 Study Area

A review of the Hunts Point, Bronx CDs #2 and #9 Study Area sections that currently host commercial waste Transfer Stations indicates that the majority of the area is non-residential; industrial and waste-related uses seem to have developed simultaneously with some pre-existing residential uses. The northeastern section does host two large apartment complexes that were constructed subsequent to Transfer Stations and other industrial uses in the area.

Brooklyn CD#1 Study Area

A review of the Transfer Stations in the Brooklyn CD #1 Study Area indicates that since the early 1900s this area has been primarily industrial with significant noxious uses. Where domiciles are historically evident, they appear to have co-existed alongside industrial uses, and it is likely that they were built to service those manufacturing industries.

Jamaica, Queens CD #12 Study Area

A 1951 map indicates that the neighborhood was largely residential, with some industrial elements present. By 1981 the area had developed substantial industrial uses. Maps from 1901 demonstrate that the neighborhood around Douglas Avenue and Benton Avenue was largely residential in character. The residences were typically four-story, fully-detached buildings occupying a small portion of each lot. However, abutting the rail tracks to the north of Douglas Avenue, a row of multi-story tenements existed to the rear of a Baptist church that is no longer standing. These apartments and the church sat on what is now a DSNY garage and Long Island Rail Road (LIRR) substation. The lot, block and street structure of the neighborhood to the north of the LIRR lines (the Jamaica, Queens CD #12 Study Area) has changed significantly over the past 100 years.

4.0 STUDY AREA ENVIRONMENTAL ANALYSES

4.1 Introduction

An evaluation methodology first determined current conditions inclusive of the existing Transfer Stations in each of the Study Areas. Second, the conditions without the Transfer Stations were evaluated to determine the net contribution of the Transfer Stations. Third, the conditions without the Transfer Stations, but with assumed other industrial uses occupying the same sites, were evaluated assuming the Transfer Stations were replaced by as-of-right general light industrial land uses in the Study Area. This land use replacement scenario assumed that the Transfer Station land uses would be occupied by other M-zone land uses typical of current conditions in the Study Area.

Analyses were conducted for: (1) air quality, odor, noise, neighborhood character, public health and water quality from Transfer Stations located within each Study Area; and (2) traffic, off-site air quality and off-site noise at key intersections along major corridors/locations leading to and from the Study Areas. Although this evaluation is not an environmental review, CEQR and other planning and engineering review criteria were used as the best available measure of the environmental effects of Transfer Stations on the surrounding community.

Available information was compiled for the Transfer Stations in the Study Areas and field data (Transfer Station operational data, aerial photographs, traffic counts, intersection geometries, etc.) were collected and analyzed through March 2004 to conduct the traffic, air quality, odor, noise, neighborhood character, public health and water quality analyses presented in this Study. These data were used to prepare analyses of current conditions and estimate the potential effects on current conditions if no Transfer Stations were located in these areas, as summarized below. A more detailed discussion of the methodologies followed for the Study Area Environmental Analyses is included in Volume I, Appendices A through I to this Study.

If the evaluation of current conditions, inclusive of the combined effects of multiple Transfer Stations in the Study Areas (areas of potential overlapping effects) met the following criteria, the potential effects of Transfer Stations on the surrounding community were not further evaluated:

On-Site Air quality, Odor and Noise

- The maximum predicted combined effects for criteria air pollutants (carbon monoxide [CO], sulfur dioxide [SO_2], nitrogen dioxide [NO_2] and particulate matter less than 10 microns in diameter [PM_{10}]) from the Transfer Stations plus background levels from the closest monitor in the City are below National Ambient Air Quality Standards (NAAQS);

- There were no maximum predicted combined odor effects at sensitive receptors within overlapping 5 odor unit (OU) contours around the Transfer Stations within the Study Area; and

- The maximum predicted combined noise effects (attributable to the Transfer Stations) at sensitive receptors within overlapping noise contours or resulted in an increase of less than 3dBA.

Traffic, Off-Site Air Quality and Off-Site Noise

- The predicted approach traffic level of service (LOS) at selected intersections was mid-level LOS D (which equates to 45 seconds of delay -- the marginally acceptable LOS required for mitigation purposes under CEQR) or better under current conditions;

- The maximum predicted combined effects for off-site criteria air pollutants (CO and PM_{10}) from the Transfer Stations plus background levels from the closest monitor in the City are below NAAQS; and

- The predicted noise level from Waste Hauling Vehicles at sensitive receptors near selected intersections (identified with the potential for commercial Waste Hauling Vehicles to double passenger car equivalents [PCEs]) results in an increase less than 3 dBA during the hour with the maximum potential noise effects.

If the evaluated current conditions exceeded these criteria, measures to reduce air quality, odor and noise effects were evaluated to determine whether these existing levels could be reduced through design or operational measures at the Transfer Stations. If current conditions for traffic, off-site air quality and off-site noise levels still exceeded the applicable criteria after evaluating the effects of these reduction measures, a replacement trip generation (RTG) analysis was performed, assuming the Transfer Stations were replaced by as-of-right general light industrial land uses (e.g., printing plants, laboratories) in the Study Area. The effects of these replacement land uses were calculated using trip generation rates published by the Institute of Transportation Engineers (ITE). This land use replacement scenario assumed that the Transfer Station land uses would be occupied by other M-zone land uses typical of current conditions in the Study Area. Evaluating the effects of reduction measures and the RTG scenario involved the following:

On-Site Air Quality, Odor and Noise

- The reduction measures that were applied to predicted air quality effects from the Transfer Stations included different types and sizes of equipment and enclosing waste processing operations;
- Maximum predicted combined odor effects were evaluated assuming a 90% odor removal efficiency from installation of a hard-piped odor control system at the putrescible waste Transfer Stations within the Study Area; and
- To determine if overlapping noise effects were reduced or removed, noise contours were prepared for Transfer Stations with predicted overlapping effects at sensitive receptors within each Study Area assuming application of noise reduction measures such as: (1) a building enclosure around processing operations at non-putrescible waste Transfer Stations; (2) removal of off-site queuing; and (3) 15' high concrete perimeter walls around all types of Transfer Stations.

Traffic, Off-Site Air Quality and Off-Site Noise

The analyses evaluated the effects of an RTG scenario on reducing the predicted effects of off-site Transfer Station operations. DSNY uses several Transfer Stations in the Study Areas for interim export. The effects of DSNY collection vehicles, traveling through analyzed intersections, were recorded. For traffic, off-site air quality and off-site noise analyses, collection vehicles (both DSNY and private carter Waste Hauling Vehicles) were removed from the analysis since it was assumed that commercial Waste Hauling Vehicles would be delivering waste to the Transfer Stations in the Study Areas if the DSNY were not using that capacity at the Transfer Stations.

- For traffic analyses, the predicted approach LOS and delay (1) without Waste Hauling Vehicles; and (2) with the replacement trips (based on the RTG analysis), were compared to the initially evaluated LOS with Waste Hauling Vehicles to determine whether there were significant differences;
- For off-site air quality analyses, (1) the maximum predicted combined CO and PM_{10} effects; and (2) the maximum predicted incremental $PM_{2.5}$ contributions from the replacement trips, were compared to those with Waste Hauling Vehicles; and
- For off-site noise analyses, the RTG analysis was not conducted since noise effects were not predicted at noise sensitive receptors.

Water Quality Evaluation

A screening process was performed to determine if Transfer Stations were located near or adjacent to surface waters and would, therefore, have the potential to impact water quality. As a result, 29 of the 43 Transfer Stations were identified as not being near or adjacent to surface water and were dropped from further evaluation. The remaining 14 Transfer Stations listed in Table 4.1-1 were evaluated for their potential impact to surface water. (None of these 14 are located within the Jamaica, Queens CD #12 Study Area.)

Cumulative effects on water quality from the Transfer Stations in the Study Areas were predicted using a mathematical model of New York Harbor, the New York Harbor Seasonal Steady State Water Quality Model (208 Model) and the conservative assumption that the entire site for each Transfer Station was impervious (i.e., paved). For each Transfer Station evaluated within the Study Areas, the volume of stormwater runoff and the associated pollutant loading was calculated using precipitation data and available databases on stormwater pollution concentration, and by calculating the runoff flow and assigning an average stormwater concentration for the following water quality parameters of concern: fecal coliform, biochemical oxygen demand (BOD), copper, lead and zinc.

Table 4.1-1
Transfer Stations Evaluated for Water Quality Effects

Name	Address	Type of Transfer Station
Port Morris, Bronx CD #1 Study Area		
Bronx County Recycling	475 Exterior Street	Fill
Felix Equities	290 East 132nd Street	Fill
Tilcon NY	980 East 149th Street	Fill
USA Waste Services of NY/Waste Management	98 Lincoln Avenue	Putrescible
Waste Management of NY	132nd Street & Saint Ann's Avenue	Putrescible (Intermodal)
Waste Services of NY	920 East 132nd Street	Putrescible
Hunts Point, Bronx CDs #2 and #9		
Waste Management of NY	Oak Point & Barry Avenue	Putrescible
Brooklyn CD#1 Study Area		
Waste Management of NY	75 Thomas Avenue	Non-Putrescible
Waste Management of NY	232 Gardner Avenue	Non-Putrescible
Waste Management of NY	215 Varick Avenue	Putrescible
Waste Management of NY	123 Varick Avenue	Non-Putrescible
Waste Management of NY	485 Scott Avenue	Putrescible
Maspeth Recycling	58-08 48th Street	Fill
Pebble Lane Associates	57-00 47th Street	Fill
Total Number of Transfer Stations Evaluated		**14**

Potential overlapping effects due to the operation of multiple Transfer Stations within a given Study Area were estimated by combining the incremental difference in water quality calculated by the model with existing water quality data and comparing these with NYSDEC water quality standards to determine whether the pollutant loading exceeds standards.

Public Health Evaluation

The effects on public health in the areas where overlapping effects of air quality, noise and odors from Transfer Stations were predicted at the nearest sensitive receptor considered the following criteria:

- Criteria air pollutants and $PM_{2.5}$ at the areas of maximum effect.
- The predicted contributions of Waste Hauling Vehicle emissions to ambient CO, PM_{10} and $PM_{2.5}$ concentrations in air, and the incremental noise levels at the nearest sensitive receptors along routes were evaluated in light of: (1) local, state or federal standards (where available); and (2) scientific literature pertaining to the health effects associated with ambient CO and particulate matter (PM), obnoxious odors, noise and municipal solid waste (MSW).

Neighborhood Character Evaluations

Data on existing land use, population characteristics, urban design and visual quality, parks and other community facilities, and cultural resources, as well as predicted traffic, air quality, odor, noise, water quality and public health were compiled for each of the Study Areas. Potential changes to neighborhood character were qualitatively evaluated with: (1) reduction measures, as applicable, identified in the air quality, odor and noise analyses; and (2) replacement trips from light manufacturing uses, to determine whether the neighborhood character would likely change or improve, or remain the same as under current conditions. The assumption used in creating the replacement industry scenario is that all components of neighborhood character conditions (zoning, socioeconomics, etc.) remain fundamentally the same as existing conditions.

5.0 STUDY AREA ENVIRONMENTAL ANALYSES FINDINGS

The following summarizes the overall approach to and results of the Study Area Environmental Analyses. A more detailed summary of the approach and results, and copies of supporting documentation (e.g., methodologies, model input parameters, intersection diagrams, summary results tables, etc.) are included in Volume I, Appendices A through I to this Study.

5.1 Neighborhood Character

Land use, population characteristics, urban design and visual quality, parks and other community facilities, and cultural resources data were compiled for the CDs within the Study Areas. This information, in conjunction with a summary of potential traffic, air quality, odor, water quality and public health findings of the Environmental Analyses, was used to determine the existing neighborhood character of each Study Area. Potential changes to neighborhood character (whether it would likely change or improve, or remain the same as under current conditions and how these conditions compare to CEQR standards) were qualitatively evaluated in light of the RTG analysis used for the traffic and off-site air quality analyses and under the potential reduction measures identified for the air quality, odor and noise analyses. The overall neighborhood character of each of the Study Areas is described below.

Port Morris, Bronx CD #1 Study Area

The portions of Port Morris in the eastern extent of the area studied and Mott Haven in the western extent and north of Bruckner Boulevard include the waterfront and are predominantly industrial areas, with scattered residential, community facility and commercial uses located further inland. Bruckner Expressway forms a physical east-west barrier that divides the area south of East 134th Street from areas further to the north. Neighborhood character south of Bruckner Boulevard is diminished by industrial uses and the presence of vacant, rubble-strewn lots and deteriorated sidewalk and building conditions. High volumes of truck traffic serving industrial uses and through-traffic accessing Manhattan via the Major Deegan Expressway also detract from the area's character.

Hunts Point, Bronx CDs #2 and #9 Study Area

The character of the Hunts Point, Bronx CDs #2 and #9 Study Area and peninsula is defined by low-scale, low-density heavy commercial and industrial uses. The Hunts Point Food Market, a wholesale food distribution facility, is the largest property within the vicinity of the Transfer Stations and largely defines the character of the Study Area. It generates considerable amounts of truck traffic, especially to and from its large warehouse buildings oriented around Food Center Drive.

Brooklyn CD #1 Study Area

The character of the Brooklyn CD #1 Study Area is defined by predominantly industrial land use and visual quality. Newtown Creek, which runs through the area studied, has been historically home to heavy industry and remains a working waterfront characterized by large-scale municipal facilities and water-dependent industrial uses on large lots. It is among these manufacturing uses that the Transfer Stations are located. Consistent with the heavily industrial area, there are no sensitive visual resources or unique features, and many of the streets are ill-suited for pedestrian activity. Within the southwestern portion of the area studied, however, lies the residential community of Greenpoint. Though adjacent to manufacturing uses at its eastern edge, the character of this residential area is generally not intruded upon by its industrial surroundings.

Jamaica, Queens CD #12 Study Area

The character of the Jamaica, Queens CD #12 Study Area is mixed. The LIRR corridor bisects the area, creating northern and southern halves. Heavily industrial uses are present along the eastern portion of the corridor and along its southern side, where the Transfer Stations are located. Residential areas are also located in the southern portion, adjacent to and south of the industrial uses. The northern portion features the vibrant commercial area along Jamaica Avenue, just north of the rail corridor. North of the commercial uses are more residential areas.

The technical studies support the conclusion that the groups of Transfer Stations do not attribute negatively to the character of the neighborhoods overall or are contributors to adverse conditions that may exist. The public health assessment has concluded that air quality and odor conditions are not of a public health concern.

5.2 Air Quality, Odor, Noise and Water Quality Analyses

Air quality, odor, noise and water quality analyses were conducted to evaluate the potential effects from the close proximity of the Transfer Stations within the Study Areas to each other.

5.2.1 Prototypical Designs

Air quality, odor, noise and water quality analyses were prepared based on review of available information in engineering reports, drawings, permit applications and environmental review documents for the Transfer Stations in the Study Areas. The available data on the 43 Transfer Stations in the Study Areas was sufficient to evaluate the effects of facility design and operations in the analyses. Data was compiled to determine average building size, lot size and space available for queuing and processing equipment for the "prototypical" categories of Transfer Stations (refer to Volume I, Appendix B for facility design specifics).

Field surveys were conducted at each of the 43 Transfer Stations to identify the average and peak number of Waste Hauling Vehicles queuing on site and on roads at the entrance/exit to each facility for inclusion in the analysis. Field surveys were also conducted to identify Transfer Station parameters (e.g., building heights, numbers and types of equipment in operation, etc.) to refine the prototypical designs.

A general discussion of the environmental analytical approach using the prototypical designs follows. Tests of actual Transfer Station designs and operational parameters, where available, were conducted to determine the relative accuracy of the results. Study Area results with prototypical facilities were compared to the test scenarios using design and operational information from one of the Transfer Stations in each of the eight categories listed in Table 5.2.1-1. In general, air quality, noise and odor analyses presented in this Study are similar on an order-of-magnitude level to those that would result from using site-specific Transfer Station information, if that were available.

Table 5.2.1-1
Categories of Prototypical Transfer Stations

Category	Type of Transfer Station
Putrescible Waste	Small
	Medium with Baler
	Large with Baler
	Large with Locomotive
Non-Putrescible Waste	C&D Processing
	C&D Processing with Crushing Equipment
Fill Material	Small/Medium
	Large

5.2.2 Air Quality

Air quality analyses were conducted for all operating Transfer Stations located in each of the four Study Areas. Prototypical Transfer Station emission-related data for various sources (e.g., processing building, equipment, storage pile, Waste Hauling Vehicles, etc.) were developed from a combination of available information (e.g., owner or vendor information, field tests, published sources) and assumptions based on each Transfer Station's size and operations (including the simultaneous operation of all applicable emission sources). A field survey conducted in each Study Area determined that no other major commercial or industrial sources were located within 400 feet of these Study Areas. Air quality levels at receptor sites (i.e., site boundary locations and sensitive-receptor locations identified from land use maps and field observations) potentially affected by the combined emissions of the Transfer Stations were predicted using the United

States Environmental Protection Agency's (USEPA) Industrial Source Complex Short-Term (ISCST3) (version 97363) dispersion model, and the 1997 through 2001 LaGuardia Airport meteorological data set.

The maximum predicted combined contribution of existing Transfer Stations in the Study Area was added to background levels from the closest air quality monitor in the area to estimate current conditions for criteria air pollutants (CO, SO_2, NO_2 and PM_{10}). For $PM_{2.5}$, for which the area is currently being evaluated by USEPA with respect to existing concentrations and attainment/non-attainment status, the analysis provides only the contribution by Study Area facilities, in comparison to existing concentrations of $PM_{2.5}$.

As shown in Tables 5.2.2-1 through 5.2.2-4, all results are below NAAQS for all criteria pollutants.

As shown in Table 5.2.2-5, for $PM_{2.5}$, the maximum predicted annual neighborhood average contribution ranges from 1% to 6% of the latest monitored concentration from the nearest monitoring station within each Study Area.

The modeled 24-hour $PM_{2.5}$ contributions (on a 98^{th} percentile basis) from the commercial waste facilities are shown in Table 5.2.2-6 for each Study Area. These contributions are a significant portion of the existing $PM_{2.5}$ concentrations measured by monitors located nearest each Study Area. However, the model results are quite conservative in that they represent all facilities operating simultaneously at their maximum allowed capacities. In addition, the modeling is based on emission rates that were calculated using the weighted average of the actual engines at non-putrescible and fill facilities. It is likely that the emission rates used are higher than the actual emissions, especially as newer equipment enters the fleet of non-road diesel engines. To the extent that facilities use newer equipment and operate less than 24 hours per day, actual contributions will be substantially lower.

In general, the air quality modeling results show that the locations of the receptors with the maximum concentration of pollutants are located between several Transfer Stations and are close to larger Transfer Stations in the Study Area with greater than 90% of the effects attributable to those Transfer Stations.

Figures 5.2.2-1 through 5.2.2-4 show the locations of the highest short-term and annual averaging concentrations for the criteria pollutants from multiple Transfer Stations in the Study Areas.

Table 5.2.2-1
Summary of Air Quality Analysis
Criteria Pollutants
Brooklyn CD #1 Study Area

Pollutant	Averaging Time Period	Background Pollutant Concentration [1] (μg/m^3)	Maximum Contributions from On-Site Emission Sources (μg/m^3)	Highest Estimated Pollutant Concentration [4] (μg/m^3)	NAAQS (μg/m^3)
Carbon Monoxide (CO)[1]	1-hr	3,321	1,857	5,178	40,000
	8-hr	2,634	877	3,511	10,000
Nitrogen Dioxide (NO_2)[2]	Annual	56	16	72	100
Particulate Matter (PM_{10})	24-hr[3]	57	68	125	150
	Annual	23	5	28	50
Sulfur Dioxide (SO_2)	3-hr	189	57	246	1,300
	24-hr	87	10	97	365
	Annual	21	1	22	80

Notes:
NAAQS = National Ambient Air Quality Standards.
(1) Background concentrations for NO_2, SO_2 and PM_{10} are from the Greenpoint monitoring station. The 8-hr CO background concentration was provided by NYCDEP.
(2) A conversion factor of 0.59 was used to convert estimated nitrogen oxide (NOx) contributions to NO_2 contributions. Source: Newtown Creek FEIS.
(3) The 1st highest high values are used to report 24-hr PM_{10} results for comparison with NAAQS.
(4) Highest on-site pollutant concentration is the total of the result plus background.

Table 5.2.2-2
Summary of Air Quality Analysis
Criteria Pollutants
Jamaica, Queens CD #12 Study Area

Pollutant	Averaging Time Period	Background Pollutant Concentration (1) (μg/m³)	Maximum Contributions from On-Site Emission Sources (μg/m³)	Highest Estimated Pollutant Concentration (4) (μg/m³)	NAAQS (μg/m³)
Carbon Monoxide (CO)(1)	1-hr	3,321	1,140	4,461	40,000
	8-hr	2,634	454	3,088	10,000
Nitrogen Dioxide (NO_2)(2)	Annual	51	12	63	100
Particulate Matter (PM_{10})	24-hr(3)	57	35	92	150
	Annual	23	3	26	50
Sulfur Dioxide (SO_2)	3-hr	186	41	227	1,300
	24-hr	107	5	112	365
	Annual	18	0.4	18	80

Notes:
NAAQS = National Ambient Air Quality Standards.
(1) Background concentrations for NO_2, SO_2 and PM_{10} are from the Queensboro Community College monitoring station. Background concentrations for PM_{10} are from the Greenpoint monitoring station. The 8-hr CO background concentration was provided by the NYCDEP.
(2) A conversion factor of 0.59 was used to convert estimated NOx contributions to NO_2 contributions. Source: Newtown Creek FEIS.
(3) The 1st highest high values are used to report 24-hr PM_{10} results for comparison with NAAQS.
(4) Highest on-site pollutant concentration is the total of the result plus background.

Table 5.2.2-3
Summary of Air Quality Analysis
Criteria Pollutants
Hunts Point, Bronx CDs #2 and #9 Study Area

Pollutant	Averaging Time Period	Background Pollutant Concentration [(1)] (μg/m³)	Maximum Contributions from On-Site Emission Sources (μg/m³)	Highest Estimated Pollutant Concentration [(4)] (μg/m³)	NAAQS (μg/m³)
Carbon Monoxide (CO)[(1)]	1-hr	3,779	1,279	5,058	40,000
	8-hr	2,634	675	3,309	10,000
Nitrogen Dioxide (NO_2)[(2)]	Annual	68	18	86	100
Particulate Matter (PM_{10})	24-hr[(3)]	75	66	141	150
	Annual	24	7	31	50
Sulfur Dioxide (SO_2)	3-hr	215	52	267	1,300
	24-hr	113	9	122	365
	Annual	26	1	27	80

Notes:
NAAQS = National Ambient Air Quality Standards.
(1) Background concentrations for NO_2, SO_2 and PM_{10} are from the IS 155 and Morrisania monitoring stations. The 8-hr CO background concentration was provided by the NYCDEP.
(2) A conversion factor of 0.59 was used to convert estimated NOx contributions to NO_2 contributions. Source: Newtown Creek FEIS.
(3) The 1st highest high values are used to report 24-hr PM_{10} results for comparison with NAAQS.
(4) Highest on-site pollutant concentration is the total of the result plus background.

Table 5.2.2-4
Summary of Air Quality Analysis
Criteria Pollutants
Port Morris, Bronx CD #1 Study Area

Pollutant	Averaging Time Period	Background Pollutant Concentration (1) (μg/m^3)	Maximum Contributions from On-Site Emission Sources (μg/m^3)	Highest Estimated Pollutant Concentration (4) (μg/m^3)	NAAQS (μg/m^3)
Carbon Monoxide (CO)(1)	1-hr	3,779	581	4,360	40,000
	8-hr	2,634	191	2,825	10,000
Nitrogen Dioxide (NO_2)(2)	Annual	68	9	77	100
Particulate Matter (PM_{10})	24-hr(3)	75	20	95	150
	Annual	24	2	26	50
Sulfur Dioxide (SO_2)	3-hr	215	17	232	1,300
	24-hr	113	3	116	365
	Annual	26	0.3	26	80

Notes:
NAAQS = National Ambient Air Quality Standards.
(1) Background concentrations for NO_2, SO_2 and PM_{10} are from the IS 155 and Morrisania monitoring stations. The 8-hr CO background concentration was provided by the NYCDEP.
(2) A conversion factor of 0.59 was used to convert estimated NOx contributions to NO_2 contributions. Source: Newtown Creek FEIS.
(3) The 1st highest high values are used to report 24-hr PM_{10} results for comparison with NAAQS.
(4) Highest on-site pollutant concentration is the total of the result plus background.

Table 5.2.2-5
Summary of Air Quality Analysis
$PM_{2.5}$ Annual Neighborhood Average

Study Area	Annual Neighborhood Concentration ($\mu g/m^3$)	Annual Average Monitored Concentration[(1)] ($\mu g/m^3$)	Percent of Transfer Station Contribution to Monitored Concentration ($\mu g/m^3$)
Brooklyn Study Area	0.88	16.3	5%
Jamaica Study Area	0.29	13.1	2%
Hunts Point Study Area	1.05	18.0	6%
Port Morris Study Area	0.22	18.0	1%

Note:
(1) Monitored concentrations are based on one-year annual average of Greenpoint Monitoring Station in Brooklyn (2000) for Brooklyn CD #1 Study Area; PS 219 Monitoring Station in Queens (2002) for Jamaica, Queens CD #12 Study Area; IS 52 Monitoring Station in the Bronx (2002) for Hunts Point, Bronx CDs #2 and #9 Study Area; and JHS 45 in Manhattan (2002) for Port Morris, Bronx CD #1 Study Area.

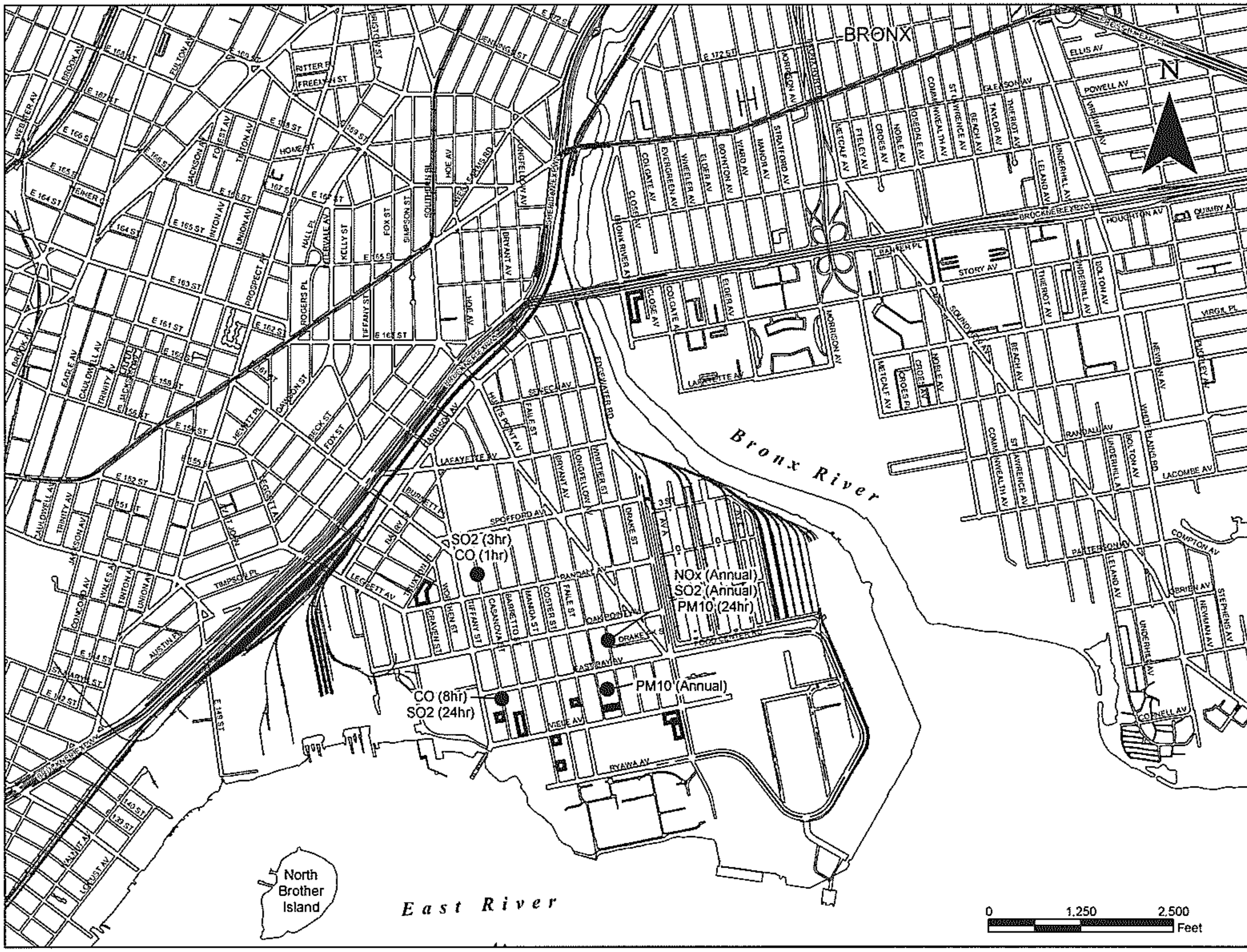
Table 5.2.2-6
Summary of Air Quality Analysis
$PM_{2.5}$ 24-Hour Average

Study Area	24-hour Concentration ($\mu g/m^3$)	98th Percentile 24-hour Monitored Concentration[(1)] ($\mu g/m^3$)	Percent of Transfer Station Contribution to Monitored Concentration ($\mu g/m^3$)
Greenpoint Study Area	11.2	41.7	27%
Jamaica Study Area	5.7	38.6	15%
Hunts Point Study Area	12.0	41.1	29%
Port Morris Study Area	4.8	41.1	12%

Note:
(1) Monitored concentrations are based on a 98th percentile of one year of data from the Greenpoint Monitoring Station in Brooklyn (2000) for Brooklyn CD #1 Study Area; PS 219 Monitoring Station in Queens (2002) for Jamaica, Queens CD #12 Study Area; IS 52 Monitoring Station in the Bronx (2002) for Hunts Point, Bronx CDs #2 and #9 Study Area; and JHS 45 in Manhattan (2002) for Port Morris, Bronx CD #1 Study Area.

Figure 5.2.2-1
Air Quality Maximum
Hunts Point, Bronx CDs #2 and #9
Study Area

City of New York
Department of Sanitation



Legend

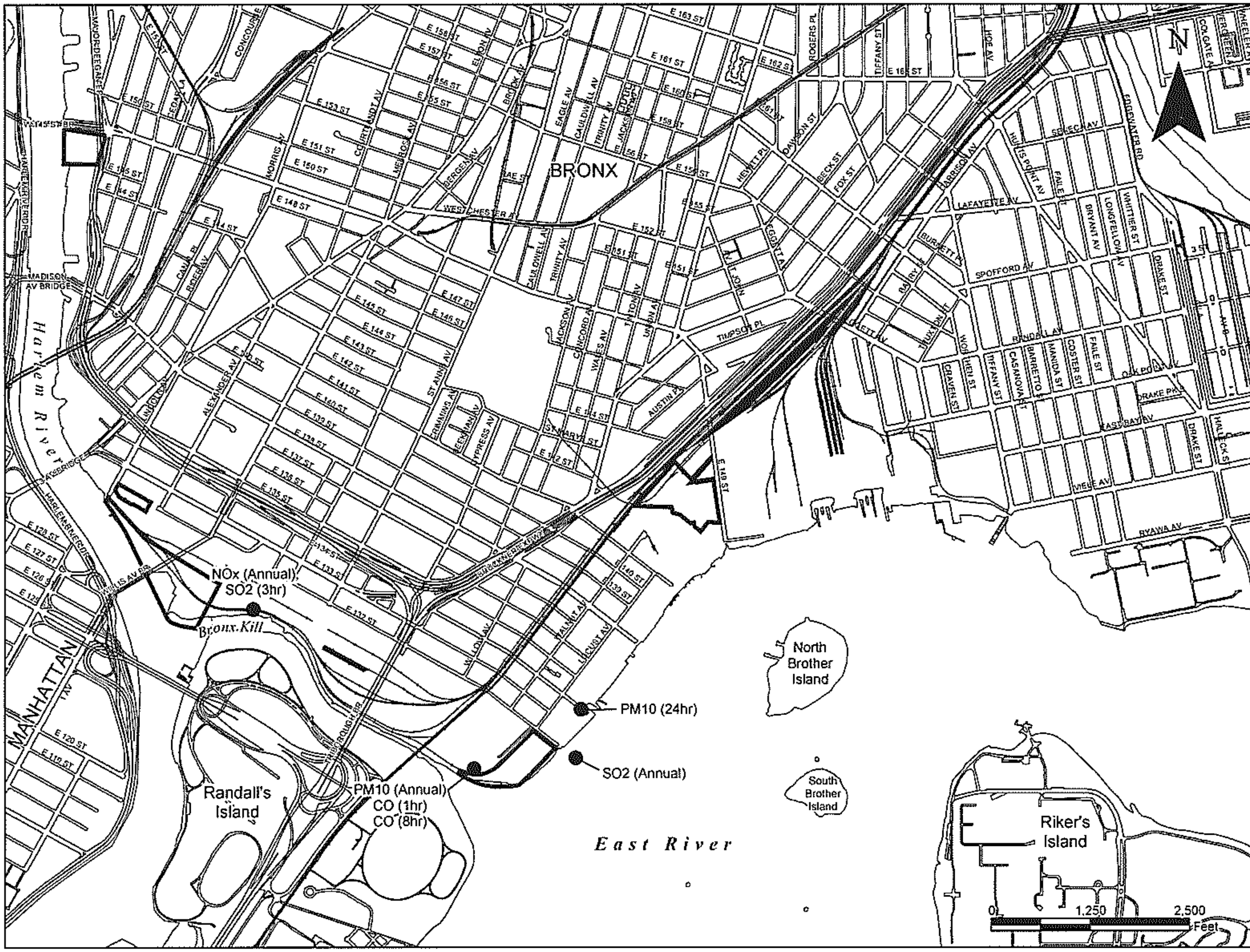
● Maximum Concentration Receptors

HDR
Cambridge Environmental Inc
URBITRAN

Site delineations and receptor locations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

Figure 5.2.2-2
Air Quality Maximum
Port Morris, Bronx CD #1 Study Area

City of New York
Department of Sanitation



Legend

● Maximum Concentration Receptors

HDR

HydroQual

Cambridge Environmental Inc

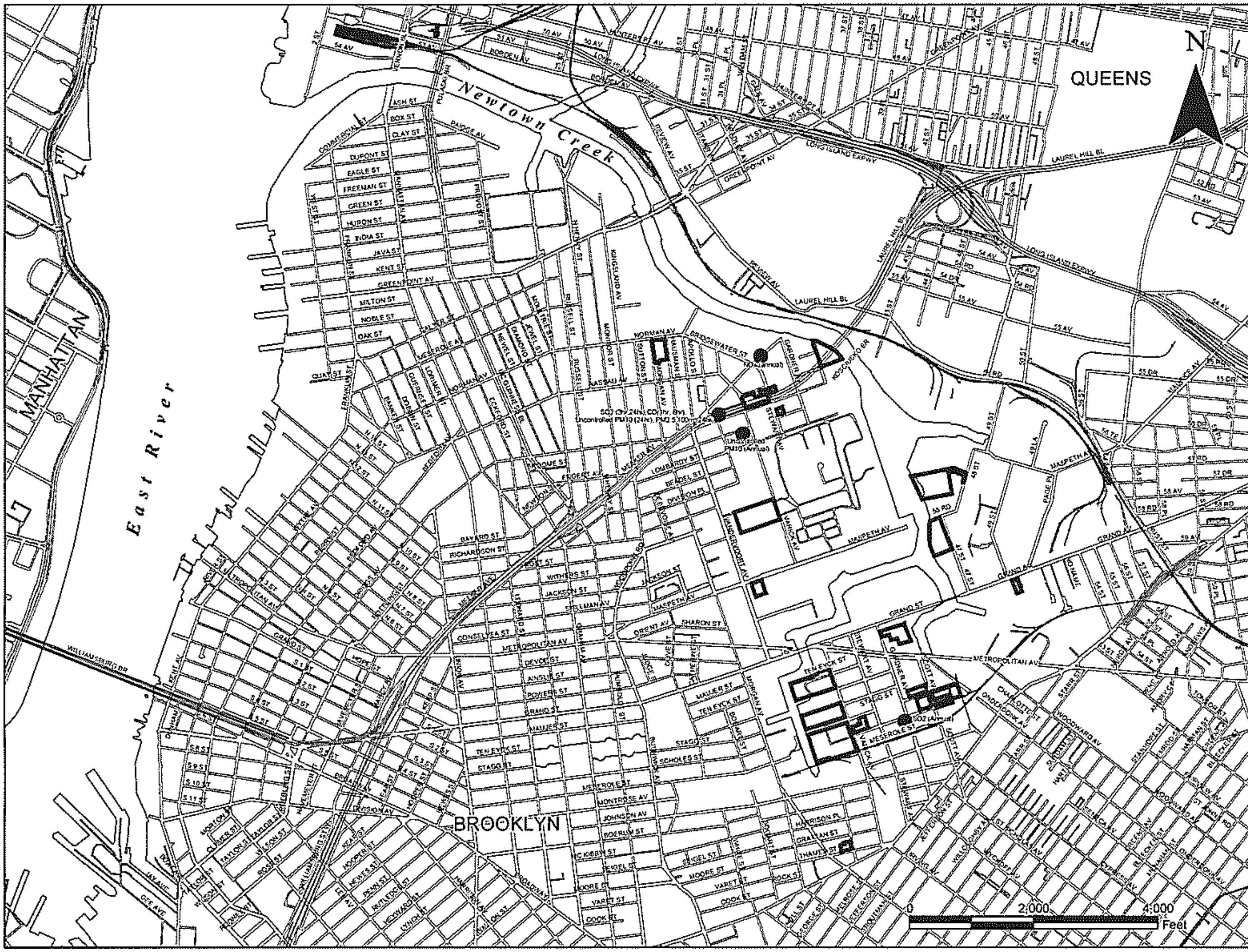
URBITRAN

PB

Site delineations and receptor locations are approximate
Base Map Sources: NYCDoitt and NYCDCP

Figure 5.2.2-3
Air Quality Maximum
Brooklyn CD #1 Study Area

City of New York
Department of Sanitation



Legend

● Maximum Concentration Receptors

Site delineations are approximate.
Base Map Sources. NYCDoitt and NYCDCP

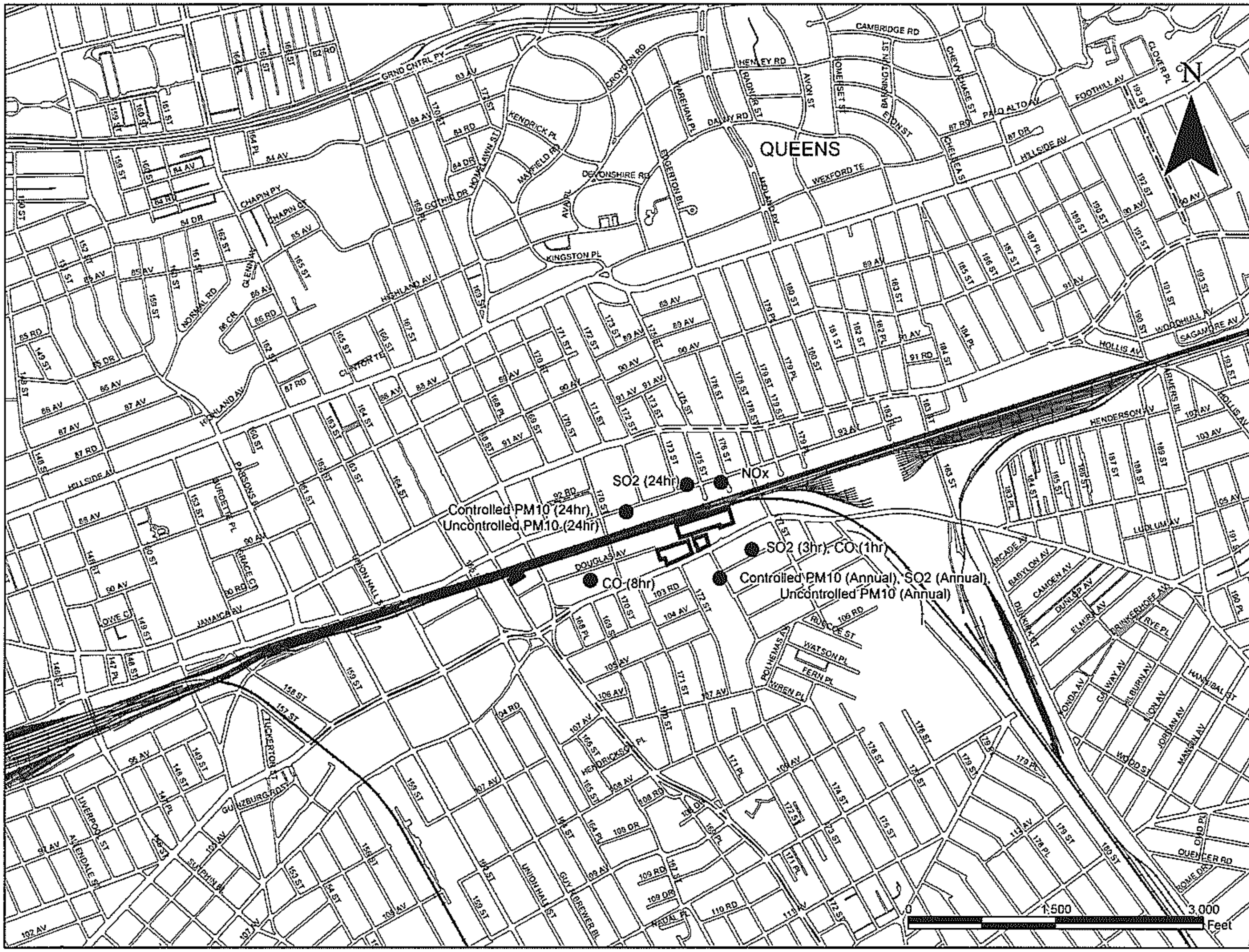


Figure 5.2.2-4
Air Quality Maximum
Jamaica, Queens CD #12 Study Area

City of New York
Department of Sanitation

Legend

● Maximum Concentration Receptors

Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

5.2.3 Odor Sampling

Sampling of odors from four Transfer Stations within the Study Areas was performed in July and August of 2003, when odor generation from waste decomposition would be expected to be at its peak. A total of 45 vent samples and 15 Quality Assurance/Quality Control (QA/QC) samples were collected. Of the 60 samples collected, 21 uncontrolled samples were used to calculate the eight facility-specific Transfer Station odor emission factors that were used to establish odor emission rates for the three prototypical Transfer Stations.

In accordance with guidance documents published by the USEPA and the Air and Waste Management Association (AWMA), whole air odor samples were collected from the exhaust vents on the roof of the processing buildings at the Transfer Stations using a vacuum chamber sampling system that consists of a rigid, airtight container with an inlet port connected to an internal Tedlar® bag and an outlet port connected to a portable pump (see Volume I, Appendix D for a more detailed description of the sampling methodology).

The analytical technique used on the odor samples is referred to as an odor panel evaluation in which a group of people, the "odor panel," quantifies the following:

- Detection and recognition thresholds ("odor concentration");
- Odor intensity; and
- Odor persistence (dose response).

The odor panel members were selected, and odor analysis conducted, by the laboratory in accordance with the following established protocols and standards set by the American Society of Testing Materials (ASTM):

- Selection and Training of Sensory Panel Members (Standard Practice 758);
- Determination of Odor and Taste Thresholds by a Forced-Choice Ascending Concentration Series Method of Limits (Standard Practice E679-91); and
- Referencing Suprathreshold Odor Intensity (Standard Practice E544-99).

A review of the controlled and uncontrolled odor emissions from the same facilities revealed that the controlled Transfer Station emissions were no more than 38% lower than the uncontrolled facilities, and in some cases the controlled emissions were deemed higher than the uncontrolled emissions. This is likely due to the use of scented masking agents as odor control measures in the Transfer Stations, rather than more effective neutralizing agents. Masking agents tend to have their own odors (e.g., cherry, pine, etc.) that can be considered a nuisance, while neutralizing agents consist of compounds that react with the odors from the waste and "neutralize" the effect.

Based on the results of the sampling study, emission factors were conservatively estimated for the Transfer Stations by: (1) using the detection threshold (DT) value provided by the laboratory (the DT value is that recorded when the odor is first detected); (2) using only the maximum emission rate for the three prototypical facility sizes; and (3) applying a 2.5 peak-to-mean factor to the maximum emission rate and associated effects. A summary of the emission factors and odor emission rates calculated for use in odor modeling are presented in Tables 5.2.3-1 and 5.2.3-2, respectively.

A more detailed summary of the approach and results, and copies of supporting documentation (i.e., sampling protocol, results, etc.) are included in Volume I, Appendices D and E to this Study.

Table 5.2.3-1
ISCST3 Model Input Emission Rates[1]

Emission Basis	Prototype Facility Size		
	Small	Medium	Large
Maximum Emission Rate (OU/sec)	0.0128	0.0253	0.1721
Average Emission Rate (OU/sec)	0.0057	0.0114	0.0774

Notes:
(1) Emission rates input as grams/second, in order to obtain output odor concentrations in multiples of detection threshold (DT).

Table 5.2.3-2
Estimated Maximum and Average Odor Emission Rates for Each Facility Prototype

Parameter	Prototype Facility Size and Type		
	Small	Medium	Large
Stockpiled Waste Capacity (tons)	119	236	1605
Maximum Emission Rate (OU/sec)[1]	5,105	10,124	68,855
Average Emission Rate (OU/sec)[2]	2,297	4,555	30,977

Notes:
[1] Maximum Emission Factor = 42.9 ([OU/sec]/ton stored).
[2] Average Emission Factor = 19.3 ([OU/sec]/ton stored).

5.2.4 Odor Modeling

Odor emission rates described in Section 5.2.3 were used to conduct the odor dispersion modeling. Because of the variation in odor control efficiency measured during sampling, the uncontrolled emission factors were used to model odors from the processing building from putrescible waste Transfer Stations within the Study Areas. Odor levels at sensitive-receptor locations identified from land use maps and field observations that may be affected by the combined emissions of adjacent Transfer Stations were estimated using USEPA's ISCST3 model and the most recent five years of historic meteorological data.

Odor contours were developed to identify areas where odors from several putrescible waste Transfer Stations in a Study Area overlapped, which were also near sensitive-receptor locations. This type of analysis is conservative in that it assumes prevailing winds occur in opposite directions simultaneously to result in overlapping effects. The odor contour maps express results of odors in OU, where one OU is defined as the amount or mass of odor needed to generate a concentration at the DT in a volume of one cubic meter of air. In other words, an average person in a laboratory setting could just barely detect that there was something different about a sample that contained a concentration of 1 OU, in comparison to clean, filtered background air. An odor concentration effect at 1 OU would not likely be detected in outdoor air within the City, which, based on background measurements taken during this Study, had on the order of 5 OU. Adding a concentration of 1 OU to such air would probably not make a detectable difference to an observer. It is assumed that an added effect of 5 OU from a waste Transfer Station would be a more likely level of odor effect that would begin to be detected by an observer.

Table 5.2.4-1 provides a summary of modeled odor levels for identified sensitive receptors in each of the Study Areas. These results are presented in terms of the frequency of modeled values with respect to specified thresholds of 5 OU (five odor units, meaning five times the laboratory determined detection threshold) and 1 OU. A level of 5 OU is considered to be a level at which the public may start to notice odors, since the background odor levels, based on laboratory analysis of samples taken upwind of commercial putrescible waste facilities, were typically in the 5 to 6 OU range. Also, these results focus only on receptors where there may be overlapping effects from multiple facilities, which may tend to increase the frequency of hours with predicted odor levels above the 5 OU threshold.

These odor modeling results are based on a conservative assumption that there is no odor control at the facilities, unless otherwise noted. In reality, the existing odor controls at commercial waste facilities handling putrescible waste vary widely, with some facilities having little or no effective control, and others having relatively good odor control. These conservative results indicate that the frequency of predicted odor levels above 5 OU is relatively small at all sensitive receptors for all Study Areas. The highest frequency of conservatively predicted odor levels exceeding the criteria, assuming no odor controls, was for a receptor in the Brooklyn CD #1 Study Area, where the model predicted an exceedance just under 0.82% of the time (72 non-consecutive hours per year). If more effective (90% efficient) odor controls were implemented at all commercial putrescible waste facilities, the odor levels would be reduced substantially (by 90%), and there would be no overlapping contributions greater than 5 OU from multiple Transfer Stations in the Study Areas.

Figures 5.2.4-1 through 5.2.4-4 show the predicted odor contours and location of sensitive receptors within the overlapping areas for each of the Study Areas.

Table 5.2.4-1
Predicted Odor Effects

Receptor	Percent of Time Greater Than or Equal to 5 OU (1)	Percent of Time Less Than or equal to 1 OU (2)	Percent of Time Between 1 and 5 OU
Brooklyn CD #1 Study Area			
Receptor #2 (R2)	0.23%	85.4%	14.4%
Receptor #3 (R3)	0.82%	86.0%	13.2%
Port Morris, Bronx CD #1 Study Area			
Receptor #15 (R15)	0.07%	98.6%	1.3%
Receptor #16 (R16)	0.06%	98.6%	1.3%
Receptor #17 (R17)	0.10%	98.6%	1.3%

Notes:
(1) Summary of 1-hour episodes of 5 OU and greater at the receptor within overlapped contours.
(2) Summary of 1-hour episodes of less than 1 OU at the receptor within overlapped contours.
OU = Odor Unit.
No modeled odor levels above 5 OU were found within the Hunts Point, Bronx CDs #2 and #9 Study Area or Jamaica, Queens CD #12 Study Area.

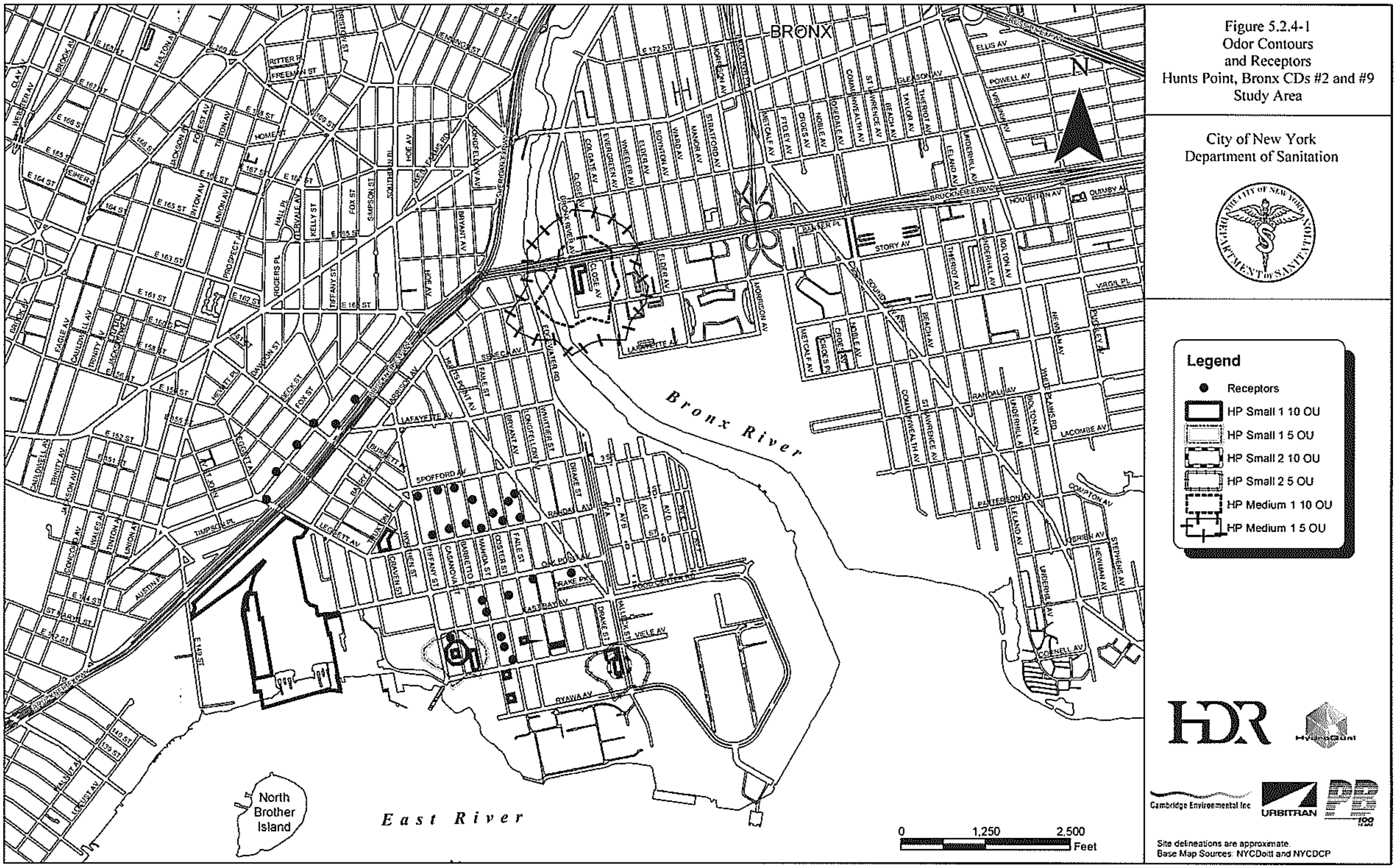


Figure 5.2.4-1
Odor Contours
and Receptors
Hunts Point, Bronx CDs #2 and #9
Study Area
City of New York
Department of Sanitation
Legend
Receptors
HP Small 1 10 OU
HP Small 1 5 OU
HP Small 2 10 OU
HP Small 2 5 OU
HP Medium 1 10 OU
HP Medium 1 5 OU
N
BRONX
Bronx River
East River
North Brother Island
0
1,250
2,500
Feet
HDR
Cambridge Environmental Inc
URBITRAN
PB
Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

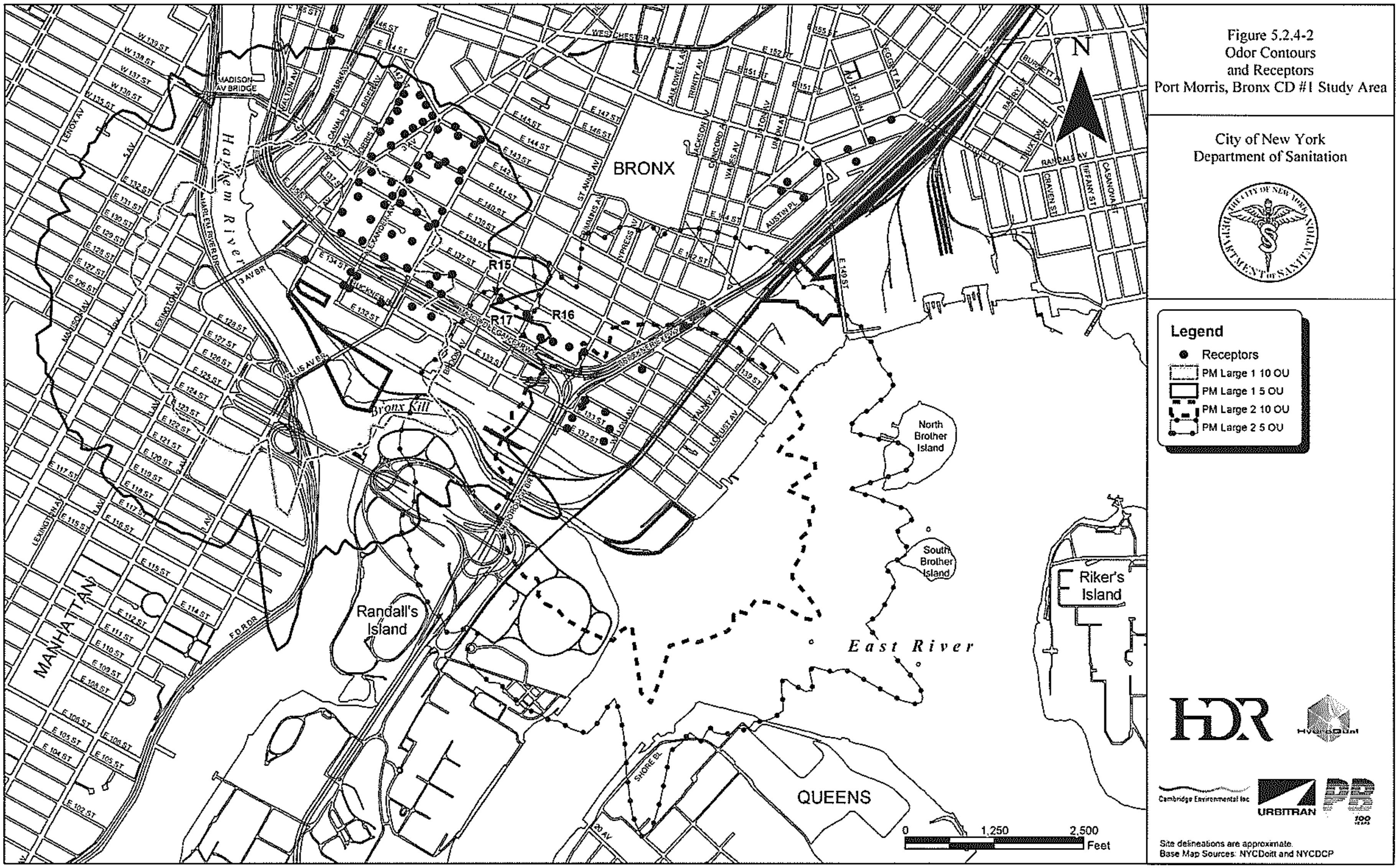


Figure 5.2.4-2
Odor Contours
and Receptors
Port Morris, Bronx CD #1 Study Area
City of New York
Department of Sanitation
Legend
Receptors
PM Large 1 10 OU
PM Large 1 5 OU
PM Large 2 10 OU
PM Large 2 5 OU
N
BRONX
MANHATTAN
QUEENS
Harlem River
Bronx Kill
East River
Randall's Island
North Brother Island
South Brother Island
Riker's Island
R15
R16
R17
0
1,250
2,500
Feet
Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP
HDR
Cambridge Environmental Inc
URBITRAN

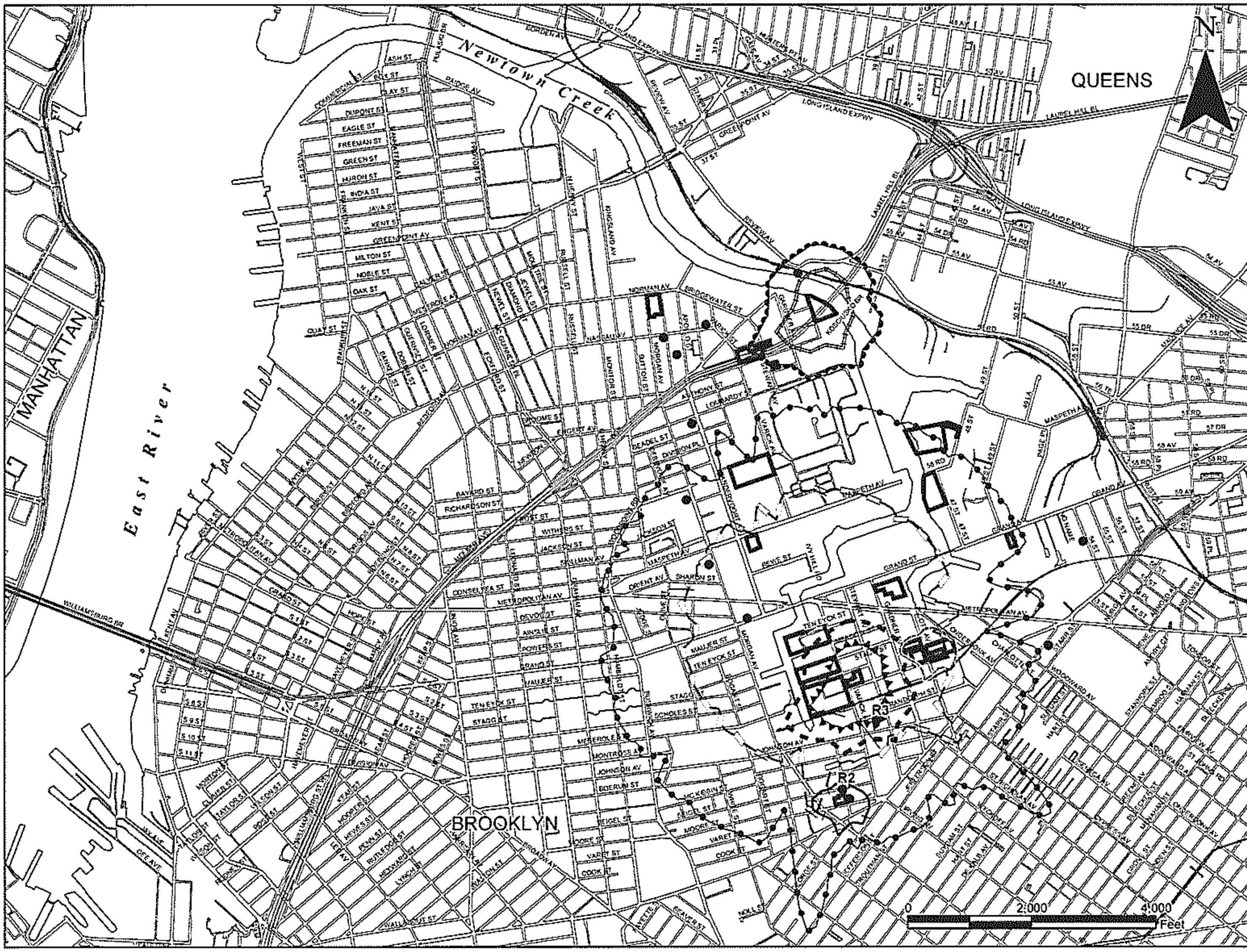


Figure 5.2.4-3
Odor Contours
and Receptors
Brooklyn CD #1 Study Area

City of New York
Department of Sanitation

Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

Figure 5.2.4-4
Odor Contours
and Receptors
Jamaica, Queens CD #12 Study Area

City of New York
Department of Sanitation

Legend

- Receptors
- JM Medium 1 10 OU
- JM Medium 1 5 OU

HDR
HydroQual
Cambridge Environmental Inc
URBITRAN
PB

Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

5.2.5 Noise

The potential noise effects of Transfer Stations within a Study Area depend on the types and number of noise sources in use. The noise spreadsheet model previously developed by the DSNY for the 2000 Solid Waste Management Plan Final Environmental Impact Statement (EIS) was used to predict the potential for combined effects from Transfer Stations within the Study Areas. Noise emission levels from equipment in the prototypical facilities were obtained from field measurements, or manufacturer's data, when field measurements were unavailable. A noise model was used to predict 55 dBA noise contours around each Transfer Station, taking into account existing shielding and conservatively assuming that all equipment at putrescible waste and non-putrescible waste Transfer Stations operated 24 hours per day, since they were permitted to do so.

The predicted 55 dBA noise contours from all of the Transfer Stations in each Study Area were combined to determine areas of overlapping noise levels where sensitive receptors exist, and field measurements were conducted to measure the existing noise levels at the sensitive receptors within the overlapping contour areas. The predicted noise levels from the Transfer Stations were removed from the existing measured noise levels to determine if the incremental effect of the combined Transfer Stations resulted in an increase of less than 3dBA (attributable to the Transfer Stations).

Transfer Stations in the Port Morris, Bronx CD #1 Study Area do not have overlapping noise effects because they are not located in proximity to each other. However, there were areas of potential overlapping effects from multiple Transfer Stations in the Brooklyn CD #1; Jamaica, Queens CD #12; and Hunts Point, Bronx CDs #2 and #9 Study Areas identified, but further analyses did not predict effects at sensitive receptors located within these Study Area overlap areas.

Waste Hauling Vehicles queuing on and off site are the highest contributor to noise levels. The removal of off-site queuing of Waste Hauling Vehicles reduces noise levels.

Figures 5.2.5-1 through 5.2.5-4 show the predicted noise contours and location of sensitive receptors within the overlapping areas for each of the Study Areas.

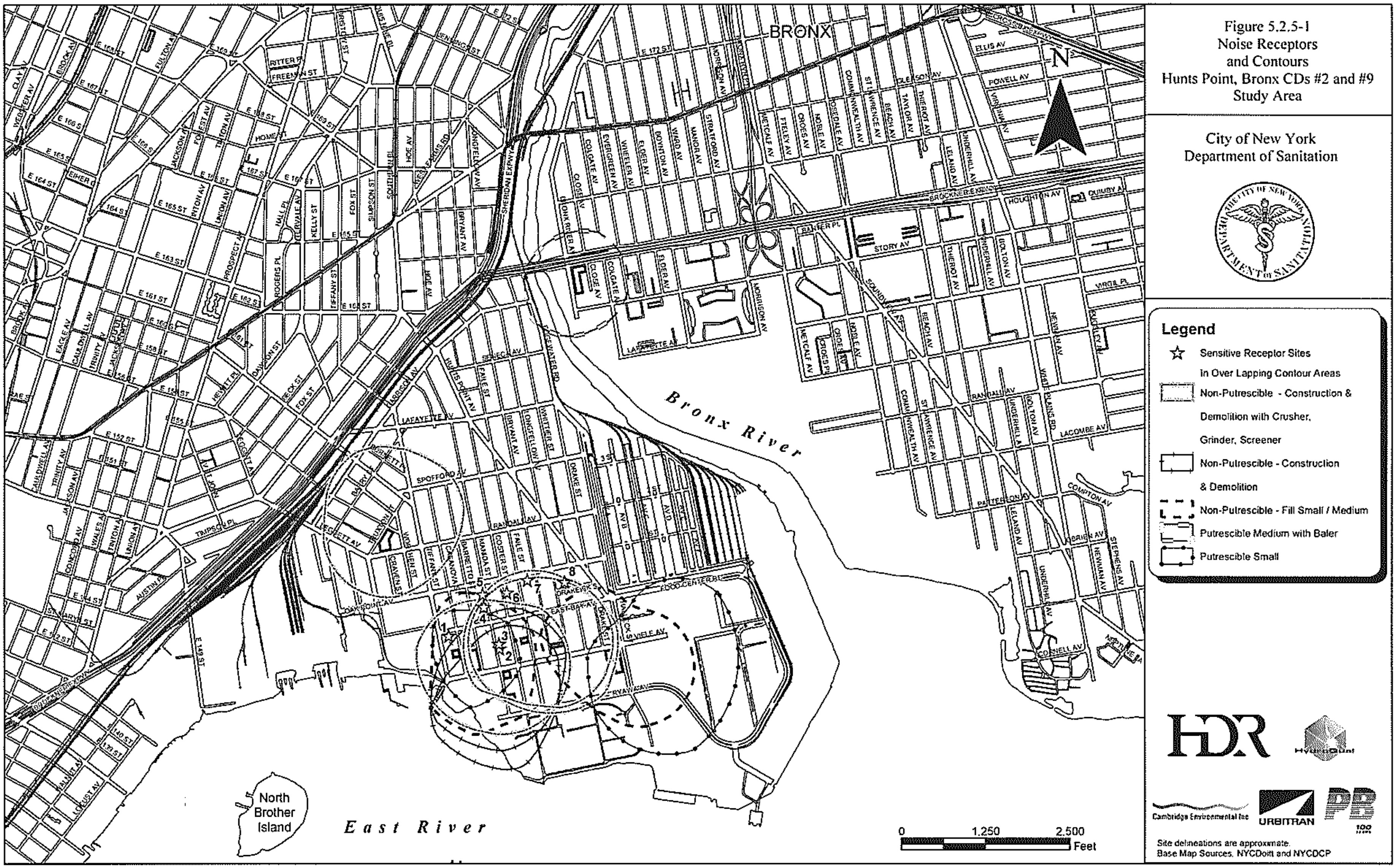


Figure 5.2.5-1
Noise Receptors
and Contours
Hunts Point, Bronx CDs #2 and #9
Study Area

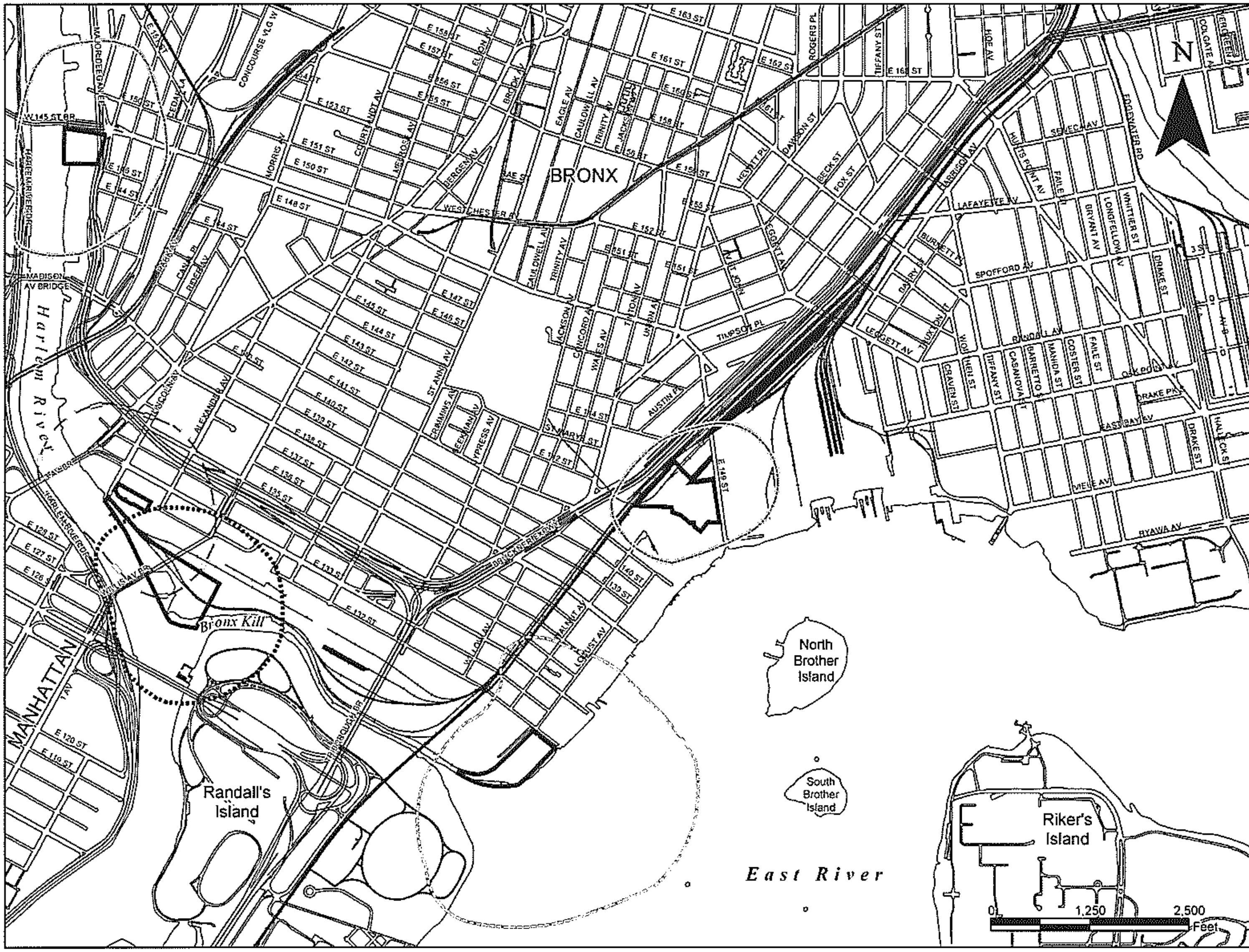


Figure 5.2.5-2
Noise Receptors
and Contours
Port Morris, Bronx CD #1 Study Area

City of New York
Department of Sanitation

Legend

- Non-Putrescible Large Fill
- Non-Putrescible Small & Medium Fill
- Putrescible Large with Baler
- Putrescible Large with Loco

Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

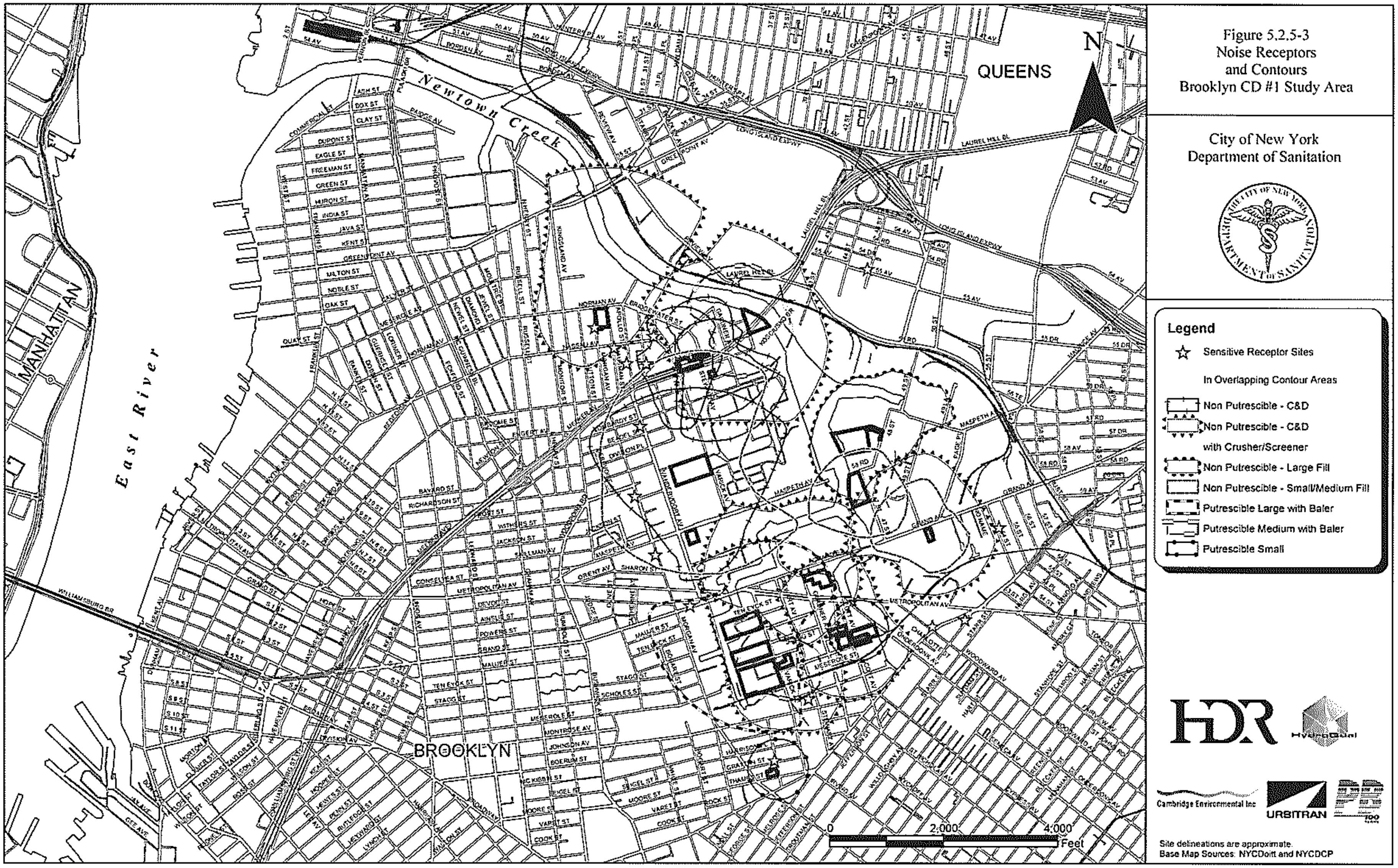


Figure 5.2.5-3
Noise Receptors
and Contours
Brooklyn CD #1 Study Area
City of New York
Department of Sanitation
Legend
Sensitive Receptor Sites
In Overlapping Contour Areas
Non Putrescible - C&D
Non Putrescible - C&D
with Crusher/Screener
Non Putrescible - Large Fill
Non Putrescible - Small/Medium Fill
Putrescible Large with Baler
Putrescible Medium with Baler
Putrescible Small
QUEENS
BROOKLYN
MANHATTAN
East River
Newtown Creek
N
0
2,000
4,000
Feet
HDR
Cambridge Environmental Inc
URBITRAN
Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

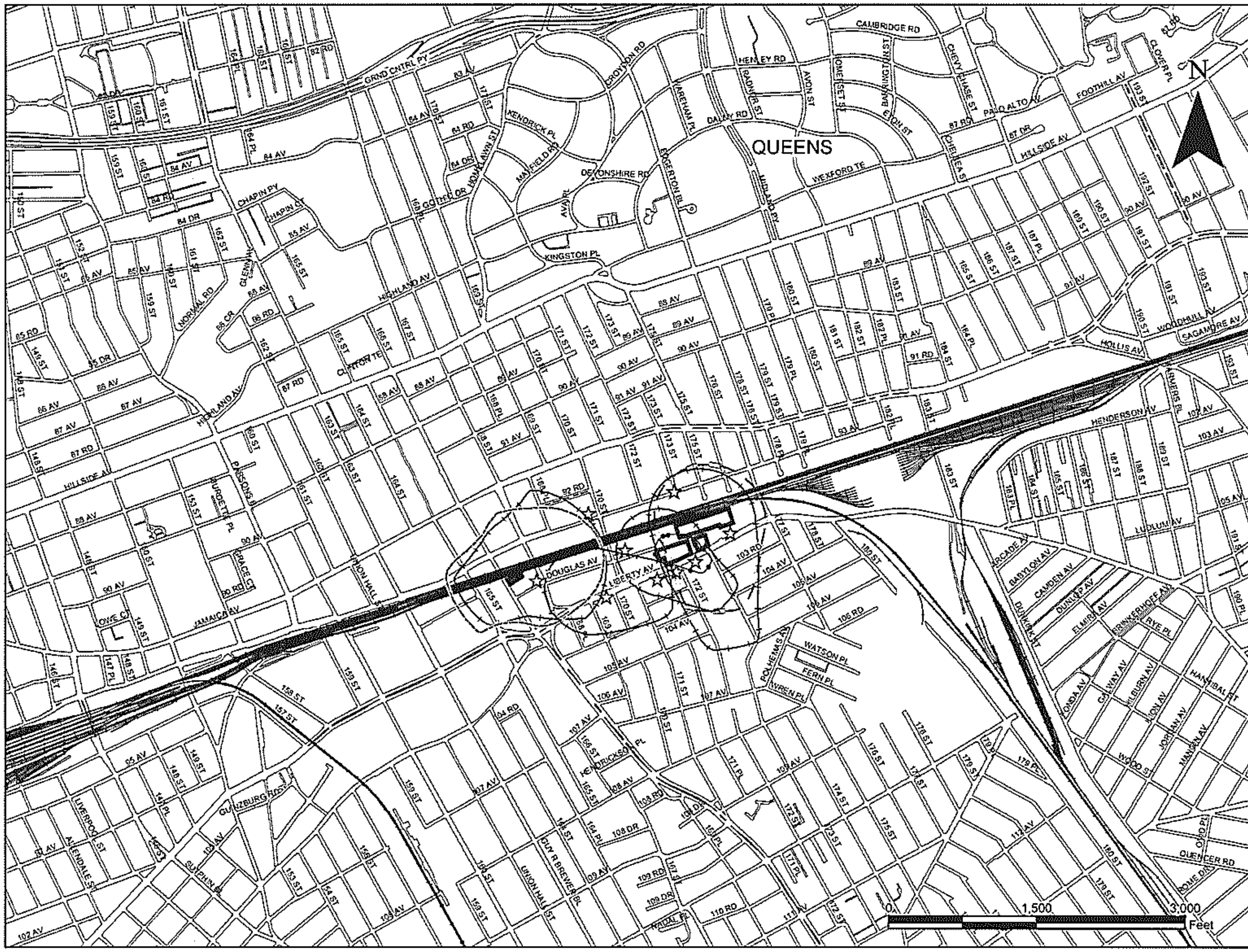


Figure 5.2.5-4
Noise Receptors
and Contours
Jamaica, Queens CD #12 Study Area

City of New York
Department of Sanitation

Legend

☆ Sensitive Receptor Sites

In Overlapping Contour Areas

Non Putrescible - C&D

Putrescible Medium with Baler

Putrescible Small

Putrescible Small/Medium with Fill

HDR

HydroQual

Cambridge Environmental Inc

URBITRAN

PB

Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

5.2.6 Water Quality Assessment

The cumulative effects on water quality from the Transfer Stations in the Study Areas were predicted using a mathematical model of New York Harbor, the 208 Model and the conservative assumption that the entire site for each Transfer Station was impervious (i.e., paved). As shown in Table 5.2.6-1, no individual or combined effects on water quality from Transfer Stations in the Study Areas were predicted.

Table 5.2.6-1
Predicted Water Quality Loadings

Facility	Study Area[3]	Impervious Area (acres)	Runoff Flow (cfs)[4]	Fecal Coliform (MF)[4]	BOD (lbs/day[4]	Copper (lbs/day) [4]	Lead (lbs/day)[4]	Zinc (lbs/day)[4]
Bronx County Recycling	Port Morris	3.79	0.23	41,713	12.3	0.042	0.033	0.19
Felix Equities	Port Morris	1.09	0.066	12,023	3.9	0.012	0.01	0.06
Tilcon NY	Port Morris	10.36	0.62	113,956	36.9	0.117	0.094	0.52
Waste Management of NY[1] (98 Lincoln Avenue, and 132nd Street and Saint Ann's Avenue)	Port Morris	15.61	0.94	171,629	55.5	0.177	0.141	0.78
Waste Services of NY	Port Morris	11.15	0.67	122,582	39.7	0.126	0.01	0.56
Waste Management of NY	Hunts Point	65.45	3.93	179,653	233	0.74	0.59	3.26
Waste Management of NY[2] (75 Thomas Avenue and 485 Scott Avenue)	Brooklyn	0.85	0.051	9,304	3.0	0.010	0.008	0.042
Waste Management of NY 232 Gardner Avenue	Brooklyn	1.78	0.11	19,513	6.3	0.020	0.016	0.088
Waste Management of NY 215 Varick Avenue	Brooklyn	4.88	0.29	53,638	17.4	0.055	0.044	0.243
Waste Management of NY 123 Varick Avenue	Brooklyn	12.24	0.73	134,580	43.5	0.14	0.111	0.61
Maspeth Recycling	Brooklyn	5.13	0.31	56,693	18.4	0.058	0.047	0.257
Pebble Lane Associates	Brooklyn	1.12	0.067	12,305	3.98	0.013	0.010	0.056

Note:
(1) For the purposes of this analysis, the Waste Management of NY facilities at 98 Lincoln Avenue, and 132nd Street and Saint Ann's Avenue, were analyzed together.
(2) For the purposes of this analysis, the Waste Management of NY facilities at 75 Thomas Avenue and 485 Scott Avenue were analyzed together
(3) Port Morris = Port Morris, Bronx CD #1 Study Area.
Hunts Point = Hunts Point, Bronx CDs #2 and #9 Study Area.
Brooklyn = Brooklyn CD #1 Study Area.
(4) cfs = cubic feet per second.
MF = membrane filter.
lbs/day = pounds per day.

5.3 Traffic, Off-Site Air Quality and Off-Site Noise Analyses

5.3.1 Traffic

The following number of intersections were analyzed using Highway Capacity Software (HCS) version 4.1c for AM, midday and PM peak hours in each of the four Study Areas:

- Six in the Port Morris, Bronx CD #1 Study Area;
- Ten (10) in the Hunts Point, Bronx CDs #2 and #9 Study Area (additional intersections were identified, but due to the overlap of routes with the Port Morris, Bronx CD #1 Study Area only 10 were required further analysis);
- Twenty-six (26) in the Brooklyn CD #1 Study Area; and
- Sixteen (16) in the Jamaica, Queens CD #12 Study Area.

A smaller number of intersections were analyzed in the Bronx Study Areas because access is limited from the north and west along major truck routes, while there is access from multiple directions to the Brooklyn CD #1 and Jamaica, Queens CD #12 Study Areas. Traffic analyses were conducted at each of these intersections for current conditions (identified through a data collection and analysis effort in 2003) that include the Waste Hauling Vehicles traveling through these intersections. Current conditions, current conditions without Waste Hauling Vehicles, and the RTG scenario were evaluated for those intersections with a mid LOS D or worse by approach. The locations of the intersections analyzed are presented in Figures 5.3.1-1 through 5.3.1-4.

The number of Waste Hauling Vehicles identified at the intersections analyzed ranged from 0 (at various intersections in the Jamaica, Queens CD #12 and Brooklyn CD #1 Study Areas) to 114 (at the intersection of Bruckner Boulevard and Leggett Avenue in the Hunts Point, Bronx CDs #2 and #9 Study Area). This is a relatively small number of vehicles compared to the background number of vehicles traveling through the intersections during the hours analyzed. Table 5.3.1-1 presents the percentage of Waste Hauling Vehicles and the percentage of RTG scenario vehicles as a percentage of total vehicles under each of these conditions.

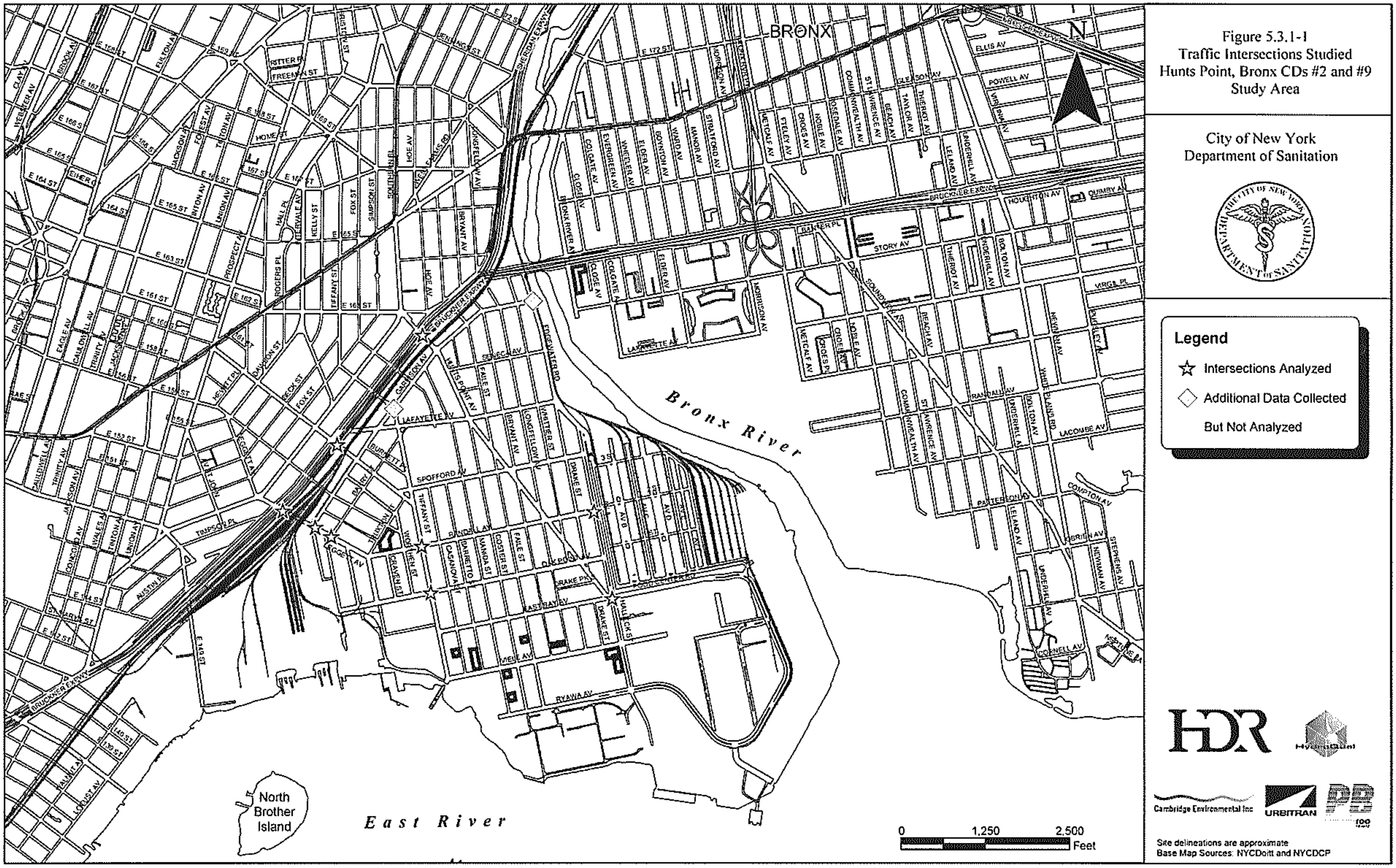
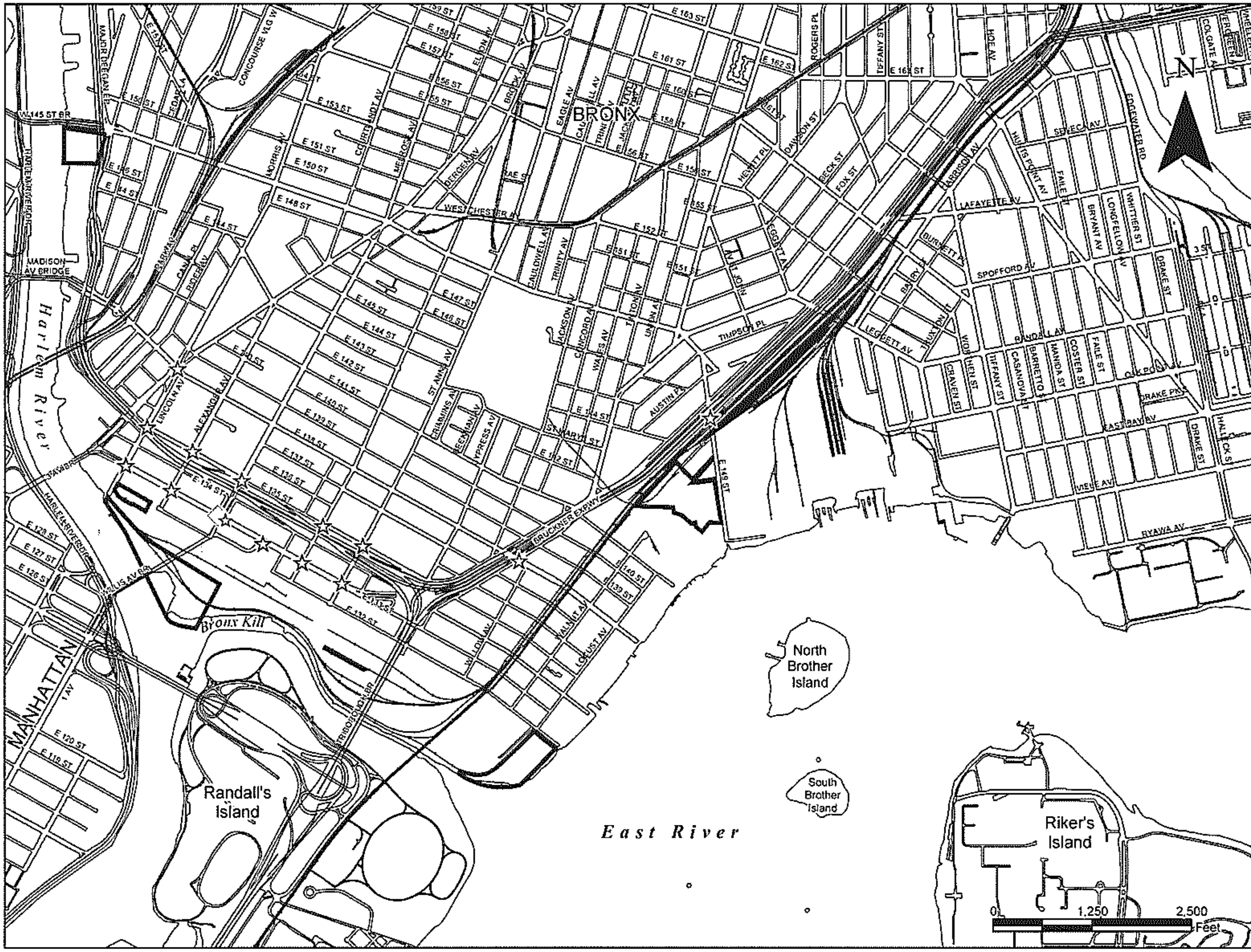


Figure 5.3.1-1
Traffic Intersections Studied
Hunts Point, Bronx CDs #2 and #9
Study Area
City of New York
Department of Sanitation
Legend
Intersections Analyzed
Additional Data Collected
But Not Analyzed
BRONX
N
Bronx River
East River
North Brother Island
0
1,250
2,500
Feet
HDR
Cambridge Environmental Inc
URBITRAN
Site delineations are approximate
Base Map Sources: NYCDoitt and NYCDCP

Figure 5.3.1-2
Traffic Intersections Studied
Port Morris, Bronx CD #1 Study Area

City of New York
Department of Sanitation



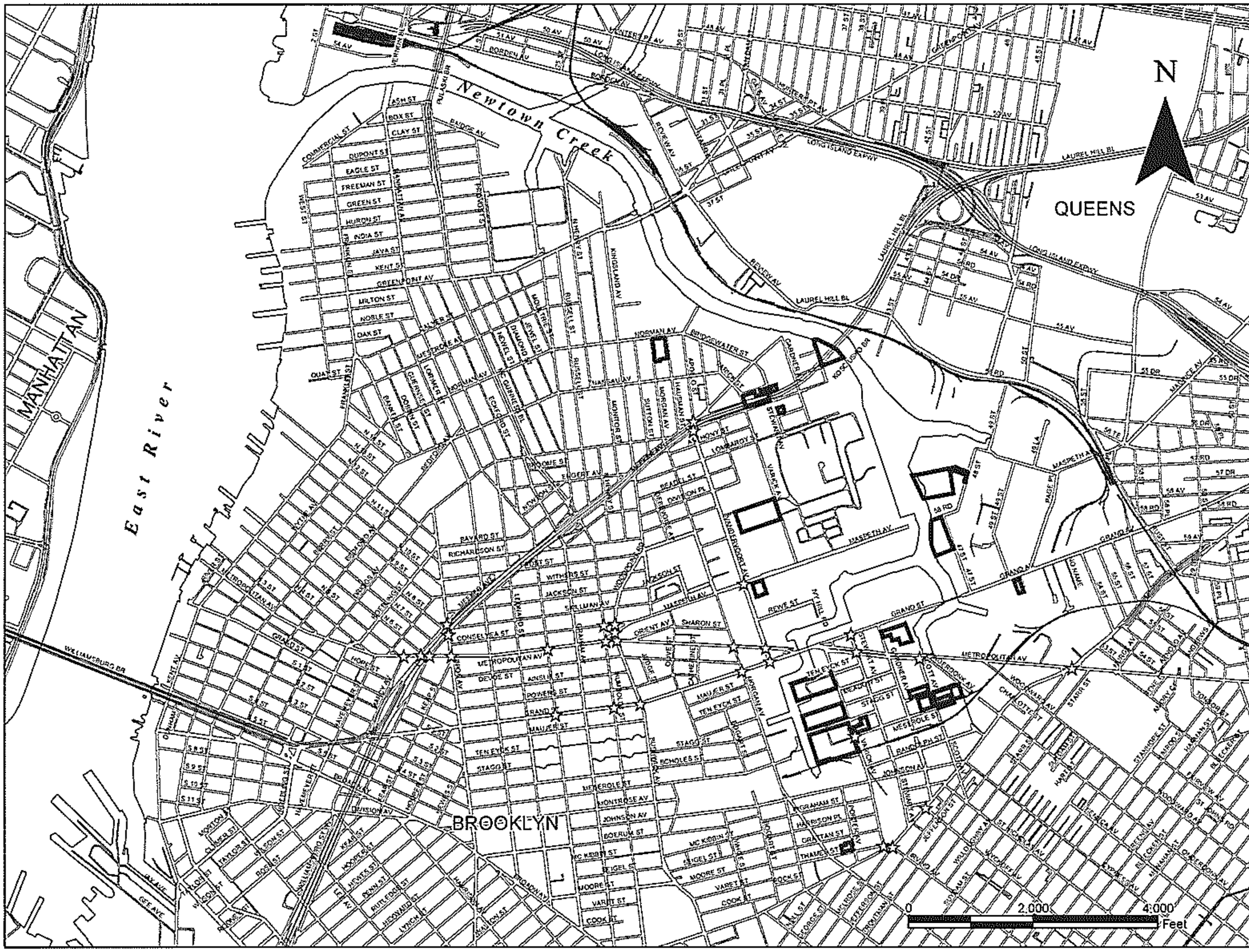
Legend
☆ Intersections Analyzed
◇ Data Collected But Not Analyzed

HDR
Cambridge Environmental Inc
URBITRAN

Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

Figure 5.3.1-3
Traffic Intersections Studied
Brooklyn CD #1 Study Area

City of New York
Department of Sanitation



Legend

☆ Intersections Analyzed

HDR
HydroQual
Cambridge Environmental Inc
URBITRAN
PB

Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

Figure 5.3.1-4
Traffic Intersections Studied
Jamaica, Queens CD #12 Study Area

City of New York
Department of Sanitation

Legend

☆ Intersections Analyzed

Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

Table 5.3.1-1
Average Percent of
Total Waste Hauling Vehicles at Intersections Analyzed

Study Area	AM Peak Hour	Midday Peak Hour	PM Peak Hour
Brooklyn CD #1			
Existing Conditions[(1)]	1.54%	1.88%	0.96%
Replacement Industry Conditions[(2)]	11.45%	11.48%	11.62%
Jamaica, Queens CD #12			
Existing Conditions[(1)]	0.30%	0.74%	0.15%
Replacement Industry Conditions[(2)]	7.83%	7.89%	8.25%
Port Morris, Bronx CD #1			
Existing Conditions[(1)]	2.07%	1.68%	1.22%
Replacement Industry Conditions[(2)]	14.02%	13.56%	19.67%
Hunts Point, Bronx CDs #2 and #9			
Existing Conditions[(1)]	4.99%	1.90%	1.21%
Replacement Industry Conditions[(2)]	9.72%	8.63%	11.90%

Notes:
(1) Represents the average percentage of total vehicles that are Waste Hauling Vehicles at intersections in the Study Area.
(2) Represents the average percentage of total vehicles that are replacement industry vehicles at intersections in the Study Area.

A summary of the LOS for current conditions and current conditions without Waste Hauling Vehicles and the RTG scenario (if mid-level LOS D or worse by approach) for each of the Study Areas is presented in Table 7-2 in Volume I, Appendix H to this Study.

Results indicate that many of the intersections operate at an overall LOS C or better under current conditions (six in Port Morris, Bronx CD #1 Study Area; seven in Hunts Point, Bronx CDs #2 and #9 Study Area; 16 in Jamaica, Queens CD #12 Study Area; and 23 in Brooklyn CD #1 Study Area). The current conditions at six of the intersections in the Study Areas operate at an overall LOS D, E or F. These are:

- Brooklyn CD #1 Study Area: (1) Meeker Avenue and Union Avenue, and (2) Flushing Avenue/Melrose Street and Varick Avenue/Irving Avenue;
- Port Morris, Bronx CD #1 Study Area: (1) Bruckner Boulevard and Alexander Street; and
- Hunt's Point, Bronx CDs #2 and #9 Study Area: (1) Hunt's Point Avenue and Bruckner Boulevard, (2) Longwood Avenue and Bruckner Boulevard, and (3) Leggett Avenue and Bruckner Boulevard.

Subtracting the Waste Hauling Vehicles from the analysis did not significantly improve the overall LOS at any intersections analyzed, primarily because the number of Waste Hauling Vehicles compared to the background traffic is low – ranging between 0% and 7% of the total traffic. For all cases, the LOS with replacement industry trips (that is, traffic that would be generated by other light industrial uses for the Transfer Station site if the Transfer Stations were absent) remained the same or deteriorated compared to the LOS with Waste Hauling Vehicles.

5.3.2 Off-Site Air Quality

Current conditions were analyzed at two links each in the Port Morris, Bronx CD #1 and the Hunts Point, Bronx CDs #2 and #9 Study Areas and at four links each in Brooklyn CD #1 and Jamaica, Queens CD #12. The "worst case" links for each Study Area were identified by evaluating convergence points along truck routes to and from the Study Areas, and observing the number of Waste Hauling Vehicles at these locations. As was the case with the traffic analysis, a lower number of links were analyzed in the Bronx Study Areas because of limited access conditions. The location of the links analyzed are presented in Figures 5.3.2-1 through 5.3.2-4.

Current conditions for CO were estimated using USEPA's MOBILE5b mobile emission factors algorithm and USEPA's CAL3QHC dispersion model. PM_{10} and $PM_{2.5}$ emission factors were estimated using the USEPA Publication AP-42 (AP-42), Section 13.2-1 and the USEPA's PART 5 model. The PM_{10} and $PM_{2.5}$ conditions were estimated using USEPA's CAL3QHCR Tier I dispersion model. Tables 5.3.2-1 through 5.3.2-4 provide a summary of current conditions for each of the links analyzed in each Study Area. For $PM_{2.5,}$ on-site contribution from the operations equipment and Waste Hauling Vehicles, at the link analyzed, were estimated and combined with the contribution from the on-street off-site sources.

5.3.3 Off-Site Noise

The number of locations initially screened to determine whether the Waste Hauling Vehicles under current conditions have the potential to double PCEs during each of the 24 hours is indicated below:

- Eight in the Port Morris, Bronx CD #1 Study Area;
- Four in the Hunts Point, Bronx CDs #2 and #9 Study Area;
- Six in the Brooklyn CD #1 Study Area; and
- Five in the Jamaica, Queens CD #12 Study Area.

These "worst case" locations were identified by evaluating convergence points along truck routes to and from the Study Areas, observing number of Waste Hauling Vehicles at these locations, and identifying sensitive receptors along these routes.

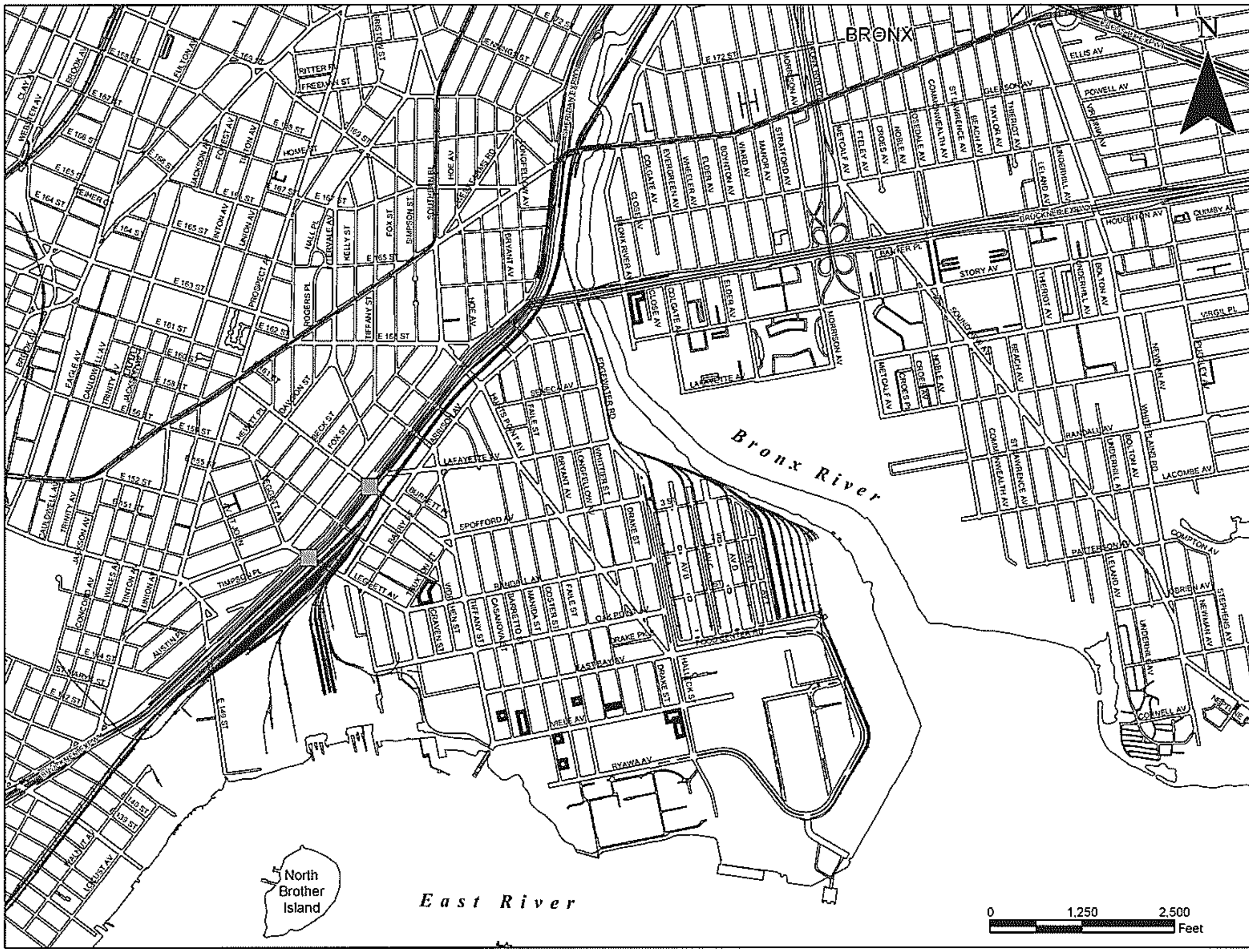


Figure 5.3.2-1
Off-Site Air Quality
Analysis Locations
Hunts Point, Bronx CDs #2 and #9
Study Area

City of New York
Department of Sanitation

Legend

Air Quality Analysis Locations

HDR
HydroQual
Cambridge Environmental Inc
URBITRAN
PB

Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

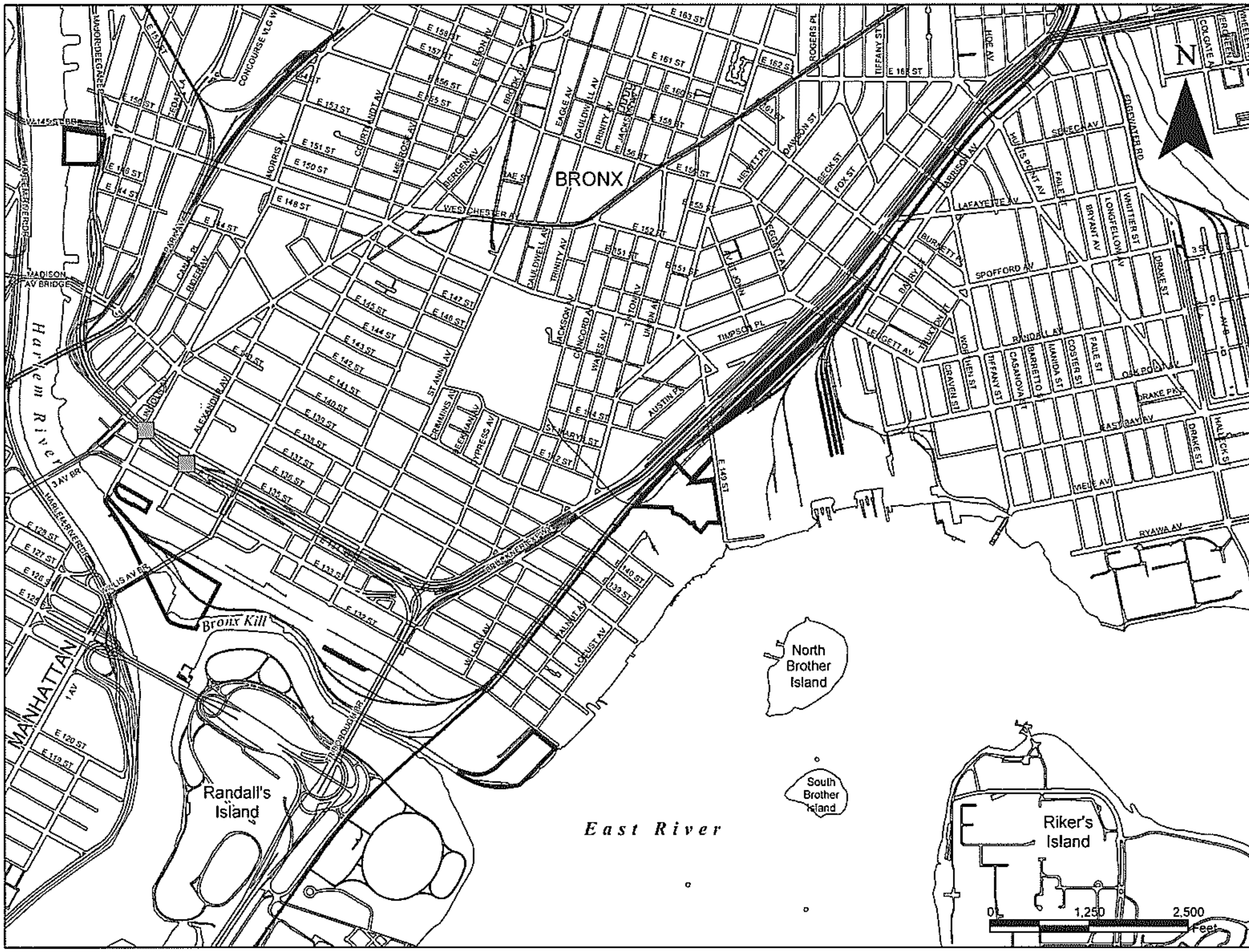


Figure 5.3.2-2
Off-Site Air Quality
Analysis Locations
Port Morris, Bronx CD #1 Study Area

City of New York
Department of Sanitation

Legend

Air Quality Analysis Locations

HDR

HydroQual

Cambridge Environmental Inc

URBITRAN

PB

Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

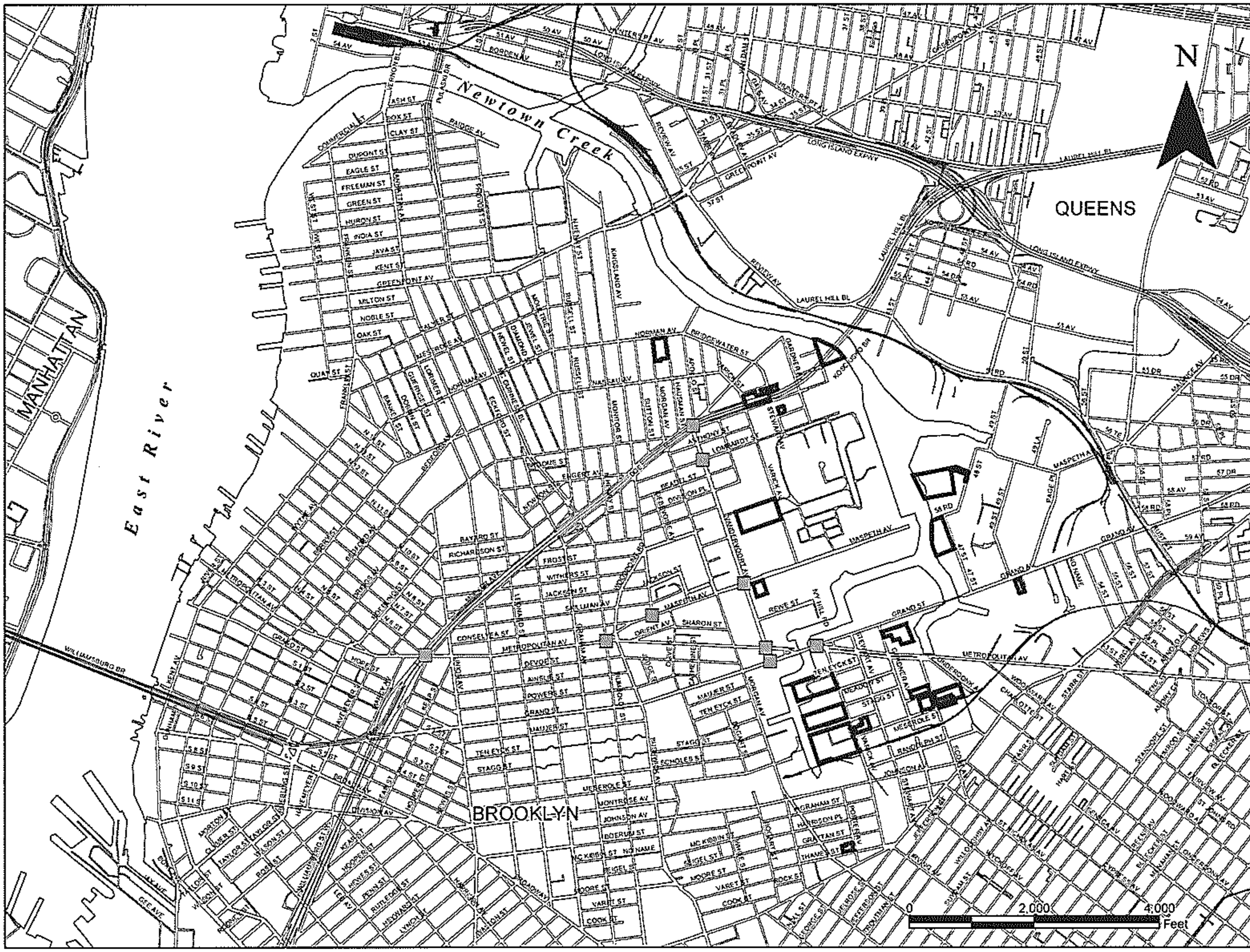


Figure 5.3.2-3
Off-Site Air Quality
Analysis Locations
Brooklyn CD #1 Study Area

City of New York
Department of Sanitation

Legend

Air Quality Analysis Locations

Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

Figure 5.3.2-4
Off-Site Air Quality Analysis Locations
Jamaica, Queens CD #12 Study Area

City of New York
Department of Sanitation

Legend

Air Quality Analysis Locations

Cambridge Environmental Inc
URBITRAN

Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

Table 5.3.2-1
Summary of Air Quality Analysis at
Selected Intersections within the Brooklyn CD #1 Study Area

Air Quality Receptor Site	CO	PM_{10}		$PM_{2.5}$					
	8-hr CO Facility (NAAQS: 9 ppm) Conc.(1) (ppm)	24-hr PM_{10} Facility (NAAQS: 150 $\mu g/m^3$) Conc.(1) ($\mu g/m^3$)	Annual PM_{10} (NAAQS: Facility 50 $\mu g/m^3$) Conc.(1) ($\mu g/m^3$)	24-hr Max. Contributions from On-Site Emission Sources Conc. (2) ($\mu g/m^3$)	24-hr Max. Contributions from Off-Site Emission Sources Conc. (3) ($\mu g/m^3$)	24-hr Total Combined Contributions from On- and Off-Site Emission Sources Conc. (5) ($\mu g/m^3$)	Annual Neighborhood Max. Contributions from On-Site Emission Sources Conc. (2) ($\mu g/m^3$)	Annual Neighborhood Contributions from Off-Site Emission Sources Conc. (4) ($\mu g/m^3$)	Annual Total Combined Contributions from Neighborhood On- and Off-Site Emission Sources Conc. (5) ($\mu g/m^3$)
Vandervoort/Meeker/ Lombardy									
Existing Conditions	5.10	119	50						
Existing Incremental				7.3	0.4	7.7	0.41	0.08	0.49
Metropolitan/Vandervoort/ Grand									
Existing Conditions	6.5	111	44						
Existing Incremental				3.8	0.5	4.2	0.30	0.06	0.36
Maspeth/Metro/Kings/ Humboldt									
Existing Conditions	5	112	46						
Existing Incremental				1	0.3	1.3	0.1	0.03	0.1
Metro/Meeker/Union/Rodney/ North 6th									
Existing Conditions	5.8	122	50						
Existing Incremental				0.81	0.16	1	0.05	0.05	0.1

Notes:

(1) CO and PM_{10} concentrations are the neighborhood concentrations estimated using the AM, Facility AM, and PM peak traffic information plus background concentration (8-hr CO = 2.8 ppm; 24-hr PM_{10} = 57 $\mu g/m^3$; Annual PM_{10}=23 $\mu g/m^3$).

(2) The maximum incremental concentrations of the on-site emissions at the intersection considered.

(3) The maximum incremental concentrations between existing conditions and without Waste Hauling Vehicles at any receptor 3 meters from the edge of the roadways.

(4) The maximum incremental concentrations between existing conditions and without Waste Hauling Vehicles at any receptor 15 meters from the edge of the roadways.

(5) Numbers may not add due to rounding.

ppm = Parts per million.

$\mu g/m^3$ = Micrograms per cubic meter.

Table 5.3.2-2
Summary of Air Quality Analysis at
Selected Intersections within the Jamaica, Queens CD #12 Study Area

Air Quality Receptor Site	CO	PM_{10}		$PM_{2.5}$					
	8-hr CO Facility (NAAQS: 9 ppm) Conc.(1) (ppm)	24-hr PM_{10} Facility (NAAQS: 150 μg/m³) Conc.(1) (μg/m³)	Annual PM_{10} (NAAQS: Facility 50 μg/m³) Conc.(1) (μg/m³)	24-hr Neighborhood Contributions from On-Site Emission Sources Conc. (2) (μg/m³)	24-hr Neighborhood Contributions from Off-Site Emission Sources Conc. (3) (μg/m³)	24-hr Total Combined Contributions from On- and Off-Site Emission Sources Conc. (5) (μg/m³)	Annual Neighborhood Max. Contributions from On-Site Emission Sources Conc. (2) (μg/m³)	Annual Neighborhood Contributions from Off-Site Emission Sources Conc. (4) (μg/m³)	Annual Total Combined Contributions from Neighborhood On- and Off-Site Emission Sources Conc. (5) (μg/m³)
Hillside/Merrick 166th / 168th									
Existing Conditions	4.5	123	48						
Existing Incremental				0.95	0.06	1.01	0.03	0	0.03
Jamaica/Merrick / 168th									
Existing Conditions	5.6	109	45						
Existing Incremental				3.9	0.03	4	0.17	0.02	0.19
Liberty/Merrick 168th									
Existing Conditions	7.1	123	50						
Existing Incremental				6.7	0.32	7	0.7	0.01	0.72
Liberty Avenue 171st / 173rd									
Existing Conditions	4.1	107	44						
Existing Incremental				13.8	0.17	14.0	1.43	0.01	1.44

Notes:

(1) CO and PM_{10} concentrations are the neighborhood concentrations estimated using the AM, Facility AM, and PM peak traffic information plus background concentration (8-hr CO = 2.8 ppm; 24-hr PM_{10} = 57 μg/m³; Annual PM_{10}=23 μg/m³).

(2) The maximum incremental concentrations of the on-site emissions at the intersection considered.

(3) The maximum incremental concentrations between existing conditions and without Waste Hauling Vehicles at any receptor 3 meters from the edge of the roadways.

(4) The maximum incremental concentrations between existing conditions and without Waste Hauling Vehicles at any receptor 15 meters from the edge of the roadways.

(5) Numbers may not add due to rounding.

ppm = Parts per million.

μg/m³ = Microgram per cubic meter.

Table 5.3.2-3
Summary of Air Quality Analysis at
Selected Intersections within the Hunts Point, Bronx CDs #2 and #9 Study Area

Air Quality Receptor Site	CO	PM_{10}		$PM_{2.5}$					
	8-hr CO Facility (NAAQS: 9 ppm) Conc.[1] (ppm)	24-hr PM_{10} Facility (NAAQS: 150 $\mu g/m^3$) Conc.[1] ($\mu g/m^3$)	Annual PM_{10} (NAAQS: Facility 50 $\mu g/m^3$) Conc.[1] ($\mu g/m^3$)	24-hr Neighborhood Contributions from On-Site Emission Sources Conc. [2] ($\mu g/m^3$)	24-hr Neighborhood Contributions from Off-Site Emission Sources Conc. [3] ($\mu g/m^3$)	24-hr Total Combined Contributions from On- and Off-Site Emission Sources Conc. [5] ($\mu g/m^3$)	Annual Neighborhood Max. Contributions from On-Site Emission Sources Conc. [2] ($\mu g/m^3$)	Annual Neighborhood Contributions from Off-Site Emission Sources Conc. [4] ($\mu g/m^3$)	Annual Total Combined Contributions from Neighborhood On- and Off-Site Emission Sources Conc. [5] ($\mu g/m^3$)
Bruckner/Leggett/Garrison									
Existing Conditions	6	123	42						
Existing Incremental				1	1	2	1	0.1	1
Bruckner & Longwood									
Existing Conditions	6	128	24						
Existing Incremental				2	0.3	2	1	0.1	1

Notes:

(1) CO and PM_{10} concentrations are the neighborhood concentrations estimated using the AM, Facility AM, and PM peak traffic information plus background concentration (8-hr CO = 2.8 ppm; 24-hr PM_{10} = 57 $\mu g/m^3$; Annual PM_{10}=23 $\mu g/m^3$).

(2) The maximum incremental concentrations of the on-site emissions at the intersection considered.

(3) The maximum incremental concentrations between existing conditions and without Waste Hauling Vehicles at any receptor 3 meters from the edge of the roadways.

(4) The maximum incremental concentrations between existing conditions and without Waste Hauling Vehicles at any receptor 15 meters from the edge of the roadways.

(5) Numbers may not add due to rounding.

ppm = Parts per million.

$\mu g/m^3$ = Microgram per cubic meter.

Table 5.3.2-4
Summary of Air Quality Analysis at
Selected Intersections within the Port Morris, Bronx CD #1 Study Area

Air Quality Receptor Site	CO	PM10		PM2.5					
	8-hr CO Facility (NAAQS: 9 ppm) Conc.(1) (ppm)	24-hr PM_{10} Facility (NAAQS: 150 µg/m3) Conc.(1) (µg/m3)	Annual PM_{10} (NAAQS: Facility 50 µg/m3) Conc.(1) (µg/m3)	24-hr Neighborhood Contributions from On-Site Emission Sources Conc. (2) (µg/m3)	24-hr Neighborhood Contributions from Off-Site Emission Sources Conc. (3) (µg/m3)	24-hr Total Combined Contributions from On- and Off-Site Emission Sources Conc. (5) (µg/m3)	Annual Neighborhood Max. Contributions from On-Site Emission Sources Conc. (2) (µg/m3)	Annual Neighborhood Contributions from Off-Site Emission Sources Conc. (4) (µg/m3)	Annual Total Combined Contributions from Neighborhood On- and Off-Site Emission Sources Conc. (5) (µg/m3)
Lincoln and Bruckner									
Existing Conditions	5	114	40						
Existing Incremental				6	0.9	7	0.2	0.17	0.4
Bruckner & Alexander									
Existing Conditions	5	115	40						
Existing Incremental				8	0.93	9	0.2	0.1	0.3

Notes:
(1) CO and PM_{10} concentrations are the Neighborhood concentrations estimated using the AM, Facility AM, and PM peak traffic information plus background concentration (8-hr CO = 2.8 ppm; 24-hr PM_{10} = 57 $\mu g/m^3$; Annual PM_{10}=23 $\mu g/m^3$).
(2) The maximum incremental concentrations of the on-site emissions at the intersection considered.
(3) The maximum incremental concentrations between existing conditions and without Waste Hauling Vehicles at any receptor 3 meters from the edge of the roadways.
(4) The maximum incremental concentrations between existing conditions and without Waste Hauling Vehicles at any receptor 15 meters from the edge of the roadways.
(5) Numbers may not add up due to rounding.
ppm = Parts per million.
$\mu g/m^3$ = Microgram per cubic meter.

The first level of screening used total traffic volumes and axle factors from the New York State Department of Transportation (NYSDOT) to conservatively estimate the existing traffic volumes, and whether the addition of Waste Hauling Vehicles would have the potential to double PCE noise levels, requiring a further evaluation of potential effects (first-level screening). Based on this first-level screening, 17 locations (five in Port Morris, Bronx CD #1; four in Hunts Point, Bronx CDs #2 and #9; three in Brooklyn CD #1; and five in Jamaica, Queens, CD #12) were identified for further screening (second-level screening) using actual field traffic classification counts at these locations to determine the potential for doubling PCEs. (To do this, Waste Hauling Vehicles were counted, removed from the analysis to determine "background" conditions, and then added back in). Based on this second-level screening, five locations (two locations in Brooklyn CD #1 and three locations in Jamaica, Queens, CD #12) were identified for modeling using Federal Highway Administration's (FHWA's) Traffic Noise Model (TNM) version 2.1. Background noise monitoring was conducted at the nearest sensitive receptor, and predicted results from TNM modeling at these five locations were compared to the Study noise threshold (an increase in 3dBA or greater attributable to the Waste Hauling Vehicles).

The locations of the analyzed intersections are presented in Figures 5.3.3-1 and 5.3.3-2.

TNM modeling simulated current conditions (with Waste Hauling Vehicles) to predict off-site noise effects. The TNM model is conservative, in that it only assumes background noise levels based on traffic volumes that are input into the model. It does not account for other ambient background noise levels that exist in the Study Areas, which were observed during background noise monitoring, such as an ambulance passing by or a noisy establishment near the receptor. Therefore, the modeled current conditions predicted at the sensitive receptor were compared to the measured results at that receptor and the model was calibrated to accurately reflect background noise levels under current conditions.

Once calibrated, the predicted results for current conditions were compared to CEQR thresholds. The incremental noise level of Waste Hauling Vehicles (when removed from the model) was compared to 3 dBA. A summary of predicted results in each of the Brooklyn CD #1 and Jamaica, Queens CD #12 Study Areas is presented in Tables 5.3.3-1 and 5.3.3-2.

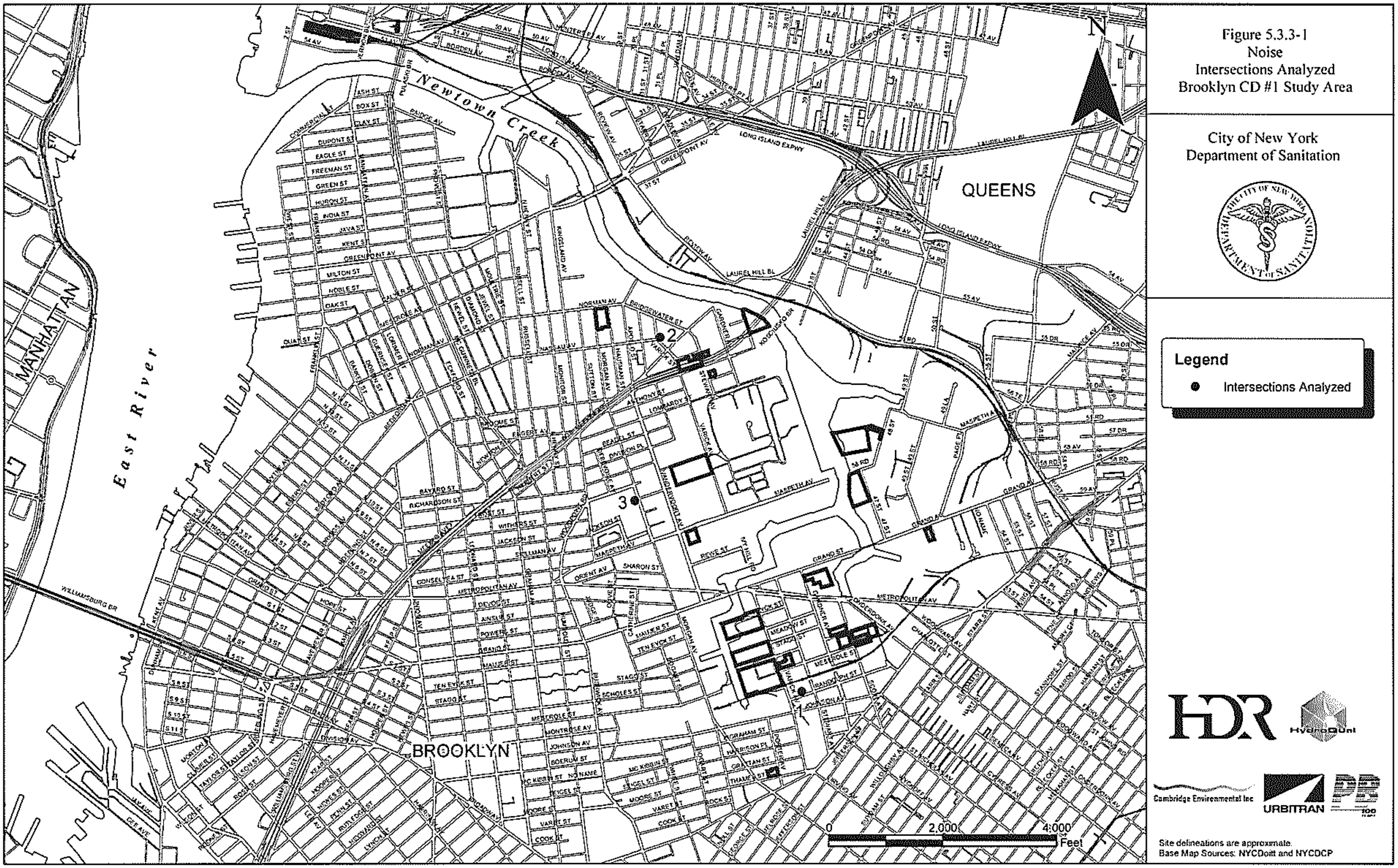


Figure 5.3.3-1
Noise
Intersections Analyzed
Brooklyn CD #1 Study Area

Figure 5.3.3-2
Noise
Intersections Analyzed
Jamaica, Queens CD #12 Study Area

City of New York
Department of Sanitation

Legend

- Intersections Analyzed

Site delineations are approximate.
Base Map Sources: NYCDoitt and NYCDCP

Table 5.3.3-1
Summary of TNM Modeling Analysis
Brooklyn CD #1 Study Area

Location	Hour of Monitoring	Existing Number of Waste Hauling Vehicles	Existing Monitored Noise Level (dBA)	TNM Model Results with Waste Hauling Vehicles (dBA)	Calculated Background Noise Level without Waste Hauling Vehicles (dBA)	TNM Model Results without Waste Hauling Vehicles (dBA)	TNM Model without Waste Hauling Vehicles with Calculated Background Noise Levels (dBA)	Noise Level Increase due to Waste Hauling Vehicles [(1)] (dBA)	Effect (Yes or No) [(2)]
Metropolitan Avenue between Olive and Catherine	3:00 a.m. to 4:00 a.m.	43	69.2	64.9	67.2	59.9	67.9	1.3	NO
Vandervoort Avenue between Beadel and Lombardy	3:00 a.m. to 4:00 a.m.	51	70.6	65.3	69.1	60.3	69.6	1.0	NO

Notes:
(1) Value is calculated by subtracting the TNM Model Results without Waste Hauling Vehicles from the calculated background noise from the Existing Monitored Noise Level.
(2) Effect is identified if the noise level increase due to Waste Hauling Vehicles is greater than or equal to 3 dBA.
dBA = A-weighted decibel.

Table 5.3.3-2
Summary of TNM Modeling Analysis
Jamaica, Queens CD #12 Study Area

Location	Hour of Monitoring	Existing Number of Waste Hauling Vehicles	Existing Monitored Noise Level (dBA)	TNM Model Results with Waste Hauling Vehicles (dBA)	Calculated Background Noise Level without Waste Hauling Vehicles (dBA)	TNM Model Results without Waste Hauling Vehicles (dBA)	TNM Model without Waste Hauling Vehicles with Calculated Background Noise Levels (dBA)	Noise Level Increase due to Waste Hauling Vehicles (1) (dBA)	Effect (Yes or No) (2)
Liberty Avenue between Guy Brewers and 160th Street	2:00 a.m. to 3:00 a.m.	15	66.4	59.8	65.3	56.2	65.8	0.6	No
Liberty Avenue between 169th Street and 170th Street	2:00 a.m. to 3:00 a.m.	35	69.3	60.3	68.7	55.4	68.9	0.4	No
Liberty Avenue between 171st Street and 172nd Street2	2:00 a.m. to 3:00 a.m.	20	70.7	60.4	70.3	55	70.4	0.3	No

Notes:
(1) Value is calculated by subtracting the TNM Model Results without Waste Hauling Vehicles from the calculated background noise from the Existing Monitored Noise Level.
(2) Effect is identified if the noise level increase due to Waste Hauling Vehicles is greater than or equal to 3 dBA.
dBA = A-weighted decibel.

As shown in Tables 5.3.3-1 and 5.3.3-2, the modeled off-site noise from the Waste Hauling Vehicles at the intersections analyzed did not exceed the threshold. Therefore, there are no predicted noise effects from these Waste Hauling Vehicles.

5.4 Public Health Evaluation

In this Study, effects on public health due to odors and contributions to air quality were assessed. Using the conservative assumption that commercial waste Transfer Stations do not control odors at all, receptors in two Study Areas were found likely to experience potentially unacceptable odors. However, these effects were predicted to be infrequent, occurring less than 1% of the time for all receptors, and are not likely to generate sustained annoyance or symptoms. Nonetheless, additional odor control would be welcome. With regard to regulated pollutants, effects on air quality were predicted to be minimal. The Transfer Stations in aggregate do not appear to be important determinants of air quality with respect to any of the pollutants regulated by the USEPA on the basis of human health effects.

ATTACHMENT A

New York City Transfer Stations

Putrescible Transfer Station Permits[1]

Company	Address	Zone	Permitted Throughput (tons per day)[3]	Community Board
A & L Cesspool Service Corp.	38-40 Review Avenue, LIC, NY 11101	M-3	N/A	QN2
American Recycling Mgt. LLC	172-33 Douglas Avenue, Jamaica, NY 11433	M-1	400	QN12
BFI Waste Systems of NJ, Inc.	115 Thames Street, Brooklyn, NY 11237	M-1	560	BK1
BFI Waste Systems of NJ, Inc.	598-636 Scholes Street, Brooklyn, NY 11237	M-3	220	BK1
Cross County Recycling	122-52 Montauk Street, Springfield Gardens, NY 11413	M-1	500	QN12
Hi-Tech Resource Recovery	130 Varick Avenue, Brooklyn, NY 11237	M-3	500	BK1
IESI NY Corporation	325 Casanova Street, Bronx, NY 10474	M-3	225	BX2
IESI NY Corporation	110-120 50th Street, Brooklyn, NY 11232	M-3	1,000	BK7
IESI NY Corporation	577 Court Street, Brooklyn, NY 11231	M-3	745	BK6
Metropolitan Transfer Station	287 Halleck Street, Bronx, NY 10474	M-1	825	BX2
New Style Recycling	49-10 Grand Avenue, Maspeth, NY 11378	M-3	50	QN5
Paper Fibres Corporation	960 Bronx River Avenue, Bronx, NY 10454	M-3	74	BX9
Regal Recycling Co., Inc.	172-06 Douglas Avenue, Jamaica, NY 11433	M-1	178	QN12
Tully Environmental, Inc.	127-20 34th Avenue, Queens, NY 11368	M-3	900	QN7
USA Waste Services of NYC, Inc.[2]	132nd Street @ Saint Ann's Avenue, Bronx, NY 10454	M-3	N/A	BX1
USA Waste Services of NYC, Waste Management Inc.	98 Lincoln Avenue, Bronx, NY 10455	M-2	3,000	BX1
Waste Management of NY, LLC	215 Varick Avenue, Brooklyn, NY 11231	M-3	4,250	BK1
Waste Management of NY, LLC	38-50 Review Avenue, LIC, NY 11101	M-3	958	QN2
Waste Management of NY, LLC	485 Scott Avenue, Brooklyn, NY 11222	M-3	1,400	BK1
Waste Management of NY, LLC[2]	Oakpoint Avenue/Barry Street, Bronx, NY 10474	M-3	N/A	BX2
Waste Services of New York, Inc.	941 Stanley Avenue, Brooklyn, NY 11208	M-1	375	BK5
Waste Services of New York, Inc.	920 East 132nd Street, Bronx, NY 10454	M-3	2,999	BX1

Notes:

(1) Some facilities have dual permits (for example, putrescible/non-putrescible) and appear on both lists of permits.

(2) Source: DSNY Quarterly Transfer Station Report Summary (third quarter 2003). Throughput is NYDEC permitted throughput.

(3) Intermodal facility, no processing.

N/A = Not Applicable

Non-Putrescible Transfer Station Permits[1]

Company	Address	Zone	Permitted Throughput (tons per day)[2]	Community Board
A.J. Recycling, Inc.	325 Faile Street, Bronx, NY 10474	M 3	1,200	BX2
American Recycling, Mgt. LLC	172-33 Douglas Avenue, Queens, NY 11433	M 1	750	QN12
Astoria Carting Co., Inc.	538-545 Stewart Avenue, Brooklyn, NY 11222	M 3	300	BK1
Atlas Roll-Off Corp.	889 Essex Street, Brooklyn, NY 11208	M 1	1,125	BK5
BFI Waste Systems of New Jersey	575 Scholes Street, Brooklyn, NY 11211	M 3	544	BK1
BFI Waste Systems of New Jersey	594 Scholes Street, Brooklyn, NY 11211	M 3	544	BK1
City Recycling Corporation	151 Anthony Street, Brooklyn, NY 11222	M 3	1,500	BK1
Cooper Tank & Welding, Inc.	222 Maspeth Avenue, Brooklyn, NY 11211	M 3	1,875	BK1
Crown Container Company	126-46 34th Avenue, Flushing, NY 11368	M 3	281	QN7
Decostole Carting Co.	1481 Troy Avenue, Brooklyn, NY 11203	M 1	300	BK17
Flag Container Services, Inc.	11 Ferry Street, Staten Island, NY 10302	M 3	2,250	SI1
G.M. Transfer Inc.	216-222 Manida Street, Bronx, NY 10474	M 3	0	BX2
IESI NY Corporation	548 Varick Avenue, Brooklyn, NY 11222	M 3	1,350	BK1
John Danna and Sons, Inc.	318 Bryant Avenue, Bronx, NY 10474	M 3	405	BX2
Kid's Waterfront Corp.	1264 Viele Avenue, Bronx, NY 10474	M 3	750	BX2
New Style Recycling Corp.	49-10 Grand Avenue, Maspeth, NY 11378	M 3	225	QN5
Point Recycling, Ltd.	686 Morgan Avenue, Brooklyn, NY 11222	M 3	300	BK1
Regal Recycling, Ltd.	172-06 Douglas Avenue, Jamaica, NY 11433	M 1	266	QN12
Stokes Waste Paper Co., Inc.	17-25 Van Street, Staten Island, NY 10310	M 1	844	SI1
Thomas Novelli Contract. Corp.	94-20 Merrick Blvd., Jamaica, NY 11433	M 1	375	QN12
Waste Management of NY, LLC	123 Varick Avenue, Brooklyn, NY 11237	M 3	5,250	BK1
Waste Management of NY, LLC	232 Gardner Avenue, Brooklyn, NY 11237	M 3	6,480	BK1
Waste Management of NY, LLC	315 Barretto Street, Bronx, NY	M 3	1,037	BX2
Waste Management of NY, LLC	620 Truxton Street, Bronx, NY 10474	M 3	1,050	BX2
Waste Management of NY, LLC	75 Thomas Street, Brooklyn, NY 11222	M 3	1850	BK1

Notes:

(1) Some facilities have dual permits (for example, putrescible/non-putrescible) and appear on both lists of permits.

(2) Source: DSNY Quarterly Transfer Station Report Summary (third quarter 2003). Throughput is NYDEC permitted throughput.

Fill Material Transfer Station Permits[1]

Company	Address	Zone	Permitted Allowable Storage Volume (cubic yard)[2]	Community Board
Allocco	540 Kingsland Avenue, Brooklyn, NY 11222	M-3	10,666	BK 1
Bronx City Recycling, Inc	1390 Viele Avenue, Bronx, NY 10474	M-3	1,400	BX 2
Bronx County Recycling, LLC	475 Exterior Street, Bronx, NY 10451	M-2	6,000	BX 1
Consolidated Edison Co. of New York	276-290 Avenue C, NY, NY 10003	M3	250	MN 6
Durante Brothers	31-40 123rd Street, Flushing, NY 11354	M3	14,696	QN 7
Felix Equities	290 East 132nd Street, Bronx, NY 10454	M3	300	BX1
Evergreen Recycling of Corona	The Corona Meadows Yard, Corona, NY 11368	M3	50,000	QN 7
Grace Associates, Inc.	151-45 Sixth Road, Whitestone, NY 11357	M1	25,000	QN 7
Interstate Materials Corporation	211 Johnson Street, Staten Island, NY 10309	M-3	75,000	SI 3
J.A. Bruno	280 Meredith Avenue, Staten Island, NY 10314	M-3	40,000	SI 2
Justus Recycling	3300 Provost Avenue, Bronx, NY 10475	M1	11,000	BX 10
Keyspan Energy	287 Maspeth Avenue, Brooklyn, NY 11201	M3	10,000	BK 1
Maspeth Recycling	58-08 48th Street, Maspeth, NY 11378	M3	30,000	QN 5
N.Y. Paving	37-18 Railroad Avenue, LIC, NY 11101	M1	500	QN 2
Pebble Lane Associates, Inc.	57-00 47th Street, Maspeth, NY 11378	M3	7,500	QN 5
Red Hook Crushers	186 Third Street, Brooklyn, NY 11215	M2	5,000	BK 6
Russo Recycling	248-12 Brookville Blvd., Rosedale, NY 11422	M1	20,000	QN 13
T. Novelli	94-07 Merrick Blvd., Jamaica, NY 11433	M-1	1,500	QN 12
Tilcon New York, Inc.	980 East 149th Street, Bronx, NY 10455	M3	80,000	BX 1
T.M. Maintenance	451 Spencer Street, Staten Island, NY 10314	M3	25,000	SI 2
Vanbro	1900 South Avenue, Staten Island, NY 10314	M3	400,000	SI 2
Waste Management of NY, LLC	73 Place & South Railroad Ave., Woodside, NY 11377	M1	15,000	QN 2

Notes:

(1) Some facilities have dual permits (for example, putrescible/non-putrescible) and appear on both lists of permits.

(2) Source: DSNY Quarterly Transfer Station Report Summary (third quarter 2003). Throughput is NYDEC permitted throughput.

ATTACHMENT B

Bureau of Legal Affairs Memo: Supplemental Information to be Included with and Deemed a Part of the Completed Environmental Assessment Statement

sanitation

BUREAU OF LEGAL AFFAIRS
125 Worth Street, 7th Floor
New York, New York 10013
Fax (212) 442-9090, 791-3824

Tel. (212) ________________

DATE: Revised February 9, 1999
July 5, 1994, original draft

TO: Solid Waste Transfer Station Permit Applicants

FROM: The New York City Department of Sanitation, Bureau of Legal Affairs

RE: SUPPLEMENTAL INFORMATION TO BE INCLUDED WITH AND DEEMED A PART OF THE COMPLETED ENVIRONMENTAL ASSESSMENT STATEMENT

Unless otherwise agreed to in advance by the Department of Sanitation, the following information and documentation is required to accompany a complete Environmental Assessment Statement ("EAS"). This Supplemental information, together with a copy of the New York State Department of Environmental Conservation Part 360 application and any other information the Department requires you to submit during the environmental review process is deemed to be a part of the EAS. The Department reserves its right to request additional information or clarification on an as needed basis.

I. General

A. Provide a detailed description of the current and proposed solid waste processing operations at the facility, including, but not limited to:

1. a list of the types and quantity of equipment used on the premises;

2. the types and quantity of fuel used for each type of equipment; and

3. the manufacturer's literature for each type of equipment;

B. a statement of whether crushers or conveyor belts are or will be used;

C. a statement of whether the site is, or will be paved or unpaved;

D. a statement identifying those parts of the transfer station operation that will take place in an <u>enclosed</u> facility and those parts of the transfer station operation that will take place in an <u>unenclosed</u> facility;

E. 1. a description of how and where each type of waste material is, or will be, stored;

2. the number of piles of debris;

3. heights of piles;

4. density of piles;

5. area of piles (in square footage); and

6. number of active/inactive piles depending on how long each type of waste remains on premises;

F. 1. the turnaround times of the material to be processed;

2. the quantity of material that is stored on the site;

3. the length of time the material will be stored;

4. the maximum length of time waste remains in the facility prior to transfer;

Applicants must <u>specifically address each of the points</u> listed above. Selectively addressing these points will not suffice and your application will be returned.

G. Provide a copy of the <u>current</u> extermination contract. The contract must be an executed contract. Simply providing a letter from an exterminator indicating that services will be rendered, or copies of past bills will not suffice. Applications that are submitted without a copy of an executed contract will be returned.

II. <u>Solid Waste Composition</u>

A. Provide a description of the types of solid waste materials currently, and proposed to be, handled at the facility and the maximum throughput amounts of each type of waste to be processed or handled at the facility.

1. calculated in volume measurements; and

2. calculated in absolute weight measurements;

III. <u>Maps</u>

A. Provide a map incorporating the following specifications in a <u>legible</u> format unless otherwise agreed to by the Department.

1. a four hundred foot (400 ft.) radius from the perimeter boundaries of the site using a scale of 1:50 or 1:60 and indicate north/south;

2. indicate the nearest residence(s) and odor sensitive receptors as such terms are defined in Section V. (D); and

3. indicate bulk and uses on all lots included within the radius;

B. Provide a map clearly showing the site and surrounding area within a half mile radius of the boundaries of the site. **You must clearly mark on the Zoning map a half mile radius from the boundaries of the entire site.**

IV. Site and Facility Background Information

A. Site/Facility Plan - Provide a map clearly showing the layout of the transfer station at a scale of 1/8 inch = 1 foot. The following items must be clearly indicated:

1. structures;
2. curb cuts;
3. location and dimensions of stacks;
4. location of fences, gates, entrances and exits;
5. location of solid waste processing areas;
6. location of sewer, drains and spigots;
7. employee parking areas;
8. internal traffic flow;
9. truck loading and unloading areas;
10. locations where vehicles will be stored on site and locations where trucks will queue while waiting to tip or load materials, and;
11. location of odor control equipment.
    (This information is also required in Section V. (B.))

B. Fifty (50) Year Site History - You must provide a fifty year history land use review showing the uses of the site since 1947. Please briefly describe the property use for these years accordingly. Acceptable documentation includes Sanborn maps and New York City Department of Buildings Certificate of Occupancy tax maps, etc. In addition, if any above or underground storage tanks are located on the site, you must provide the following:

1. A copy of the New York City Fire Department inspection records;
2. A copy of all records on tank testing and leaks, including those maintained by the New York City Bureau of Fire Prevention, Buried Tank Unit and the New York State

Department of Environmental Conservation;

3. If available, a description of the tanks, including dimensions, volume, construction material, age and type of material contained in the tanks, and the fate of such tanks (i.e., plans for removal or filling and sealing).

C. If any aboveground storage tanks or underground storage tanks were removed from the site you must provide an affidavit and/or appropriate removal documentation stating that the tanks were removed.

The above information may be obtained by contacting:

1. New York City Bureau of Fire Prevention
9 Metrotech Center
Brooklyn, New York 11201

Contact: Daniel Flynn, Manager, File Records
(718) 999-2684

2. DEC Hazardous Waste Division and Underground Tank Unit
47-40 21st Street
Long Island City, New York

Contact: Koon Tang (for information concerning tanks holding 1,100 gallons or more)
(718) 482-4996

V. Odor Protocol

A. Provide a written Odor Control Plan detailing:

1. how the facility intends to control any odors;

B. Explain the type of odor controlling devices to be used at the facility;

1. provide factory literature and Material Safety Data Sheets (MSDS) for all chemicals used in the deodorizing process;

2. highlight on a map where each device is, or will, be located; (Please indicate this information on the Site Plan required in Section IV.)

C. List and describe all existing land uses immediately adjacent to, and directly or diagonally across the street from, the property lines of the project site.

1. estimate distances from the nearest project site boundary;*

D. Identify and describe in chart form and list on a map the odor sensitive receptors within 400 feet of property lines of the site;

1. estimate the distances of these odor sensitive receptors from the project site;

Odor sensitive receptors include: residential facilities, educational facilities, public water supply facilities, health care facilities, social services facilities, recreational facilities, parks, playgrounds and commercial facilities.*

E. Identify and describe in chart form and list on a map all existing facilities of any type within 400 feet of the property lines of the site with existing of potential odor impacts (e.g., putrescible or non-putrescible solid waste transfer stations, composting facilities, liquid storage, or surface impoundment facilities).

1. estimate the facilities' distance of these facilities from the project site;*

VI. Traffic Analysis

A. Provide a Truck Routes Map identifying the routes trucks accessing and departing the facility use, or will use, within a half-mile radius;

B. Provide two hourly charts indicating:

1. current and proposed arrivals and departures of vehicles by waste category and vehicle type over the course of a typical 24-hour period and for the facility operating at its maximum throughput capacity;

2. specify the peak hours of operation for the facility;

3. describe the methodology used to determine what constitutes a typical 24-hour period (e.g., a description of how you determined what a typical 24-hour period is). You may be asked in the future to povide written support to justify your traffic analysis in a "typical 24-hour period;"

4. include total hourly vehicle trip ends (i.e., truck trip ends for each waste type plus employee trip ends) and indicate peak hours; and

5. include trip ends to weigh stations. A "trip end" is a one-way. A round trip equals two "trip ends;"

If the facility has or will have its own weigh station, you must provide proof of its existence. If the facility receives, or will receive, trips from other transfer stations for the purpose of using the weigh station, the number of these trip ends on an hourly basis must be given.

C. Provide the number, type and capacity of trucks utilizing the facility;

1. include the weight of trucks and the number of wheels per truck;

(*The Land Use Map will be helpful and should be consulted to provide the information requested.)

D. Provide the number of current and proposed employees by shift and the hours of each shift;

1. identify the number of employee-related vehicle trips generated during each hour of operation and where they park;

E. Describe the proximity of truck routes to facilities that attract schoolchildren or the elderly;

F. Provide a map or a written description indicating on-street parking regulations adjacent to the facility;

G. If trucks need to queue on the streets adjacent to the facility before tipping and/or when waiting to load prior to departure:

1. provide information as to where, when, and for how long on the Site Plan or in a separate description; and

2. provide the amount of on-street parking, and queuing space available immediately adjacent to the facility;

H. Provide the hours of proposed operation for the facility;

I. Provide the number of width of curb-cuts and whether they are one-way or two-way;

J. Provide the direction of streets immediately adjacent to the facility;

K. Provide the number of parking spaces available for employees, trucks and visitors;

Emissions and Drainage

A. Provide a written plan describing how the facility intends to control Fugitive Dust Emissions. You must also provide the ventilation plans for any enclosed structures on the site;

B. Drainage Plan

1. Provide the quantity and quality of wastewater effluent generated by the facility per day;

2. Provide a copy of the potable plumbing riser diagram, detailing all backflow prevention devices;

3. Provide a copy of the wastewater plumbing riser diagram, detailing all backflow prevention devices;

4. Describe the storm water and hosing procedures drainage plan to be used at the facility which incorporates the necessary provision for preventing its wastewater run-off and solid wastes from entering city sewers untreated. The drainage plan must include:

a. the location and scale of on-site drain(s), pretreatment system and containment system; and

b. the location of the connection points, if any, to the New York City sewer system.

5. Specifically, indicate whether pretreatment will be provided in accordance with Federal categorical pretreatment standards;

The plumbing diagrams and drainage information required above must be provided at the time the application is submitted. Promising to provide the diagrams or information at a later date will not suffice and your application will be returned.

VIII. Waterfront Revitalization Program

A. Identify whether or not the site is within the City's Local Waterfront Revitalization Program (LWRP) boundaries. If it is, you must include the following information:

1. a map showing the location of the site with respect to the boundaries of the LWRP;

2. identify whether or not the site is within the States's coastal Hazard Area boundaries or within FEME zones; and

3. complete every item and return the attached Waterfront Consistency Assessment Form.

If the facility is located within the City's Local Waterfront Revitalization Program boundaries, failure to return a completed Waterfront Consistency Assessment Form with the information required above will result in your application being returned.

COMMERCIAL WASTE MANAGEMENT STUDY

VOLUME II

COMMERCIAL WASTE GENERATION AND PROJECTIONS

March 2004

Prepared for:

New York City Department of Sanitation
for submission to the New York City Council

Prepared by:

Henningson, Durham & Richardson
Architecture and Engineering, P.C.

and its
Subconsultants

This report was prepared by

HDR

Henningson, Durham & Richardson
Architecture and Engineering, P.C.

and its
Subconsultants

ECODATA INC.

FRANKLIN Associates
A Division of ERG

PREFACE

Local Law 74 of 2000 (LL74) mandated a comprehensive study of commercial waste management (Commercial Waste Management Study or Study) in New York City (City) by a Consultant funded by the City Department of Sanitation (DSNY). This Study undertaken to comply with LL74 will assist the City in managing the commercial waste stream in the most efficient and environmentally sound manner, and assist in the development of the City's Solid Waste Management Plan (New SWMP) for the New SWMP Planning Period.

As stated in the Commercial Waste Management Study Final Scope of Work: *"In June 2002, DSNY published a Preliminary Report in accordance with the requirements of LL74 that contained information on commercial waste quantities by type and borough of origin that had been collected and analyzed by DSNY and its consultants from sources such as available reporting systems and interviews with waste management companies involved in aspects of the commercial waste management business. As noted in the Preliminary Report, there is no single comprehensive system for recording data on commercial waste generation in the City. Furthermore, the data in the Preliminary Report were for the calendar year 2000, and the events of September 11, 2001 and the subsequent decline in business activity in the City since 2000 have all affected commercial waste generation. The Study will apply methods to adjust the year 2000 data to year 2002 to account for these economic effects. Additionally, the Study will evaluate and apply alternative methods to those used in the Preliminary Report to supplement existing estimates of commercial waste generation. The recycled material in the commercial waste stream that is not accounted for in the Preliminary Report data will also be quantified. The Study will project changes in commercial waste generation over the New Plan period based on an employment forecast for the same period."*

In addition to this Volume II, the Study consists of five other volumes:

- Volume I: Private Transfer Station Evaluations;
- Volume III: Converted Marine Transfer Stations – Commercial Waste Processing and Analysis of Potential Impacts;
- Volume IV: Evaluation of Waste Disposal Capacity Potentially Available to New York City;
- Volume V: Manhattan Transfer Station Siting Study, and
- Volume VI: Waste Vehicle Technology Assessment.

This volume, Volume II: Commercial Waste Generation and Projections, reports the results of five different evaluations. The reports and appendices that provide the analyses and data in support of this Executive Summary are:

Summary Report on Commercial Waste Generation and Projections

Appendices:

A: Facilities Estimate of Putrescible Waste Generation Year 2002

B: Employment-Based Estimate of Putrescible Waste Generation Year 2002

C: Commercial Putrescible Waste Disposed and Recycled: BIC-DSNY Carter Survey

D: Commercial Putrescible Waste 20-Year Forecast

E: Non-Putrescible Commercial Waste Quantification and Projections

This volume examines the quantities of waste generated within the City that is collected and managed by private carters, i.e., the commercial waste stream. DSNY regulates[1] putrescible, non-putrescible and fill material Transfer Stations that are permitted to receive and process these categories of waste materials. The New York State Department of Environmental Conservation (NYSDEC) also regulates[2] the design, construction and operation of Transfer Stations.

[1] DSNY's regulatory authorities derive from Titles 16, 17 and 25 of the New York City Administrative Code (NYCAC), Title 16 of the Rules of the City of New York (RCNY) and the City Environmental Quality Review (CEQR) Procedures.

[2] NYSDEC's regulatory authority derives from Title 6 of New York Codes, Rules and Regulations (NYCRR) Part 360 and Title 6 NYCRR Part 617 under the state's Environmental Conservation Law (ECL).

Commercial Waste, as discussed in this report, is comprised of three types of waste, as defined in DSNY rules:

1. Commercial putrescible waste[3] is solid waste generated by the City's businesses, containing organic matter having the tendency to decompose with the formation of malodorous by-products. It is principally office and retail waste with small quantities of putrescible material, but also includes restaurant and other waste. Significant amounts of office waste are recycled directly at the source by carters that primarily collect recyclable office paper from commercial buildings and deliver it to recyclers, exporters or paper manufacturers. Consistent with DSNY's rules defining three basic types of waste generated, the term putrescible waste, as used in this report, includes the portions of commercial putrescible waste that are both disposed and recycled (such as office paper).

2. Non-putrescible waste is waste that does not contain organic matter having the tendency to decompose with the formation of malodorous by-products, including but not limited to dirt, earth, plaster, concrete, rock, rubble, slag, ashes, waste timber, lumber, Plexiglas, fiberglass, ceramic tiles, asphalt, sheetrock, tar paper, tree stumps, wood, window frames, metal, steel, glass, plastic pipes and tubes, rubber hoses and tubes, electric wires and cables, paper and cardboard.

3. Fill material is a subset of non-putrescible waste and, as defined in DSNY rules, is clean material consisting of earth, ashes, dirt, concrete, rock, gravel, asphalt millings, stone or sand.

[3] As defined in DSNY rules (Subchapter A of 4 RCNY 16).

EXECUTIVE SUMMARY

Scope of Analysis/Approach

The Study employed three different methodologies to develop independent estimates of commercial putrescible waste quantities for the years 2002 and 2003, as described in Appendix A (Facilities Estimate of Putrescible Waste Generation Year 2002), Appendix B (Employment-Based Estimate of Putrescible Waste Generation Year 2002), and Appendix C (Commercial Putrescible Waste Disposed and Recycled: BIC-DSNY Carter Survey). The independent estimates were compared for reasonableness to the data obtained through DSNY's Quarterly Transfer Station Report system (Quarterly Reports). Quarterly Reports are required to be completed by DSNY-regulated Transfer Station operators/owners. The Quarterly Reports do not account for all of the commercial waste generated in the City. Waste not reflected in the Quarterly Reports includes waste that is disposed out-of-City or recycled commercial waste that does not pass through the City's network of private Transfer Stations. The waste quantity estimates developed from the other estimation methodologies corroborated the Quarterly Report data for quantities processed at City Transfer Stations.

All these data sources were used to establish a new, year 2003 baseline estimate inclusive of the total commercial putrescible waste generated, i.e., disposed in and out of the City, and recycled. The new baseline year 2003 estimate accounts for the job loss effects of 9/11 and the subsequent economic recession, and therefore provides a sound starting point for projecting waste generation for the New SWMP Planning Period.

These data sources were also compared to the year 2000 waste quantity estimates in the Preliminary Report (which did not include recycled material) and used as a basis for adjusting Preliminary Report estimates of putrescible waste disposed to eliminate inconsistencies in waste-type definitions and carter classifications, and to establish a revised year 2000 estimate of

8,381 tons per day (tpd)[4] disposed. Comparing the year 2000 estimate of putrescible waste disposed with the 2003 total net disposed (based on three quarters of DSNY Quarterly Reports and direct export totals estimated from the BIC-DSNY carter survey), shows a decline of 1,131 tpd, or 13.5%, in putrescible waste disposed over that period of time.

The ***Facilities Estimate*** (Appendix A) relies upon DSNY's Quarterly Reports for data on waste quantities delivered to Transfer Stations in the City in 2002. Through an extensive survey effort, new data were collected on waste carted out-of-City for disposal and also on recycled waste from commercial sources in the City that was processed in or out of the City or directly exported to foreign sources. Approximately 31% of the City's putrescible waste was recycled in 2002.

The ***Employment-Based Estimate*** (Appendix B) used post-9/11 estimates of City employment that reflected the effects of the economic recession on employment, and relied on waste generation factors for commercial business sectors developed through a literature search. These data were used to estimate citywide waste generation for the year 2002 as a function of employment in the City.

The ***BIC-DSNY Carter Survey*** (Appendix C) assembled information from a survey of the City's licensed carting industry conducted in the fall of 2003. The surveys, collected from all carters collecting in the City and followed up in person or via phone interviews, developed data that resulted in an estimate of commercial putrescible waste disposed and recycled in 2003 that included the quantities processed at in-City and out-of-City locations and quantities collected for recycling. Approximately, 27% of the City's commercial putrescible waste was recycled in 2003, a decline of 4% from the prior year. This decline is consistent with nationally reported data on paper markets.

[4] Tons per day are calculated on the basis of a six-day collection week, equivalent to a 312-day year.

The 2003 baseline waste estimate was allocated among the five boroughs using collection route data obtained from the BIC-DSNY carter survey. Based on this borough allocation, and using projected employment over this period, the quantity of commercial waste generated (both disposed and recycled) was forecast for the New SWMP Planning Period, for each borough. The relative proportions of waste generated by each borough change as a function of changes in projected employment over time. The forecast assumes that the percentage of materials recycled by each borough would remain constant at 2003 levels[5] for the New SWMP Planning Period. These projections are discussed in Appendix D: ***Commercial Putrescible Waste 20-Year Forecast***.

Quantities of non-putrescible waste, which include construction and demolition debris (C&D) and fill material, were estimated based upon waste generation rates derived from a literature search for three types of residential and commercial construction projects: new construction, demolition and renovation. A regression analysis of data obtained from F.W. Dodge on actual and projected construction activity in the City in each of these respective areas over the period of 2000 to 2007 was used to develop projections of the generation of C&D waste over the New SWMP Planning Period. Non-building-related C&D, which would include clean fill, was estimated by obtaining waste generation factors expressed as tons per $1,000 of activity. These factors were applied to the value of this construction in the City obtained from F.W. Dodge. Details of these estimates are discussed in Appendix E: ***Non-Putrescible Commercial Waste Quantification and Projections***.

The estimates of commercial putrescible and non-putrescible waste are relevant in determining the Transfer Station capacity required to serve the City's businesses over the next 20 years.

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[5] Percentages developed from 2003 BIC-DSNY City carter collection truck and fax-back surveys data plus recycling at City Transfer Stations plus estimated recycling through the deposit container redemption system.

Findings

- In 2003, approximately 3,085,000 tons, or 9,889 tpd, of putrescible waste and approximately 8,641,000 tons, or 27,695 tpd, of non-putrescible waste and clean fill material were generated by the commercial sector in the City. Quantities of waste generated include that which is disposed and recycled.

- In 2003, approximately 6,209 tpd of commercial putrescible waste[6] were processed for disposal at in-City Transfer Stations and 1,039 tpd were processed at out-of-City facilities. (Although some material is recycled at putrescible Transfer Stations, the vast majority is material destined for disposal.) An estimated 2,641 tpd were recycled directly. The quantities processed out-of-City represent a 21% increase over 2002.

- Of the total commercial putrescible waste generated, 42% is generated in Manhattan,[7] 19% in Brooklyn, 13% in the Bronx, 20% in Queens and 5% in Staten Island.[8]

- Overall, approximately 27% of the commercial putrescible waste was recycled in 2003.

- Quantities of commercial putrescible waste generated are anticipated to increase to 3,414,000 tons, or 10,942 tpd in 2024, which represents an annual average rate of increase of 0.5%.

- Quantities of non-putrescible commercial waste and clean fill are more difficult to predict in the future due to the variability in generation from year to year, but are anticipated to range from approximately 8.0 to 10.9 million tons, (25,640 to 34,810 tpd) by the end of the New SWMP Planning Period.

- The City's commercial putrescible waste (disposed and recycled) is collected by approximately 124 licensed carters.

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[6] These quantities do not include DSNY-managed Waste processed at in-City Transfer Stations.
[7] 61% of the City's jobs are located in Manhattan.
[8] Numbers may not add due to rounding.

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List of Acronyms/Definitions

Acronyms	
BIC	Business Integrity Commission
C&D	construction and demolition
CD	community district
CDEP	Connecticut Department of Environmental Protection
CEQR	City Environmental Quality Review
DSNY	New York City Department of Sanitation
ECL	State Environmental Conservation Law
lbs/cy	pounds per cubic yard
LL74	Local Law 74, effective December 19, 2000, enacted by the City Council, requiring a comprehensive assessment of commercial solid waste management in New York City
MGP	metal, glass and plastic
MOP	mixed office paper
MRF	materials recycling facility
MSW	municipal solid waste
NJDEP	New Jersey Department of Environmental Protection
NYCAC	New York City Administrative Code
NYCDCP	New York City Department of City Planning
NYCRR	New York Codes, Rules and Regulations
NYMTC	New York Metropolitan Transportation Council
NYSDEC	New York State Department of Environmental Conservation

Acronyms	
NYSDOL	New York State Department of Labor
OCC	old corrugated cardboard
ONP	old newsprint
PIU	DSNY's Permit and Inspection Unit
RCNY	Rules of the City of New York
SIC	Standard Industrial Classification
tpd	tons per day
tpy	tons per year
USEPA	United States Environmental Protection Agency
WTE	waste-to-energy

Definitions	
City	New York City
Consultant	The DSNY's Consultant Team, including Henningson, Durham & Richardson Architecture and Engineering, P.C.; Parsons Brinckerhoff Quade and Douglas, Inc.; Ecodata, Inc.; Franklin Associates, Ltd.; Urbitran Associates, Inc.; HydroQual, Inc.; and Cambridge Environmental, Inc., who prepared the Commercial Waste Management Study
DSNY-managed Waste	Solid waste that DSNY collects from all residential households in the City and the institutional waste of City, state and federal agencies that DSNY collects and/or for which DSNY arranges disposal
Final Study Scope or Final Scope of Work	Commercial Waste Management Study Final Scope of Work issued on July 31, 2003
New SWMP	The new comprehensive Solid Waste Management Plan to be developed in 2004 for both DSNY-managed Waste and commercial waste for the planning period 2004 through 2024
New SWMP Planning Period	The 20-year period from 2004 to 2024 addressed by the City's New Solid Waste Management Plan
Preliminary Report	The New York City comprehensive Commercial Waste Management Study Preliminary Report dated June 2002
Quarterly Reports	DSNY's Quarterly Transfer Station Report system
Study	Commercial Waste Management Study
Transfer Station(s)	Privately owned and operated transfer station in New York City that accepts, transfers and transports some portion of municipal solid waste or construction and demolition debris or fill material generated in the private sector for out-of-City disposal

1.0 WASTE QUANTIFICATION SUMMARY REPORT

1.1 Introduction and Background

This report provides estimates of the quantity of commercial waste generated in New York City (City) and projects estimates of the future quantities that will be generated during the New SWMP Planning Period. It summarizes information that is presented in greater detail in Volume II, Appendices A through E, of the Commercial Waste Management Study (Study).

Commercial waste is a category of municipal solid waste (MSW) and is comprised of three types of waste, as defined in City Department of Sanitation (DSNY) rules: putrescible, non-putrescible and fill material. Commercial waste is generated by businesses in the City, including construction projects, and is collected by private carters, who either: (1) deliver their waste to private in-City Transfer Stations, from which the waste is recycled or hauled to out-of-City disposal sites; or (2) directly haul the waste to out-of-City transfer stations or disposal sites.

These waste quantity estimates are important in evaluating the current adequacy and the future demands on the City's existing network of private Transfer Stations.

1.1.1 Commercial Waste Types

DSNY rules classify commercial waste into two major categories and one sub-category. These are:

1. Putrescible waste – Solid waste generated daily by the City's business establishments that is principally office and retail waste with small quantities of putrescible[1] material, and also includes restaurant and other waste. Significant amounts of office waste are recycled directly at the source by carters that primarily collect recyclable office paper from commercial buildings and deliver it to recyclers, exporters or paper manufacturers. Consistent with DSNY rules, putrescible waste referred to in this report is inclusive of the fractions that are disposed and recycled (such as office paper). Some additional recycling occurs at the City's putrescible Transfer Stations, where old corrugated containers, commonly referred to as cardboard (OCC), and concentrated loads of office paper are diverted to recyclers.

[1] Putrescible solid waste is solid waste containing organic matter having the tendency to decompose with the formation of malodorous by-products.

2. Non-putrescible[2] waste – Inert waste that does not contain organic matter having the tendency to decompose with the formation of malodorous by-products, including but not limited to dirt, earth, plaster, concrete, rock, rubble, slag, ashes, waste timber, lumber, Plexiglas, fiberglass, ceramic tiles, asphalt, sheetrock, tar paper, tree stumps, wood, window frames, metal, steel, glass, plastic pipes and tubes, rubber hoses and tubes, electric wires and cables, paper and cardboard. It is typically generated from commercial and residential demolition, new construction and renovation projects. This waste can vary significantly with the volume of construction activity in the City. It is comprised of a range of inert materials, some of which is recycled. The non-recycled fraction of the waste is densified and transferred to the City's non-putrescible Transfer Stations for disposal. This report also refers to this waste as construction and demolition (C&D) debris to distinguish it from fill material, which is also a category of non-putrescible waste.

3. Fill material – A subset of non-putrescible waste, and as defined in DSNY rules, is clean material consisting of earth, ashes, dirt, concrete, rock, gravel, asphalt millings, stone or sand, provided that such material shall not contain organic matter having the tendency to decompose with the formation of malodorous by-products. Typically these materials are stockpiled for reuse at the City's fill material Transfer Stations. Almost all fill material is reused.

Significant quantities of materials in each of the above categories are recycled. This report also provides information on waste recycled within the putrescible waste category. The sum of waste disposed and waste recycled equals the waste generated in each category.

1.1.2 Types of Commercial Waste Transfer Stations

DSNY permits three different categories of Transfer Stations that receive and process the above-noted waste materials. The DSNY rules applicable to each are found in Chapter 4 Title 16, Rules of the City of New York (RCNY). The New York State Department of Environmental Conservation (NYSDEC) also regulates the design, construction and operation of Transfer Stations under Title 6 of the New York Codes, Rules and Regulations (NYCRR), Part 360. NYSDEC regulations classify Transfer Stations into three categories: putrescible, non-putrescible and clean fill facilities.

[2] As defined in DSNY rules (Subchapter A of 4 RCNY 16).

1.1.2.1 Putrescible Waste Transfer Stations

Putrescible waste Transfer Stations receive waste delivered in waste collection vehicles (e.g., packer trucks or roll-off containers). They typically process the waste by sorting out bulky items, and then generally crushing, baling or compacting the waste. The processed waste is placed into transfer trailers for over-the-road long haul, or into intermodal containers for export by rail to out-of-City disposal locations.

All but one of the putrescible Transfer Stations in the City transfer the waste received to disposal facilities in trailer trucks that can carry approximately 22 to 25 tons per transfer trailer. Typically, one transfer trailer or one intermodal container consolidates the waste delivered by approximately two typical collection vehicles. All putrescible Transfer Stations operate with scales, and all waste processing operations must occur in an enclosed building.

1.1.2.2 Non-Putrescible Waste Transfer Stations

C&D debris is typically delivered to non-putrescible Transfer Stations in roll-off containers that are picked up from demolition, new construction or renovation sites. These Transfer Stations typically engage in sorting, crushing and processing of the C&D debris material. Some facilities sort the materials to recover recyclables such as metal, wood or aggregate; they recover some materials for recycling and reduce the volume of waste disposed.

As of early 2003, there were 28 non-putrescible Transfer Stations in the City, and approximately 60% of the tonnage was weighed. The waste processing operations typically occur outdoors. Some facilities have paved surfaces for processing; others operate with unpaved sites. Processed waste is loaded into transfer trailers for over-the-road long haul to out-of-City disposal locations. Some non-putrescible Transfer Stations operate with scales, but others record materials handled based on inbound and outbound truck volumes (cubic yards).

1.1.2.3 Fill Material Transfer Stations

Fill material Transfer Stations typically receive loads of excavated dirt, rock, concrete, etc., from construction sites, including roadwork and other public works projects. They typically have equipment on site that is used to sort the aggregate into various sizes. The majority of the material received is stored on site and recycled or reused. Very little size reduction takes place, as most of the processed materials are stockpiled on site and reused in other projects. None of the fill material Transfer Stations have scales.

1.1.3 Commercial Waste Collection

The carting (commercial waste collection) industry that collects putrescible and non-putrescible waste in the City is regulated by the City's Business Integrity Commission (BIC). BIC maintains a registry of carters that are licensed to collect putrescible and non-putrescible waste, qualifies business entities to provide carting services, and regulates the rate charged for collection.

BIC has cooperated with DSNY in implementing a first-time survey to collect information directly from the carter industry. The survey obtained data on the quantities and origins of commercial waste collected within the City. This report uses these estimates as one source of data for developing a year 2003 baseline estimate of putrescible waste generation, inclusive of disposed and recycled fractions, for use in forecasting future quantities.

1.1.4 Commercial Waste Data Collection and Reporting

Unlike the reporting system for DSNY-managed Waste, there is no central database that records all of the waste generated, recycled and disposed by point of origin, destination and type of material received. DSNY, as a regulator of the City's Transfer Stations, has, since 1995, maintained and refined a reporting system, the Quarterly Transfer Station Report system (Quarterly Reports), which collects data on the quantities of waste delivered to in-City Transfer Stations. This reporting system, while providing very useful and reliable information, does not account for waste disposed out of the City or waste recycled at the source of generation, e.g., recycled office paper.

Although all of the City's putrescible Transfer Stations record inbound and outbound material by weight, in early 2003 only 60% of the tonnage was weighed at non-putrescible facilities, and none of the incoming fill material was weighed. Consequently, in early 2003, approximately 80% of the reported tonnage in the Quarterly Reports for C&D and fill material Transfer Stations reflects a conversion of cubic yard volume data to tons, based on assumed factors for converting cubic yards to tons.

In accordance with Local Law 74 of 2000 (LL74), DSNY published the Comprehensive Commercial Waste Management Study Preliminary Report (Preliminary Report) in June 2002. This report presented preliminary data for the year 2000 on the volumes, types, origins and destinations of commercial putrescible and non-putrescible waste managed by private carters and Transfer Stations in the New York metropolitan area, as well as on DSNY-managed Waste. The data for this report were developed during the period when the Fresh Kills Landfill was still receiving waste, and prior to the events of September 11, 2001.

The impact of September 11 and the business recession in the City during the period of 2001 to 2003 influence developing estimates of commercial waste generation. The City comptroller has estimated that the City suffered a loss of over 200,000 jobs during this period, and commercial putrescible waste generation correlates with levels of employment. Post-2001 estimates of waste generated and future projections have to address the impact of these events on waste generation between the period of 2002 and 2003.

The estimates of commercial putrescible and non-putrescible waste are relevant to the types and amounts of Transfer Station capacity that will be required to serve the City's businesses over the New SWMP Planning Period. This report updates the estimates contained in the Preliminary Report based on new information developed for the years 2002 and 2003, and provides a new 2003 baseline estimate of commercial putrescible waste generation as the basis for forecasting commercial putrescible waste generation over the New SWMP Planning Period.

1.2 Objectives

The objectives of this report are to:

1. Report on current estimates for the years 2002 to 2003 of the quantities of each type of commercial putrescible waste generated, recycled and disposed.
2. Compare these more recent estimates with those provided in the Preliminary Report, make adjustments as indicated, and establish a year 2003 baseline for commercial putrescible waste generated.
3. Forecast, from the year 2003 baseline estimate, the quantities of commercial putrescible waste to be generated, recycled and disposed over the New SWMP Planning Period.
4. Use current estimates of commercial non-putrescible waste and forecasting methodologies to project the quantity of commercial non-putrescible waste to be generated over the New SWMP Planning Period.

2.0 METHODOLOGIES FOR ESTIMATING WASTE QUANTITIES

The different methodologies used to estimate current quantities and to develop projections for each specific type of commercial waste are summarized in this section.

2.1 Putrescible Waste Disposed and Recycled

Estimating the quantities of the commercial putrescible waste generated involved the following:

- Three different methods were utilized to develop independent estimates of waste quantities for the years 2002 and 2003, and are described in detail in Volume II, Appendices A, Facilities Estimate; B, Employment-Based Estimate; and C, BIC-DSNY Carter Survey.
- These different estimates were compared for reasonableness to the year 2000 estimate in the Preliminary Report, used to adjust the Preliminary Report data to more accurately reflect the quantity of commercial putrescible and non-putrescible waste disposed in the year 2000 (the Preliminary Report did not estimate total waste recycled), and used to establish a baseline estimate for 2003.
- A forecast methodology was developed and applied to the baseline to project waste over the New SWMP Planning Period.

2.1.1 Facilities-Based Estimating Methodology

The DSNY Quarterly Report system was implemented in 1995 and has been maintained and refined since that time. It provides accurate data from scale weights for putrescible waste tipped at in-City Transfer Stations and records the quantity of materials recycled at these facilities. This system is a primary source of data for estimating putrescible waste tipped at Transfer Stations in the City.[3]

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[3] Under the Interim Export Program, DSNY delivers DSNY-managed Waste to eight in-City putrescible Transfer Stations. DSNY deliveries were therefore subtracted from the total quantities to estimate the quantity from commercial sources.

Data on putrescible waste generated by commercial sources in the City and carted to either Transfer Stations or out-of-City disposal sites was collected through a survey for the year 2002 and described in detail in Volume II, Appendix A to this Study. Lists of facilities located within a 50-minute traveling radius of the City -- located in Connecticut, New Jersey and Westchester and Nassau Counties in New York -- were developed by contacting state agencies. Telephone surveys of operators of these facilities were used to collect information on the quantity of putrescible waste originating in the City and tipped at those locations.

To estimate total waste generation, data on materials recycled from commercial sources in the City was also developed. Sources of information included the major carters in the City who pick up recyclables; state agencies (for lists of recyclables processors in the region); the Yellow Pages (for listings of recycling centers); end-user markets (such as fiber mills); and brokers involved in the paper export business. The information obtained from these sources was cross-checked and organized into a database to estimate the quantity of recyclables.

The combined total of putrescible waste disposed and waste recycled materials was 3,295,677 tons (10,563 tons per day [tpd]) in 2002, as reported in Table 3.3.4-1 of Volume II, Appendix A.

2.1.2 Employment-Based Estimate

A second, independent estimating methodology for commercial putrescible waste generation in the City used available employment data. This methodology is described in detail in Volume II, Appendix B of the Study. This approach used a literature search to develop waste generation factors, expressed as tons of waste generated per employee per year, for specific types of businesses with significant employment in the City. Table 2.1.2-1 lists the factors developed through this research and used in this report. These business sector-specific factors are multiplied by sector-specific employment to estimate total commercial putrescible waste generation in the City.

Table 2.1.2-1
Employment Categories, Commercial Waste Generation Factors and Tons Generated, and Category Percent of Total Commercial Waste Generation

Employment Category	Generation Factor Tons/Employee/Year	New York City 2002 Tons Generated	% of Commercial Waste Generation
Construction	0.44	51,400	1.6%
Finance & Insurance	0.44	146,770	4.5%
Real Estate Rental & Leasing	0.44	51,570	1.6%
Manufacturing	1.40	199,410	6.2%
Wholesale Trade	1.20	172,160	5.3%
Retail Trade	2.50	724,410	22.4%
Transportation & Warehousing	0.74	79,520	2.5%
Utilities	0.56	8,640	0.3%
Information	0.65	109,650	3.4%
Professional, Technical & Scientific	0.65	188,190	5.8%
Management of Companies	0.65	37,110	1.1%
Administrative Support Services	0.65	128,240	4.0%
Health Care & Social Assistance	0.63	419,530	12.9%
Arts, Entertainment & Recreation	3.40	46,090	1.4%
Accommodation & Food Services	3.40	710,340	21.9%
Other Services(1)	0.65	92,190	2.9%
Unclassified & Other	0.65	13,080	0.4%
State & Federal Government(2)	0.44	61,950	1.9%
Total New York City(3)		3,240,250	100%

Notes:
(1) Except public administration.
(2) Except local government agencies.
(3) Numbers may not add due to rounding.

In July 2003, the New York Metropolitan Transportation Council (NYMTC) published an interim update of employment in the City accounting for the direct impacts of September 11, 2001. NYMTC is the only source of regional employment projections to 2024 and its data is used by many planning agencies in the New York region. However, the NYMTC data did not account for job loss at the census tract level, did not provide employment by industry sector and did not reflect job losses in the period 2000-2003 due to the economic recession. DSNY's Consultants made adjustments to the NYMTC data to develop a more accurate 2002 employment baseline for use in conjunction with waste generation factors. The additional adjustments included converting census tract employment data to employment estimates for the City's community districts (CD). Table 2.1.2-2 presents the employment data by business category.

The data in Tables 2.1.2-1 and 2.1.2-2 were used in the employment-based methodology to develop a year 2002 baseline estimate of 3,240,250 tons (10,385 tpd) of commercial putrescible waste generated, as reported in Table 1.4-2 of Volume II, Appendix B.

2.1.3 BIC-DSNY Carter Survey

In October and November of 2003 DSNY and BIC collaborated to conduct a survey of licensed carters in the City in order to collect data on City putrescible waste collection operations during the first six months of 2003. The waste quantity data was then doubled to approximate waste generated on an annual basis. The survey also developed information on the origin of commercial putrescible waste by borough, and on the destinations where collection vehicles tipped their loads. This borough-of-origin data was used as a basis for allocating the 2003 baseline waste generation estimate to the borough level. The survey methodology and results are reported in detail in Volume II, Appendix C of this Study.

Table 2.1.2-2
Annual Employment in New York City by Borough and by Employment Category, 2002
(Number of Employees)

Employment Category	Bronx	Brooklyn	Manhattan	Queens	Staten Island	Total Employees
Construction	10,508	23,043	32,976	44,442	7,021	117,990
Finance & Insurance	3,291	15,014	302,617	13,459	2,536	336,917
Real Estate Rental & Leasing	10,838	14,444	75,962	15,573	1,573	118,390
Manufacturing	9,948	36,267	53,423	41,115	1,357	142,110
Wholesale Trade	10,313	22,774	87,617	24,882	1,463	147,049
Retail Trade	24,643	57,234	136,564	53,016	15,974	287,431
Transportation & Warehousing	4,817	14,369	26,894	56,716	4,550	107,346
Utilities	1,723	4,475	6,197	2,471	653	15,519
Information	4,395	8,014	143,400	10,391	2,616	168,816
Professional, Technical & Scientific	3,272	12,069	259,690	10,994	3,701	289,726
Management of Companies	962	1,207	52,267	1,798	905	57,139
Administrative Support Services	8,568	18,702	141,321	25,045	3,798	197,434
Health Care & Social Assistance	73,025	135,965	204,429	92,813	26,370	532,602
Arts, Entertainment & Recreation	2,823	3,211	47,671	4,233	1,118	59,056
Accommodation & Food Services	10,629	18,465	144,621	29,842	6,117	209,674
Other Services[(1)]	8,120	21,241	87,204	21,779	3,586	141,930
Unclassified & Other	1,384	5,018	8,325	4,587	823	20,137
State & Federal Government[(2)]	14,257	20,565	81,952	20,283	5,163	142,220
Total	**203,516**	**432,077**	**1,893,130**	**473,439**	**89,324**	**3,091,486**

Notes:
(1) Except public administration.
(2) Except local government agencies.

A two-step approach was used to implement the survey:

1. All haulers received a survey form by fax, with a cover letter, describing the purpose of the survey and imposing a three-day deadline for faxing back the requested data. The data requested from each carter included: (i) the amount of waste disposed and recycled by month; and (ii) the transfer stations or disposal sites where waste disposed was tipped, indicating the name, address, and the quantities disposed at each site.

2. The information on the survey form was then corroborated and supplemented through a follow-up, in-person or telephone interview with the carting firm. The information gathered during these interviews included the number of truck shifts operated by the carter in each borough, the number of truckloads of refuse or recyclables picked up per shift, the types and sizes of vehicles used to pick up the refuse and recyclables, and a listing of customers by borough. In-person field visits for on-site data collection were restricted to large firms, defined as those carters with more than 10 trucks; the remaining firms were contacted by telephone. Interview data were collected from 124 carting firms.

2.2 Non-Putrescible and Fill Waste

The private non-putrescible Transfer Stations in the City are required to provide quarterly reports to the DSNY on the quantities of materials received, processed, recycled and disposed. In 2003, four (4) of these Transfer Stations did not use scales to weigh inbound loads; their reports list cubic yards received, which are converted to tons using density factors for various materials. Mixed C&D debris is converted to tons at a density of 1,500 pounds per cubic yard.[4] Source-separated recyclables are converted at a density of 500 pounds per cubic yard. Most loads of single material fill (road building material, gravel, dirt, rocks, asphalt and concrete) are converted at densities of approximately 2,200 pounds per cubic yard. In 2000, approximately 49% of the materials received by non-putrescible Transfer Stations was weighed. By early 2003, approximately 60% of C&D handled by non-putrescible Transfer Stations was weighed.

There were 20 fill material Transfer Stations licensed by the DSNY in early 2003. None of these stations weighs incoming or outgoing debris. All incoming and outgoing materials are converted to tons either by the Transfer Station itself or by the DSNY, using the density factors for various materials referred to above.

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[4] This is the density factor for mixed C&D debris, including fill, provided by NYSDEC.

It appears, however, that the density conversions utilized when scale-weights are not available tend to overestimate the quantities of non–putrescible waste and underestimate fill debris. However, when aggregated, they appear to be reasonably accurate. Thus, baseline quantities of C&D debris for the year 2003 are determined from DSNY densities, as 8,640,840 tons, or 27,695 tpd.

In order to project quantities through the New SWMP Planning Period, it is necessary to relate C&D generation to the quantity of construction activity in the City.

2.2.1 Residential and Commercial Building-Related C&D Estimate

A literature search was performed to determine average C&D generation per square foot of: (1) residential construction; (2) residential demolition; and (3) residential renovation. Data from F.W. Dodge regarding the square footage of residential and commercial building construction, demolition and renovation are projected forward and multiplied by a tonnage generation factor (pounds of C&D per square foot) to obtain an estimate of building-related C&D debris. This type of C&D debris is projected forward.

2.2.2 Non-Building-Related C&D Estimate

Non-building debris includes waste materials generated during the process of constructing, demolishing and renovating bridges, streets and other projects that don't involve buildings, per se. Non-building-related C&D debris is estimated by subtracting building-related C&D debris from the estimated total for the City in 2003 (8,640,840). This total is related to the value of non-building construction, provided for the City by F.W. Dodge, and projected forward.

2.2.3 Fill Material and Non-Putrescible C&D Debris Estimate

The building-related and non-building-related quantities are summed, and presented as the C&D projection for the City. In order to allocate this total into the same material categories used by DSNY (non putrescibles and clean fill), a range of 60 to 70% of this total is classified as clean fill, and a range of 30 to 40% is classified as non-putrescible debris.

3.0 PUTRESCIBLE WASTE DISPOSED AND RECYCLED - BASELINE ESTIMATES

3.1 Year 2002 Estimates

Table 3.1-1 presents the estimates of the commercial putrescible waste generation for the year 2002 from the facilities estimate and the employment-based estimate. The methodology for the facilities estimate involved a survey of out-of-City disposal and transfer facilities and recyclables processors. In this table, the quantities of waste and recyclable materials these facilities received directly from the City carters were added to the DSNY (in-City) Quarterly Reports. The methodology for the employment-based estimate used factors that were developed for the generation of commercial wastes in tons per employee per year. These factors were multiplied by the number of employees in the City within any given sector (e.g., food service, finance, health care) to obtain generation of commercial waste.

3.2 Year 2003 Estimates and Year 2003 Baseline

Table 3.2-1 shows the results of the BIC-DSNY carter survey of commercial putrescible carting companies, and data from the DSNY Quarterly Reports.

The only source of 2003 data for waste tipped out of the City is the fax-back responses from the carter survey that reported tonnages delivered to specific transfer stations or disposal facilities located out of the City. In 2003, this direct export of waste amounted to 1,039 tpd – a significant increase from the 188 tpd directly exported in 2000.

Table 3.2-1 also displays the results of follow-up carter interviews with all the licensed carters operating in the City. The carter interviews yielded a different estimate of waste disposed and waste recycled than the fax-back responses. The carter interview estimates were derived from information developed on each carter's fleet operations, including truckloads of waste tipped per week, and the average weights of each truckload.

Table 3.1-1
2002 Estimated Commercial Putrescible Waste – Disposed and Recycled

Material/Destination	Data Sources [1]					
	Facility		Employment		Average [2]	
	TPY	TPD	TPY	TPD	TPY	TPD
Waste Disposed						
First tipped in City	2,006,316	6,431	N/A	N/A	N/A	N/A
Direct hauled out of City	266,642	855	N/A	N/A	N/A	N/A
Subtotal	2,272,958	7,285	2,253,380	7,222	2,263,169	7,254
Waste Recycled						
First tipped in City	890,565	2,854	N/A	N/A	N/A	N/A
Direct hauled out of City	132,154	424	N/A	N/A	N/A	N/A
Subtotal	1,022,719	3,278	986,870	3,163	1,004,795	3,221
Total Generation (Disposed & Recycled)	3,295,677	10,563	3,240,250	10,385	3,267,964	10,474
Recycling Percentage (Waste Recycled/Total Generation)	31%		30%		31%	

Notes:

[1] Data Sources:

a) Facility data combines data from DSNY Quarterly Transfer Station Reports for putrescible waste disposed in-City, and in-person and phone interviews with out-of-City waste transfer stations, other disposal facilities and recyclables processors, brokers and exporters.

b) Employment-based estimate was developed based on City employment for year 2002 and waste and recyclables generation factors for specific types of employment, based on waste generation studies conducted in large cities. The underlying employment estimate for 2002 reflects a net loss of 241,500 jobs in the City between 2000 and 2002 from the combined effect of 9/11 and the recession, according to the City comptroller's office.

[2] Straight average of facilities and employment estimates.

TPY = Tons per Year.

TPD = Tons per Day.

Table 3.2-1
2003 Estimates of Putrescible Solid Waste – Disposed and Recycled

Material/Destination	Data Sources[1]						2003 Estimate	
	Carter Survey Fax-Back[2]		Carter Survey Interviews on Fleet Operations		DSNY Quarterly Reports			
	TPY	TPD	TPY	TPD	TPY	TPD	TPY	TPD
Waste Disposed								
First tipped in City	1,779,447	5,703	N/A	N/A	1,937,208	6,209	N/A	N/A
Direct hauled out of City	324,148	1,039	N/A	N/A	324,147	1,039[2]	N/A	N/A
Subtotal	2,103,595	6,742	2,244,318	7,193	2,261,355	7,248	2,261,355	7,248
Waste Recycled								
First tipped in City	428,655	1,374	N/A	N/A	N/A	N/A	N/A	N/A
Direct hauled out of City	277,370	889	N/A	N/A	N/A	N/A	N/A	N/A
Subtotal[3]	706,025	2,263	810,133	2,597	N/A	N/A	758,079	2,430
Additional recycling at Transfer Stations[4]	35,037	112	35,037	112			35,037	112
Deposit containers[5]	31,000	99	31,000	99			31,000	99
Total Recycling	772,062	2,475	876,170	2,808			824,116	2,641
Total Generation (Disposed & Recycled	2,875,657	9,217	3,120,488	10,001	N/A	N/A	3,085,000	9,889
Recycling Percentage (Waste Recycled/Total Generation)	27%		28%		NA		27%	

Notes:

(1) Data Sources:

a) Fax-back data are forms returned by carters in response to BIC-DSNY survey. Returns represented 100% compliance.

b) Carter survey interviews on fleet operations data were derived from follow-up in-person or phone interviews with carters responding to fax-back to clarify data anomalies and to develop information on fleet operations as an alternative basis for estimating waste quantities from fleet operations, i.e., truck shifts.

c) Data summarized from the average of the first three Quarterly Reports filed by in-City putrescible Transfer Stations with DSNY. The 1,039 tpd disposed of out-of-City is carried over from carter survey fax-back to include out-of-City disposal in estimate.

(2) The fax-back response is the only source of data for determining 2003 out-of-City disposal. Note that quantity is consistent with upward trend from 2002 facilities estimate.

(3) Waste recycled (first tipped in-City and direct hauled out-of-City) represents an average of carter survey fax-back and interview data.

(4) Additional recycling separated at Transfer Stations from mixed loads.

(5) Deposit container estimate developed from data obtained from the facilities survey, published market consumption data and NYSDEC deposit statistics.

TPY = Tons per Year.

TPD = Tons per Day.

The data from these two sources (the fax-back data on tons tipped and the carter interviews) show similar results; the fax-back estimates for waste disposed are 6,742 tpd, while the carter interviews derived an estimate of 7,193 tpd – a difference of less than 7%. The estimated quantity of waste recycled is 2,263 tpd from the fax-back responses and 2,597 tpd from the carter interview data – a difference of 15%.

Additional recycling from the commercial sector includes recycling of materials at Transfer Stations from mixed waste loads. This amounted to 35,037 tons in 2003. An additional 31,000 tons of bottles and containers are recycled through the deposit program. In the aggregate, commercial recycling was 824,116 tons in 2003, or 2,641 tpd. The commercial recycling rate was approximately 27%, or 824,116 tons recycled out of approximately 3,085,000 tons generated in 2003. Overall, the quantity of commercial putrescible solid waste disposed in 2003 is estimated to be 2,261,355 tons (7,248 tpd), while 824,116 tons (2,641 tpd) are estimated to be recycled in 2003, for a total generation of 9,889 tpd.

3.3 Reconciliation of Preliminary Report Data

Table 3.3-1 presents data from the Preliminary Report and compares the results to the 2003 BIC-DSNY survey of commercial collection firms.

As shown in the table, the Preliminary Report data are adjusted to be consistent with the definitions of commercial putrescible waste utilized in the BIC-DSNY carter survey. The Preliminary Report included all materials collected by licensed putrescible carters, whereas the carter survey excluded non-putrescible materials collected by licensed putrescible collection firms. Putrescible materials delivered by self-haulers were removed from the Preliminary Report data, as these materials were not included in the BIC-DSNY carter survey. Materials collected from customers located outside the boundaries of the City were also subtracted from the Preliminary Report data; these materials were not included even if they were collected by firms licensed to collect putrescible waste within the City.

Table 3.3-1
Comparison of 2000 Preliminary Report to
2003 Transfer Station Quarterly Reports/BIC-DSNY Survey[(1)]

	2000 Preliminary Report			2000 Preliminary Report Adjusted	2003 DSNY Transfer Station Quarterly Reports – Out of City from BIC-DSNY Carter Survey
	Reported Disposed (TPD)	Adjustment Amount (TPD)	Reason[(2)]	Net Amount Disposed (TPD)	Net Amount Disposed (TPD)
In-City Transfer Stations	8,257	-209	Out-of-City Origins	8,048	6,209
Direct Export	514	-326	304 tpd of NP[(3)] 22 tpd of P[(4)]	188	1,039
Direct In-City Disposal[(5)]	644	-638	175 tpd of NP[(3)] 463 tpd of P[(4)]	6	
Excess[(5)]	576	-437	306 tpd of NP[(3)] 131 tpd of P[(4)]	139	
Total	**9,991**	**-1,609**		**8,381**	**7,248**

Notes:

(1) Input waste defined according to permit of either carter or Transfer Station (e.g., all waste to putrescible Transfer Station was defined as putrescible). Output waste defined according to type of waste recorded by survey. Table cannot be 100% reconciled with report because it attempts to merge both input and output information.

(2) Backup Table in Attachment 1 details the adjustments made by carter.

(3) Non-putrescible (NP) tonnage carried by putrescible (P) carters and/or destined for putrescible Transfer Stations was included in putrescible total, as part of tonnage being handled by the putrescible infrastructure. This category totals approximately 785 tpd.

(4) Some putrescible tonnage is taken out either because the BIC-DSNY survey did not include the category (e.g., self-haulers), or because classification of survey responses was judged to be incorrect (e.g., Filco Carting loads were classified as disposed rather than recycled tonnage.).

(5) Some of the Transfer Station excess was shifted to in-City direct disposal.

The net result of these adjustments is removal of 1,609 tpd from the results reported in the Preliminary Report, which had reported 9,991 daily tons of commercial putrescible waste disposed. The revised Preliminary Report total is 8,381 tpd. Of this quantity of waste, 188 tpd were exported directly to disposal facilities or transfer stations located outside of the City in the year 2000.

It is this adjusted figure of 8,381 tpd of commercial putrescible solid waste that can be accurately compared to the 2003 total net amount disposed of 7,248 (see Table 3.3-1). This table shows that between years 2000 and 2003, the commercial putrescible waste stream in the City decreased by approximately 13.5%. This decrease is attributable to decreases in employment which occurred over this interval as the economy entered into a recession, and to the after-effects of 9/11.

Taking into account the 2002 data, the trend in commercial putrescible waste disposed is 8,381 tpd in 2000, declining to 7,254 tpd in 2002 and decreasing slightly to 7,248 tpd in 2003. Because there is some inherent error in the different estimating methodologies used, these estimates should be interpreted as approximations. However, the consistency of the estimates, considering the external factors that would cause commercial waste generation to decline over this time, provides a degree of confidence that these estimates are reasonable.

3.4 Waste Origins and Destinations

The BIC-DSNY carter survey provided information on the origin and destination of commercial putrescible waste generated at the borough level. These data are presented in Table 3.4-1. Manhattan, which has the highest proportion of employment of the five boroughs, produces 41% of the waste disposed and accounts for 45% of the waste recycled. Brooklyn and Queens account for about equal quantities of waste disposed – 19% for Brooklyn and 20% for Queens; each of these boroughs accounts for 21% of waste recycled. Bronx discards 14% of the waste disposed and accounts for 9% of waste recycled. Staten Island discards 6% of the waste disposed and accounts for 3% of waste recycled.

Table 3.4-1
Origins and Destinations of Putrescible Waste, 2003

	Commercial Putrescible Waste					
	Waste Disposed		Waste Recycled		Total Generation	
	Tons/Day	% of Total	Tons/Day	% of Total	Tons/Day	% of Total
ORIGINS						
Manhattan	2,970	41%	1,178	45%	4,147	42%
Brooklyn	1,349	19%	553	21%	1,902	19%
Bronx	1,019	14%	240	9%	1,259	13%
Queens	1,419	20%	555	21%	1,974	20%
Staten Island	436	6%	71	3%	507	5%
New York City	7,193	100%	2,597	100%	9,790	100%
DESTINATIONS						
Manhattan	0	0%	0	0%	0	0%
Brooklyn	2,341	35%	678	30%	3,019	34%
Bronx	2,467	37%	219	10%	2,686	30%
Queens	896	13%	246	11%	1,142	13%
Staten Island	0	0%	231	10%	231	3%
New York City	5,703	85%	1,374	61%	7,077	79%
Out-of-City:						
Long Island	95	1%	66	3%	162	2%
Westchester	26	0%	2	0%	27	0%
New Jersey	878	13%	821	36%	1,699	19%
Other	40	1%	0	0%	40	1%
Total Out-of-City	1,039	15%	889	39%	1,928	21%
Grand Total	6,742	100%	2,263	100%	9,005	100%
Percent difference (1)	6.69%		14.75%		8.71%	

Notes:

(1) The difference is due to the differences in data sources: the data source for the Origins is BIC-DSNY carter survey interviews on fleet operations, and the data source for the Destinations is the BIC-DSNY carter survey Fax-Back response.

Origins = BIC-DSNY carter survey interviews – fleet operations

Destinations = BIC-DSNY carter survey – fax-back

Eighty-five percent (85%) of the City's waste disposed is initially transferred within the City; 15% is directly exported to nearby facilities in neighboring states or counties. Recycled waste is more likely to be exported directly -- 39% of this waste is directly exported out of the City.

These origin and destination estimates are used in conjunction with the employment-based estimate, as a basis for allocating the total waste generated to the City's boroughs and then forecasting waste generation over the New SWMP Planning Period.

3.5 Direct Export

Table 3.5-1 presents more detailed information on the destinations of the tons of waste disposed that were directly exported in 2002 and 2003.

Destinations are grouped by area: Western New Jersey, Newark, Staten Island Area, North Metro Area, Southern New Jersey, New York State, and Other Locations. The 2002 facilities estimate shows 855 tpd were directly exported, while the 2003 fax-back survey indicates 1,039 tpd. The increase in directly exported waste is consistent with anecdotal comments made during interviews with carters, who frequently mentioned that increases in tip fees at Transfer Stations in the City had made it economically beneficial to tip outside the City. In terms of where the directly exported waste is tipped, the most frequently used facilities are located in western New Jersey, where about two-thirds of the directly exported waste was tipped in 2002 and about one-half was tipped in 2003. The next most common locations for direct export of waste are those facilities located in or near Newark, New Jersey.

3.6 Distribution by Borough of Customers, Waste Disposed and Recycled

Table 3.6-1 summarizes the distribution of customers, waste disposed and waste recycled by borough.

Table 3.5-1
Direct Export - 2002 and 2003 Comparison

Carter Survey Fax-Back Out-of-City Disposal Sites		Tons per Year		Tons per Day	
		Facilities Estimate	Carter Survey Faxback	Facilities Estimate	Carter Survey Faxback
Name From Fax-Back Form	State	Tons 2002	Jan-Dec 2003	Tons 2002	Jan-Dec 2003
WESTERN NEW JERSEY GROUP					
Covanta, Warren County	NJ				
Warren County Landfill, Union, NJ	NJ				
PCFA, Oxford, NJ	NJ				
Waste Management Hunterdon County, NJ	NJ				
BFI, Fairview, NJ	NJ				
Bridgewater Resources, Somerset	NJ				
Union County Disposal, Union County, NJ	NJ				
Subtotal		**187,852**	**144,013**	**602**	**462**
NEWARK FACILITIES					
Recycling & Salvage, Newark, NJ	NJ				
American Refuel, Newark, NJ	NJ				
Hi Tech, Newark, NJ	NJ				
DJM South Kearny, NJ	NJ				
NJMC, Arlington, NJ	NJ				
Subtotal		**10,287**	**51,935**	**33**	**166**
STATEN ISLAND AREA					
Automated Modular Systems, Linden, NJ	NJ				
Waste Management Julia St, Elizabeth	NJ				
SWTR, Elizabeth, NJ	NJ				
Subtotal		**58,700**	**51,389**	**188**	**165**
NORTH METRO AREA					
Onyx, Totowa, NJ	NJ				
Garafola Transfer Station, Garfield, NJ	NJ				
Waste Management of NJ, Fairlawn NJ	NJ				
Allegro Sanitation, Secaucus, NJ	NJ				
Subtotal		**0**	**4,794**	**0**	**15**
SOUTHERN NEW JERSEY					
Midco, New Brunswick, NJ	NJ				
Camden County	NJ				
Woodhur Ltd, Wrightstown, NJ	NJ				
Subtotal		**7,403**	**21,868**	**24**	**70**
NEW YORK STATE					
American Refuel, Westbury, NY	NY				
Capital Compost, Menands, NY	NY				
Town of North Hempstead	NY				
Waste Management, Yonkers, NY	NY				
BFI Suburban, Westchester, NY	NY				
Sanitary District #1, Lawrence, NY	NY				
A1 Compaction, Yonkers, NY	NY				
Winter Brothers, West Babylon, NY	NY				
RIC, Mamaroneck, NY	NY				
Wheelabrator Westchester, Peekskill, NY	NY				
Subtotal		**1,200**	**39,782**	**4**	**128**
OTHER LOCATIONS					
Better Management Corp. of Ohio	OH				
American Ref Fuel, Chester, PA	PA				
Subtotal		**1,200**	**10,366**	**4**	**33**
Facilities Not in Fax-Back Form					
Pen Pac Fulton	NJ				
Onyx Robros	NJ				
		266,642	**324,147**	**855**	**1,039**

Table 3.6-1
Number of Carter Customers by Borough

	Manhattan	Brooklyn	Bronx	Queens	Staten Island	Total
Number of Customers	44,116	34,043	12,649	23,093	4,270	118,171
Percent of Total Customers	37.33%	28.81%	10.70%	19.54%	3.61%	100%
Percent of Total Waste Disposed	41.3%	18.8%	14.2%	19.7%	6.1%	100%
Percent of Total Recycled	45.4%	21.3%	9.3%	21.4%	2.7%	100%

3.7 Commercial Waste Generation Forecast

Commercial waste generation projections were developed for the New SWMP Planning Period. The projections were based upon three underlying assumptions:

- Waste generation, on a per employee basis, remains at 2003 levels for each borough;
- Waste generation, on a per employee basis, remains constant across the CDs within each borough, and
- The percentage of waste recycled, by borough, remains at 2003 levels.

In order to project commercial waste generation, the 2003 BIC-DSNY generation estimate was applied to the City employment forecast data, since City job growth or loss will directly affect future waste generation.

Revised NYMTC employment projections, which took into account the effects of September 11, were utilized as the basis of the projections. These projections were revised to reflect the downturn in the economy due to the economic recession in the City, and data were translated from the census tract level to the CD level.

Borough-wide waste generation factors were developed based upon the numbers generated in the BIC-DSNY survey and the number of employees in each borough in 2003. Borough-wide waste generation rates utilized were assumed to be the same throughout all CDs within each borough. The borough-wide rates are as follows:

- Bronx: 1.95 tons/employee-year;
- Brooklyn: 1.38 tons/employee-year;
- Manhattan: 0.677 tons/employee-year;
- Queens: 1.31 tons/employee-year; and
- Staten Island: 1.78 tons/employee-year.

The percentages of materials recycled were developed from the fax-back surveys, were developed at the borough level and were assumed to remain constant through 2024. The quantity of waste generated, recycled and disposed through the year 2024 is shown in Table 3.7-1.

Table 3.7-1
New York City Estimated Commercial Putrescible Waste Generation, Recycling and Disposal, 2003 through 2024

New York City	2003 (tons)	2005 (tons)	2010 (tons)	2015 (tons)	2020 (tons)	2024 (tons)
Generation	3,086,000	3,145,000	3,214,000	3,275,000	3,358,000	3,414,000
Recycling	824,000	840,000	858,000	874,000	895,000	909,000
Disposal	2,262,000	2,305,000	2,356,000	2,401,000	2,463,000	2,505,000

Table 3.7-2 shows the generation of commercial putrescible waste by borough, through the year 2024.

Table 3.7-2
Generation of Commercial Putrescible Waste by Borough, 2003 through 2024[(1)(2)]

	2003 (tons)	2005 (tons)	2010 (tons)	2015 (tons)	2020 (tons)	2024 (tons)
Bronx	398,000	400,000	413,000	424,000	443,000	458,000
Brooklyn	599,000	602,000	611,000	619,000	633,000	640,000
Manhattan	1,306,000	1,355,000	1,380,000	1,406,000	1,429,000	1,446,000
Queens	623,000	627,000	642,000	653,000	673,000	687,000
Staten Island	160,000	161,000	168,000	173,000	180,000	183,000
Total (tons/yr)	3,086,000	3,145,000	3,214,000	3,275,000	3,358,000	3,414,000

Notes:
(1) 2003 derived by multiplying generation quantities (Volume II, Appendix D, Table 1.5-1) by borough of origin (Volume II, Appendix D, Table 1.5-2). 2005 through 2024 derived from employment generation factors.
(2) Numbers may not add due to rounding.

Table 3.7-3 shows the quantity of commercial putrescible waste recycled, and Table 3.7-4 shows the quantity disposed by borough through the year 2024.

Table 3.7-3
Recycling of Commercial Putrescible Waste by Borough, 2003 through 2024[1][2]

	2003 (tons)	2005 (tons)	2010 (tons)	2015 (tons)	2020 (tons)	2024 (tons)
Bronx	77,000	77,000	80,000	82,000	86,000	89,000
Brooklyn	175,000	176,000	179,000	181,000	185,000	187,000
Manhattan	373,000	387,000	394,000	402,000	408,000	413,000
Queens	176,000	177,000	181,000	184,000	190,000	194,000
Staten Island	23,000	23,000	24,000	25,000	26,000	26,000
Total (tons/yr)	824,000	840,000	858,000	874,000	895,000	909,000

Notes:
(1) Derived by multiplying generation quantities (Volume II, Appendix D, Table 1.5-3) by borough estimated recycling rate (Volume II, Appendix D, Table 1.5-4).
(2) Numbers may not add due to rounding.

Table 3.7-4
Disposal of Commercial Putrescible Waste by Borough, 2003 through 2024[1][2]

	2003 (tons)	2005 (tons)	2010 (tons)	2015 (tons)	2020 (tons)	2024 (tons)
Bronx	321,000	323,000	333,000	342,000	357,000	369,000
Brooklyn	424,000	426,000	432,000	438,000	448,000	453,000
Manhattan	933,000	968,000	986,000	1,004,000	1,021,000	1,033,000
Queens	447,000	450,000	461,000	469,000	483,000	493,000
Staten Island	137,000	138,000	144,000	148,000	154,000	157,000
Total (tons/yr)	2,262,000	2,305,000	2,356,000	2,401,000	2,463,000	2,505,000

Notes:
(1) Derived by subtracting recycling quantities (Volume II, Appendix D, Table 1.5-5) from generation quantities (Volume II, Appendix D, Table 1.5-3).
(2) Numbers may not add due to rounding.

4.0 COMMERCIAL NON-PUTRESCIBLE WASTE

Volume II, Appendix E of this Study describes the means of projecting the generation of commercial non-putrescible waste. It should be noted that waste generated during residential construction, demolition and renovation is not considered DSNY-managed Waste, and hence is part of the commercial waste stream collected by the private carters.

4.1 Total Tons of C&D Debris

Table 4.1-1 presents the DSNY-reported quantities of clean fill and non-putrescible C&D waste, which together equal the total quantity of C&D debris in the City, for the years 2000, 2001, 2002 and 2003. C&D ranged from 6.35 million tons in 2000 to 7.91 million tons in 2002. For 2003, total tons are estimated at 8.64 million by utilizing data from the first three quarters of 2003, and assuming that the 4th quarter would average 100% of the 3rd quarter for fill, and 90% of the 3rd quarter for C&D. Average daily tonnage is in the 20,000 to 27,000 range, and has increased steadily over these four years. It is not known if the trend will continue to rise, or if tonnages will, over time, revert to quantities more typical of the year 2000. The average of the three years for which complete data is available is just under 7 million tons. As shown by the table, on average, clean fill represented approximately 60% of the total amount of C&D for the years 2000 through 2002, and non-putrescible C&D represented the remaining 40%. However, as shown by the 2003 data, clean fill appears to be accounting for an ever larger percentage of C&D debris, totaling almost 70%. Therefore, in allocating the total quantity of C&D waste into non-putrescible and clean fill components, a range was derived, with clean fill constituting between 60% and 70% of the total material, and C&D constituting between 30% and 40% of the total.

Table 4.1-1

Total Quantity of C&D in New York City

Item	Year 2000	2001	2002	Average	2003[2]
Tons per day input[1]					
Non-Putrescible C&D	9,475	9,735	8,610	9,274	8,626
Clean Fill C&D	10,891	11,706	16,729	13,109	19,069
Total C&D	20,366	21,441	25,340	22,382	27,695
Tons per year input					
Non-Putrescible C&D	2,956,200	3,037,398	2,686,398	2,893,332	2,691,390
Clean Fill C&D	3,398,070	3,652,194	5,219,526	4,089,930	5,949,450
Total C&D	6,354,270	6,689,592	7,905,924	6,983,262	8,640,840
Clean fill as percent of Total C&D	53.5%	54.6%	66.0%	58.6%	68.9%

Notes:

(1) Based upon 312 days per year of operation.

(2) 2003 consists of first three quarters, plus fourth quarter estimated at 90% of third quarter for non-putrescible and 100% of third quarter tonnages for fill material.

4.2 Residential Construction, Demolition and Renovation Debris

An average waste generation rate of 4.10 pounds per square foot was utilized for determining the quantity of residential construction waste generated from single-family residences, as typically found in Staten Island. For multi-family construction, a residential construction waste generation factor of 3.99 pounds per square foot was utilized, and a weighted average of 4.02 pounds per square foot was applied to residential construction waste generation throughout the City. New residential building construction debris estimates are shown in Table 4.2-1. It is important to note that the construction industry exhibits cyclic behavior, related to economic cycles within a region. Therefore, this table illustrates the general trend in the increase in residential construction waste generated within this sector, but may not be a good indicator of new residential construction waste generated in a given year in the future.

For single-family buildings, an average waste generation rate of 85.10 pounds per square foot demolished was utilized; 50.50 pounds per square foot was used for multi-family housing. New construction within the City generally requires the demolition of existing buildings, so the waste generated mirrors the trend in the generation of construction debris. Projections of residential demolition debris are shown on Table 4.2-1.

An average residential debris generation factor of 27.3 pounds per square foot of residential renovation was utilized and applied to the square footage of residential renovations, which was derived from information on the value of residential renovation obtained from F.W. Dodge. These projections are also shown in Table 4.2-1.

4.3 Commercial Construction, Demolition and Renovation Debris

Generation rates of 3.8, 130.3 and 11.3 pounds per square foot were utilized to estimate C&D from commercial construction, demolition and renovation, respectively. Square footages for each of these categories were projected into the future based upon data provided by F.W. Dodge, as well as a number of assumptions, as described in detail in Volume II, Appendix E of this Study. The total tonnage of commercial construction, demolition and renovation debris generated in the City is shown in Table 4.3-1.

4.4 Non-Building-Related C&D

Non-building debris includes waste materials generated in the process of constructing, demolishing and renovating public works projects such as gas and communications facilities, streets and highways, water supply systems and other non-building activities. Data on the constant dollar value of this construction in the City was obtained from F.W. Dodge, and projected forward through 2024. Aggregate non-building debris is estimated by subtracting the total of building-related C&D debris from the baseline total estimated above from DSNY non-putrescible and fill transfer station reports. The range of tonnage per thousand dollars of value of non-building construction in the years 2000 to 2002 and the year 2003 was used to generate an anticipated range of tonnage projections through 2024. These projections are shown in Table 4.4-1.

Table 4.2-1
Projected Residential Construction, Demolition and Renovation Debris for New York City, 1997-2024

Year	Residential Construction Debris in Tons	Residential Demolition Debris in Tons	Residential Building Renovation Debris in Tons	Total Residential Sector C&D Debris
1997	21,003	NA	NA	NA
1998	26,492	NA	NA	NA
1999	29,686	431,526	96,765	557,977
2000	31,952	467,262	64,865	564,079
2001	33,710	487,773	53,685	575,168
2002	35,146	471,105	42,397	548,648
2003	36,360	485,872	7,180	529,412
2004	37,412	518,212	14,524	570,148
2005	38,339	529,421	6,088	573,848
2006	39,169	515,098	11,029	565,296
2007	37,230	503,626	17,267	558,123
2008	37,915	512,223	18,673	568,811
2009	38,546	520,167	20,652	579,365
2010	39,130	527,549	23,178	589,857
2011	39,673	534,444	26,181	600,298
2012	40,181	540,913	29,621	610,715
2013	40,659	547,006	33,483	621,148
2014	41,109	552,765	37,729	631,603
2015	41,535	558,223	42,329	642,087
2016	41,939	563,410	47,297	652,646
2017	42,323	568,354	52,607	663,284
2018	42,689	573,074	58,231	673,994
2019	43,040	577,592	64,182	684,814
2020	43,375	581,922	70,434	695,731
2021	43,696	586,081	77,000	706,777
2022	44,005	590,082	83,866	717,953
2023	44,302	593,936	91,032	729,270
2024	44,589	597,653	98,485	740,727

Table 4.3-1
Projected Commercial Construction, Demolition and Renovation Debris in New York City, 1999-2024

Year	Commercial Construction (Tons)	Commercial Demolition (Tons)	Commercial Renovation (Tons)	Commercial Total (Tons)
1999	23,563	622,924	606,884	1,253,371
2000	24,149	709,347	606,425	1,339,921
2001	40,234	813,838	609,525	1,463,597
2002	28,670	654,580	607,879	1,291,129
2003	25,005	625,097	609,495	1,259,597
2004	26,409	650,021	611,273	1,287,703
2005	27,560	668,533	613,196	1,309,289
2006	28,255	674,335	615,244	1,317,834
2007	27,455	672,804	617,112	1,317,371
2008	28,118	689,057	619,025	1,336,200
2009	28,797	705,702	620,985	1,355,484
2010	29,493	722,750	622,992	1,375,235
2011	30,205	740,209	625,047	1,395,461
2012	30,935	758,089	627,152	1,416,176
2013	31,682	776,403	629,308	1,437,393
2014	32,447	795,158	631,516	1,459,121
2015	33,231	814,366	633,778	1,481,375
2016	34,034	834,039	636,094	1,504,167
2017	34,856	854,186	638,466	1,527,508
2018	35,698	874,820	640,895	1,551,413
2019	36,560	895,953	643,383	1,575,896
2020	37,444	917,596	645,931	1,600,971
2021	38,348	939,762	648,541	1,626,651
2022	39,285	962,464	651,213	1,652,962
2023	40,223	985,714	653,950	1,679,887
2024	41,195	1,009,525	656,754	1,707,474

Table 4.4-1
Projected Non-Building-Related Construction, Demolition and Renovation Debris in New York City, 2000-2024

Year	Value of Non-Building-Related Construction (000s of 1996 $)	Non-Building-Related C&D Debris[(1)] (1.96 * Value) (Tons)	Non-Building-Related C&D Debris (2.97 * Value) (Tons)
2000	$2,535,203	4,450,000	NA
2001	$2,079,637	4,651,000	NA
2002	$3,236,764	6,066,000	NA
2003	$2,306,670	NA	6,852,000
2004	$2,143,400	4,201,000	6,366,000
2005	$2,177,569	4,268,000	6,467,000
2006	$2,281,721	4,472,000	6,777,000
2007	$2,340,870	4,588,000	6,952,000
2008	$2,455,527	4,813,000	7,293,000
2009	$2,486,428	4,873,000	7,385,000
2010	$2,515,918	4,931,000	7,472,000
2011	$2,544,135	4,987,000	7,556,000
2012	$2,571,197	5,040,000	7,636,000
2013	$2,597,205	5,091,000	7,714,000
2014	$2,622,248	5,140,000	7,788,000
2015	$2,646,404	5,187,000	7,860,000
2016	$2,669,739	5,233,000	7,929,000
2017	$2,692,316	5,277,000	7,996,000
2018	$2,714,186	5,320,000	8,061,000
2019	$2,735,399	5,361,000	8,124,000
2020	$2,755,997	5,402,000	8,185,000
2021	$2,776,019	5,441,000	8,245,000
2022	$2,795,500	5,479,000	8,303,000
2023	$2,814,473	5,516,000	8,359,000
2024	$2,832,965	5,553,000	8,414,000

Notes:
(1) Utilized actual tons of non-building-related debris per $1,000 of expenditure for the years 2000 to 2002, from Volume II, Appendix E, Table 6.1.1-1.

The average value for the years 2000 to 2002 of the tons of non-building-related debris per $1,000 expended was approximately 1.96 tons. For the year 2003, the rate dramatically increases to 2.97 tons per $1,000 expended. The quantity of non-building-related C&D tons rises from 4,450,000 in 2000 to an estimated 6,852,000 tons in 2003. Both the lower and upper ranges, using the 1.96 and 2.97 factors, are utilized to project quantities of non-building-related C&D through the New SWMP Planning Period. By 2024, the quantity is expected to range from approximately 5.6 to 8.4 million tons.

Table 4.4-1 presents the dollar value of non-building-related construction, demolition and renovation in the City from 2000 to 2024. This table also contains the estimated range of tons of non-building-related C&D debris, which will be generated as a result of the predicted level of economic activity.

4.5 Total Estimated C&D Commercial Waste

Tables 4.5-1 and 4.5-2 disaggregate the total estimate for C&D debris into the fill material and non-putrescible categories used by the City in regulating its Transfer Stations, on a tons per year basis. In these tables, fill is shown as ranging from 60% to 70% of the total C&D, with the remainder allocated to the non-putrescible category. These tables utilize the 2003 baseline quantity of C&D material, and utilize the previously described methodology to project these quantities for the New SWMP Planning Period.

Non-putrescible material can be expected to range from 2.4 to 3.2 million tons utilizing the average data from 2000 to 2002, while fill material would range from 4.8 million to 5.6 million tons. By utilizing the higher factor of 2003, non-putrescible materials would range from 3.3 to 4.3 million tons, while fill material would range from 6.5 to 7.6 million tons in the year 2024. These percentages are likely to vary seasonally and annually, due to the highly variable nature of non-putrescible materials.

Table 4.5-1
Range of Quantities of Non-Putrescible and Fill Material, 2004-2024
(based upon average data for 2000-2002, in tons per year)

Year	Average (2000-2002) Estimate (Using 1.96)			
	Non-Putrescible		Fill	
	30%	40%	60%	70%
2004	1,728,000	2,304,000	3,455,000	4,031,000
2005	1,845,000	2,460,000	3,691,000	4,306,000
2006	1,907,000	2,542,000	3,813,000	4,449,000
2007	1,939,000	2,585,000	3,878,000	4,525,000
2008	2,015,000	2,687,000	4,031,000	4,702,000
2009	2,042,000	2,723,000	4,085,000	4,766,000
2010	2,069,000	2,759,000	4,138,000	4,827,000
2011	2,095,000	2,793,000	4,189,000	4,888,000
2012	2,120,000	2,827,000	4,240,000	4,947,000
2013	2,145,000	2,860,000	4,289,000	5,004,000
2014	2,169,000	2,892,000	4,338,000	5,061,000
2015	2,193,000	2,924,000	4,386,000	5,117,000
2016	2,217,000	2,956,000	4,434,000	5,173,000
2017	2,240,000	2,987,000	4,481,000	5,227,000
2018	2,264,000	3,018,000	4,527,000	5,282,000
2019	2,287,000	3,049,000	4,573,000	5,335,000
2020	2,310,000	3,079,000	4,619,000	5,389,000
2021	2,332,000	3,110,000	4,665,000	5,442,000
2022	2,355,000	3,140,000	4,710,000	5,495,000
2023	2,378,000	3,170,000	4,755,000	5,548,000
2024	2,400,000	3,200,000	4,800,000	5,601,000

Table 4.5-2
Range of Quantities of Non-Putrescible and Fill Material, 2004-2024
(based upon 2003 data, in tons per year)

Year	Upper Estimate (Using 2.97)			
	Non-Putrescible		Fill	
	30%	40%	60%	70%
2004	2,377,000	3,169,000	4,754,000	5,547,000
2005	2,505,000	3,340,000	5,010,000	5,845,000
2006	2,598,000	3,464,000	5,196,000	6,062,000
2007	2,648,000	3,531,000	5,297,000	6,180,000
2008	2,759,000	3,679,000	5,519,000	6,439,000
2009	2,796,000	3,728,000	5,592,000	6,524,000
2010	2,831,000	3,775,000	5,662,000	6,606,000
2011	2,866,000	3,821,000	5,731,000	6,686,000
2012	2,899,000	3,865,000	5,798,000	6,764,000
2013	2,932,000	3,909,000	5,863,000	6,841,000
2014	2,964,000	3,952,000	5,927,000	6,915,000
2015	2,995,000	3,993,000	5,990,000	6,988,000
2016	3,026,000	4,034,000	6,052,000	7,060,000
2017	3,056,000	4,075,000	6,112,000	7,131,000
2018	3,086,000	4,115,000	6,172,000	7,201,000
2019	3,115,000	4,154,000	6,231,000	7,269,000
2020	3,145,000	4,193,000	6,289,000	7,337,000
2021	3,173,000	4,231,000	6,347,000	7,405,000
2022	3,202,000	4,269,000	6,404,000	7,471,000
2023	3,230,000	4,307,000	6,461,000	7,538,000
2024	3,259,000	4,345,000	6,517,000	7,603,000

Attachment 1

Reconciliation Backup Details

Reconciliation Back-up Details: Direct In-City Disposal 2000 [1]

Facility Name	County	State	Annual Tonnage	Tons per Day	Carter License	Material	Reason for Omitting
Non-Putrescible Omitted							
CHAMBERS PAPER FIBRES CORP	BROOKLYN	NY	12,000	38	Carter: Putr.	N-Purtescible	paper
CHAMBERS PAPER FIBRES CORP	BROOKLYN	NY	12,000	38	Carter: Putr.	N-Purtescible	paper
CHAMBERS PAPER FIBRES CORP	BROOKLYN	NY	3,600	12	Carter: Putr.	N-Purtescible	paper
CHAMBERS PAPER FIBRES CORP	BROOKLYN	NY	100	0	Carter: Putr.	N-Purtescible	paper
SPRINT RECYCLING INC	NEW YORK	NY	1,482	5	Carter: Putr.	Mixed Paper	paper
SPRINT RECYCLING INC	NEW YORK	NY	4,943	16	Carter: Putr.	Mixed Paper	paper
SPRINT RECYCLING INC	NEW YORK	NY	2,466	8	Carter: Putr.	C & D	paper
BAVARO CARTING CORP	BROOKLYN	NY	501	2	Carter: Putr.	Corrugated Cardboard	recyclables
D&D CARTING CO	BROOKLYN	NY	208	1	Carter: Putr.	Corrugated Cardboard	recyclables
D&D CARTING CO	BROOKLYN	NY	599	2	Carter: Putr.	Mixed Paper	recyclables
D&D CARTING CO	BROOKLYN	NY	728	2	Carter: Putr.	Corrugated Cardboard	recyclables
DECOSTELLO CARTING	BROOKLYN	NY	520	2	Carter: Putr.	Mixed Paper	recyclables
DECOSTELLO CARTING	BROOKLYN	NY	520	2	Carter: Putr.	Mixed Paper	recyclables
FRANK LOMANGINO & SONS	NASSAU	NY	1,703	5	Carter: Putr.	Corrugated Cardboard	recyclables
J RUTICLIANO WASTE REMOVAL	NASSAU	NY	2,250	7	Carter: Putr.	Mixed Paper	recyclables
J RUTICLIANO WASTE REMOVAL	NASSAU	NY	1,550	5	Carter: Putr.	Corrugated Cardboard	recyclables
ATLAS SANITATION CO INC	QUEENS	NY	500	2	Carter: Putr.	Mixed Paper	recyclables
ATLAS SANITATION CO INC	QUEENS	NY	1,500	5	Carter: Putr.	Mixed Paper	recyclables
UNITED SANITATION INC	QUEENS	NY	11	0	Carter: Putr.	Corrugated Cardboard	recyclables
STAR RUBBISH REMOVAL	STATEN ISLAND	NY	1,560	5	Carter: Putr.	Corrugated Cardboard	recyclables
DYNAMIC RUBBISH REMOVAL	SUFFOLK	NY	1,463	5	Carter: Putr.	Mixed Recyclables	recyclables
TIA OF NEW YORK	SUFFOLK	NY	900	3	Carter: Putr.	Corrugated Cardboard	recyclables
TIA OF NEW YORK	SUFFOLK	NY	400	1	Carter: Putr.	Corrugated Cardboard	recyclables
CHINATOWN CARTING CORP	WESTCHESTER	NY	3,060	10	Carter: Putr.	Corrugated Cardboard	recyclables
Non-Putrescible Omitted:			54,564	175			
Putrescible Omitted							
RAGS CONTRACTING CORP	NASSAU	NY	65	0	Carter: Putr.	Putrescible MSW	C&D
ALLSTATE POWER VAC INC	UNION	NJ	7,210	23	Carter: Putr.	LIQUID/PUTRESCIBLE	Env. Remediation
ALLSTATE POWER VAC INC	UNION	NJ	518	2	Carter: Putr.	LIQUID/PUTRESCIBLE	Env. Remediation
ANTONIO ROTONDI LANDSCAPING	BROOKLYN	NY	11	0	Self Haulers: Putr.	Putrescible MSW	Greenwaste
ANTONIO ROTONDI LANDSCAPING	BROOKLYN	NY	34	0	Self Haulers: Putr.	Putrescible MSW	Greenwaste
GIUSEPPE COMMISSO GARDENER LANDSCAP	BROOKLYN	NY	336	1	Self Haulers: Putr.	Putrescible MSW	Greenwaste
THE GREENWOOD CEMETERY CORP.	BROOKLYN	NY	963	3	Self Haulers: Putr.	Putrescible MSW	Greenwaste
B & P SERVICES OF STATEN ISLAND INC	MONMOUTH	NJ	20	0	Self Haulers: Putr.	Putrescible MSW	Greenwaste
B & P SERVICES OF STATEN ISLAND INC	MONMOUTH	NJ	5	0	Self Haulers: Putr.	Grass, Landscape Material	Greenwaste
PRIME LANDSCAPE SERVICES	STATEN ISLAND	NY	400	1	Self Haulers: Putr.	Putrescible MSW	Greenwaste
PRIME LANDSCAPE SERVICES	STATEN ISLAND	NY	19	0	Self Haulers: Putr.	Putrescible MSW	Greenwaste
LA ROSA DOMINGO	QUEENS	NY	5	0	Carter: Putr.	LIQUID/PUTRESCIBLE	liquid
MC LAUGLIN & TERRI HARRIS	QUEENS	NY	234	1	Self Haulers: Putr.	Putrescible MSW	liquid
FILCO CARTING CORP.(ALSO CF WASTE PAPER CO.)	BROOKLYN	NY	48,027	154	Carter: Putr.	Putrescible MSW	paper
FILCO CARTING CORP.(ALSO CF WASTE PAPER CO.)	BROOKLYN	NY	86,449	277	Carter: Putr.	Putrescible MSW	paper
OUTSTANDING RENEWAL ENTERPRISES	NEW YORK	NY	130	0	Transfer Station: Putr.	Putrescible MSW	self haul
Putrescible Omitted:			144,426	463			
Putrescible Retained							
ARGENTO RUBBISH REMOVAL INC	BRONX	NY	512	2	Carter: Putr.	Putrescible MSW	
LA ROSA DOMINGO	QUEENS	NY	26	0	Carter: Putr.	Putrescible MSW	
UNITED SANITATION INC	QUEENS	NY	27	0	Carter: Putr.	Putrescible MSW	
SCOCOZZO CARTING CORP	STATEN ISLAND	NY	600	2	Carter: Putr.	Mixed Recyclables	
DYNAMIC RUBBISH REMOVAL	SUFFOLK	NY	736	2	Carter: Putr.	Putrescible MSW	
Putrescible Retained:			1,901	6			
TOTAL Direct In-City Disposal			200,891	644			

(1) Data extracted from 2000 Survey Forms

Reconciliation Back-up Details: Direct Export (1)							
Facility Name	County	State	Annual Tonnage	Tons per Day	Carter License	Material	Reason for Omitting
			Non-Putrescible Omitted				
JEM SANITATION CORP	BERGEN	NJ	960	3	Carter: Putr.	C & D	C&D
ACTION CARTING ENV SERVICES	ESSEX	NJ	158	1	Carter: Putr.	C & D	C&D
ACTION CARTING ENV SERVICES	ESSEX	NJ	1,280	4	Carter: Putr.	C & D	C&D
OMNI WASTE SERVICES INC	PASSAIC	NJ	2,408	8	Carter: Putr.	C & D	C&D
MAC HEALTH CARE SERVICES	UNION	NJ	213	1	Carter: Putr.	C & D	C&D
ALLSTATE POWER VAC INC	UNION	NJ	1,227	4	Carter: Putr.	Soil	env. Remediation
P.J.C. SANITATION SERVICE INC.	BROOKLYN	NY	720	2	Carter: Putr.	C & D	C&D
SPRINT RECYCLING INC	NEW YORK	NY	44,231	142	Carter: Putr.	Mixed Paper	recyclables
JEM SANITATION CORP	BERGEN	NJ	7,000	22	Carter: Putr.	Corrugated Cardboard	recyclables
JEM SANITATION CORP	BERGEN	NJ	18,000	58	Carter: Putr.	Mixed Recyclables	recyclables
JEM SANITATION CORP	BERGEN	NJ	2,000	6	Carter: Putr.	Mixed Recyclables	recyclables
JEM SANITATION CORP	BERGEN	NJ	2,000	6	Carter: Putr.	Corrugated Cardboard	recyclables
GOTHAM RECYCLING RESOURCES	ESSEX	NJ	7,242	23	Carter: Putr.	Mixed Paper	recyclables
M&M SANITATION CORP (POSSIBLY KNOWN	HUDSON	NJ	3,484	11	Carter: Putr.	Corrugated Cardboard	recyclables
RUSSELL REID WASTE HAULING AND DISP	MIDDLESEX	NJ	5	0	Carter: Putr.	Mixed Paper	recyclables
J RUTICLIANO WASTE REMOVAL	NASSAU	NY	900	3	Carter: Putr.	Corrugated Cardboard	recyclables
J RUTICLIANO WASTE REMOVAL	NASSAU	NY	2,700	9	Carter: Putr.	Mixed Paper	recyclables
MIDLAND CARTING CORP	NASSAU	NY	513	2	Carter: Putr.	Corrugated Cardboard	recyclables
Non-Putrescible Omitted			95,040	305			
			Putrescible Omitted				
THE SALVATION ARMY	NEW YORK	NY	1,092	4	Self Haulers: Putr.	Putrescible MSW	self haul
ALLSTATE POWER VAC INC	UNION	NJ	16	0	Carter: Putr.	Putrescible MSW	env. Remediation
ALLSTATE POWER VAC INC	UNION	NJ	125	0	Carter: Putr.	LIQUID/PUTRESCIBLE	env. Remediation
ALLSTATE POWER VAC INC	UNION	NJ	1,174	4	Carter: Putr.	LIQUID/PUTRESCIBLE	env. Remediation
ALLSTATE POWER VAC INC	UNION	NJ	959	3	Carter: Putr.	LIQUID/PUTRESCIBLE	env. Remediation
ALLSTATE POWER VAC INC	UNION	NJ	669	2	Carter: Putr.	LIQUID/PUTRESCIBLE	env. Remediation
ALLSTATE POWER VAC INC	UNION	NJ	815	3	Carter: Putr.	LIQUID/PUTRESCIBLE	env. Remediation
ALLSTATE POWER VAC INC	UNION	NJ	1,416	5	Carter: Putr.	LIQUID/PUTRESCIBLE	env. Remediation
ALLSTATE POWER VAC INC	UNION	NJ	62	0	Carter: Putr.	LIQUID/PUTRESCIBLE	env. Remediation
RUSSELL REID WASTE HAULING AND DISP	MIDDLESEX	NJ	269	1	Carter: Putr.	LIQUID/PUTRESCIBLE	liquid
Putrescible Omitted:			6,597	21			
			Putrescible Retained				
FALLETTA CARTING CORP	BROOKLYN	NY	1,052	3	Carter: Putr.	Putrescible MSW	
IDEAL SANITATION SERVICE	BERGEN	NJ	3,796	12	Carter: Putr.	Putrescible MSW	
JEM SANITATION CORP	BERGEN	NJ	13,730	44	Carter: Putr.	Putrescible MSW	
JOHN PASQUALE, INC.	BERGEN	NJ	1,352	4	Carter: Putr.	Putrescible MSW	
ACTION CARTING ENV SERVICES	ESSEX	NJ	3,709	12	Carter: Putr.	Putrescible MSW	
SPRINT RECYCLING INC	NEW YORK	NY	368	1	Carter: Putr.	Putrescible MSW	
CLASSIC RECYCLING NEW YORK, INC.	PASSAIC	NJ	6,871	22	Carter: Putr.	Putrescible MSW	
CLASSIC SANITATION CO., LTD.	PASSAIC	NJ	448	1	Carter: Putr.	Putrescible MSW	
OMNI WASTE SERVICES INC	PASSAIC	NJ	350	1	Carter: Putr.	Putrescible MSW	
CAPITOL CARTING CORP	QUEENS	NY	866	3	Carter: Putr.	Putrescible MSW	
MAC HEALTH CARE SERVICES	UNION	NJ	1,872	6	Carter: Putr.	Putrescible MSW	
FALLETTA CARTING CORP	BROOKLYN	NY	3,524	11	Carter: Putr.	Putrescible MSW	
RAGS CONTRACTING CORP	NASSAU	NY	501	2	Carter: Putr.	Putrescible MSW	
KEY CONTAINER SERVICE	QUEENS	NY	8,428	27	Carter: Putr.	Putrescible MSW	
CHAMBERS PAPER FIBRES CORP	BROOKLYN	NY	1,080	3	Carter: Putr.	Putrescible MSW	
CITY WASTE SERVICES OF NY	BRONX	NY	3,000	10	Carter: Putr.	Putrescible MSW	
GOTHAM RECYCLING RESOURCES	ESSEX	NJ	6,958	22	Carter: Putr.	Putrescible MSW	
BASIN HAULAGE INC	QUEENS	NY	10	0	Carter: Putr.	Putrescible MSW	
ROYAL WASTE SERVICES	QUEENS	NY	695	2	Carter: Putr.	Putrescible MSW	
Putrescible Retained:			58,611	188			
TOTAL DIRECT EXPORT			160,248	514			

(1) Data extracted from 2000 Survey Forms

Reconciliation Back-up Details: Excess [1]							
Facility Name	County	State	Annual Tonnage	Tons per Day	Carter License	Material	Reason for Omitting
			Non-Putrescible Omitted				
JEM SANITATION CORP	BERGEN	NJ	210	1	Carter: Putr.	C & D	C&D
LEO P IPPOLITO INC.	BERGEN	NJ	34	0	Carter: Putr.	C & D	C&D
LEO P IPPOLITO INC.	BERGEN	NJ	1,659	5	Carter: Putr.	C & D	C&D
J.F. DUFFY RUBBISH REMOVAL	BRONX	NY	596	2	Carter: Putr.	Wood, Wood Chips, Mulch	C&D
MID BRONX HAULAGE	BRONX	NY	10,469	34	Carter: Putr.	N-Purtescible	C&D
SANITATION SALVAGE CORP	BRONX	NY	520	2	Carter: Putr.	N-Purtescible	C&D
CANAL CARTING INC	BROOKLYN	NY	6,000	19	Carter: Putr.	N-Purtescible	C&D
CONSUMERS RUBBISH REMOVAL INC.	BROOKLYN	NY	83	0	Carter: Putr.	C & D	C&D
H ANDREANA CARTING	BROOKLYN	NY	1,760	6	Carter: Putr.	N-Purtescible	C&D
MULTI CARTING INC	BROOKLYN	NY	234	1	Carter: Putr.	N-Purtescible	C&D
MULTI CARTING INC	BROOKLYN	NY	234	1	Carter: Putr.	N-Purtescible	C&D
P.J.C. SANITATION SERVICE INC.	BROOKLYN	NY	2,100	7	Carter: Putr.	C & D	C&D
WATCHTOWER BIBLE & TRACT SOCIETY OF	BROOKLYN	NY	925	3	Self Haulers: Putr.	N-Purtescible	C&D
M&M SANITATION CORP (POSSIBLY KNOWN	HUDSON	NJ	3,873	12	Carter: Putr.	C & D	C&D
B & P SERVICES OF STATEN ISLAND INC	MONMOUTH	NJ	12	0	Self Haulers: Putr.	Fill	C&D
AJI INDUSTRIES	NASSAU	NY	34,335	110	Carter: Putr.	N-Purtescible	C&D
GREGOR CARTING CORP	NASSAU	NY	592	2	Carter: Putr.	N-Purtescible	C&D
GREGOR CARTING CORP	NASSAU	NY	811	3	Carter: Putr.	Wood, Wood Chips, Mulch	C&D
GREGOR CARTING CORP	NASSAU	NY	175	1	Carter: Putr.	Wood, Wood Chips, Mulch	C&D
GREGOR CARTING CORP	NASSAU	NY	1,059	3	Carter: Putr.	Wood, Wood Chips, Mulch	C&D
OMNI WASTE SERVICES INC	PASSAIC	NJ	394	1	Carter: Putr.	C & D	C&D
OMNI WASTE SERVICES INC	PASSAIC	NJ	847	3	Carter: Putr.	C & D	C&D
ATLAS SANITATION CO INC	QUEENS	NY	10,829	35	Carter: Putr.	C & D	C&D
BASIN HAULAGE INC	QUEENS	NY	3,967	13	Carter: Putr.	N-Purtescible	C&D
BESTWAY CARTING	QUEENS	NY	1,711	5	Carter: Putr.	N-Purtescible	C&D
BESTWAY CARTING	QUEENS	NY	6,902	22	Carter: Putr.	N-Purtescible	C&D
FOREST HILLS CONTAINER SERVICE	QUEENS	NY	691	2	Carter: Putr.	N-Purtescible	C&D
UNITED SANITATION INC	QUEENS	NY	185	1	Carter: Putr.	C & D	C&D
PARK RUBBISH REMOVAL	SUFFOLK	NY	110	0	Carter: Putr.	C & D	C&D
PARK RUBBISH REMOVAL	SUFFOLK	NY	945	3	Carter: Putr.	C & D	C&D
TIA OF NEW YORK	SUFFOLK	NY	200	1	Carter: Putr.	Concrete	C&D
A & D CARTING CORP.	WESTCHESTER	NY	480	2	Carter: Putr.	C & D	C&D
J RUTICLIANO WASTE REMOVAL	NASSAU	NY	625	2	Carter: Putr.	Mixed Paper	recyclable
UNITED SANITATION INC	QUEENS	NY	246	1	Carter: Putr.	Corrugated Cardboard	recyclable
DYNAMIC RUBBISH REMOVAL	SUFFOLK	NY	58	0	Carter: Putr.	Mixed Recyclables	recyclable
DYNAMIC RUBBISH REMOVAL	SUFFOLK	NY	523	2	Carter: Putr.	Mixed Recyclables	recyclable
TIA OF NEW YORK	SUFFOLK	NY	1,012	3	Carter: Putr.	Corrugated Cardboard	recyclable
Non-Putrescible Omitted:			95,405	306			
			Putrescible Omitted				
GREGOR CARTING CORP	NASSAU	NY	3,479	11	Carter: Putr.	Putrescible MSW	C&D
CHELSEA GARDEN CENTER, INC.	NEW YORK	NY	30	0	Self Haulers: Putr.	Grass, Landscape Material	Greenwaste
FILCO CARTING CORP.(ALSO CF WASTE PAPER CO.)	BROOKLYN	NY	37,211	119	Carter: Putr.	Putrescible MSW	misclassified
NECESSARY OBJECTS LTD	NEW YORK	NY	130	0	Self Haulers: Putr.	Putrescible MSW	self haul
TRUSTEES OF ST. PATRICK'S CATHEDRAL	NEW YORK	NY	20	0	Self Haulers: Putr.	Putrescible MSW	self haul
Putrescible Omitted			40,869	131			
			Putresible Retained				
HERITAGE CARTING CORP	BRONX	NY	259	1	Carter: Putr.	Putrescible MSW	
BAVARO CARTING CORP	BROOKLYN	NY	198	1	Carter: Putr.	Putrescible MSW	
CONSUMERS RUBBISH REMOVAL INC.	BROOKLYN	NY	564	2	Carter: Putr.	Putrescible MSW	
CONSUMERS RUBBISH REMOVAL INC.	BROOKLYN	NY	124	0	Carter: Putr.	Putrescible MSW	
AJI INDUSTRIES	NASSAU	NY	7,728	25	Carter: Putr.	Putrescible MSW	
CROWN WASTE CORP.	NASSAU	NY	1,370	4	Carter: Putr.	Putrescible MSW	
FRANK LOMANGINO & SONS	NASSAU	NY	4,745	15	Carter: Putr.	Putrescible MSW	
JOE MOREA & SONS PRIVATE SANITATION	NASSAU	NY	5,400	17	Carter: Putr.	Putrescible MSW	
JOE MOREA & SONS PRIVATE SANITATION	NASSAU	NY	600	2	Carter: Putr.	Putrescible MSW	
CINELLI CARTING	QUEENS	NY	3,933	13	Carter: Putr.	Putrescible MSW	
HILLSIDE CARTING CO INC	QUEENS	NY	1,277	4	Carter: Putr.	Putrescible MSW	
UNITED SANITATION INC	QUEENS	NY	3,996	13	Carter: Putr.	Putrescible MSW	
UNITED SANITATION INC	QUEENS	NY	291	1	Carter: Putr.	Putrescible MSW	
STAR RUBBISH REMOVAL	STATEN ISLAND	NY	5,200	17	Carter: Putr.	Putrescible MSW	
DYNAMIC RUBBISH REMOVAL	SUFFOLK	NY	568	2	Carter: Putr.	Putrescible MSW	
DYNAMIC RUBBISH REMOVAL	SUFFOLK	NY	1,878	6	Carter: Putr.	Putrescible MSW	
DYNAMIC RUBBISH REMOVAL	SUFFOLK	NY	99	0	Carter: Putr.	Putrescible MSW	
PARK RUBBISH REMOVAL	SUFFOLK	NY	1,265	4	Carter: Putr.	Putrescible MSW	
PARK RUBBISH REMOVAL	SUFFOLK	NY	2,162	7	Carter: Putr.	Putrescible MSW	
TIA OF NEW YORK	SUFFOLK	NY	1,800	6	Carter: Putr.	Putrescible MSW	
Putresible Retained			43,457	139			
TOTAL EXCESS			179,732	576			

(1) Data extracted from 2000 Survey Forms

APPENDIX A

FACILITIES ESTIMATE OF PUTRESCIBLE WASTE GENERATION YEAR 2002

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1.0 INTRODUCTION

Three different methodologies were used to quantify the putrescible[1] portion of commercial waste generated in New York City (City), inclusive of the total amounts disposed and recycled. One method, reported here and called the **Facilities Estimate,** determined the number of tons processed or received for disposal at Transfer Stations located within the City or directly hauled in collection vehicles to transfer stations, landfills, waste-to-energy (WTE) facilities or materials recycling facilities (MRFs) outside the City.

This estimate will be compared to the other methodologies: (1) the **Employment Estimate**, obtained by multiplying employee waste generation rates by the number of individuals employed within the City; and (2) the Business Integrity Commission-City Department of Sanitation (**BIC-DSNY) Estimate**, which surveyed City private carters in order to estimate the quantities of putrescible waste and recyclables collected from commercial establishments in the City. The data reported in the Facilities Estimate is for calendar year 2002.

These efforts build upon and refine the Comprehensive Commercial Waste Management Study, Preliminary Report (Preliminary Report). The Preliminary Report, released by the City Department of Sanitation (DSNY) in 2002, provides data on commercial waste generated by businesses in the City in 2000. It relied on DSNY's Quarterly Transfer Station Report system (Quarterly Reports) and interviews with carters operating in the City as primary data sources. It did not attempt to determine the total quantity of recyclables generated by City business establishments, nor did it obtain extensive information about disposal of wastes via direct haul in collection vehicles to out-of-City disposal facilities.

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[1] The term "putrescible solid waste" shall mean solid waste containing organic matter having the tendency to decompose with the formation of malodorous by-products. (Administrative Code of New York City, Title 16, Chapter 1, Section 130).

The Facilities Estimate also relies upon DSNY's Quarterly Reports for data on waste tipped at in-City Transfer Stations in 2002. The Quarterly Reports are complemented with additional data on direct out-of-City disposal of the City's commercial waste and recyclables and on recyclable processing within City boundaries. The Facilities Estimate was developed by contacting major in-City recycling facilities and waste transfer, disposal and processing facilities located outside of the City to determine if they were receiving commercial waste from the City.

2.0 METHODOLOGY

2.1 Travel Times to Out-of-City Facilities

The initial step in developing the Facilities Estimate was to identify a list of potential out-of-City sites that may be handling or processing commercial waste that is hauled directly from the City. Similarly, a list of facilities handling recyclables both within and outside the City had to be created.

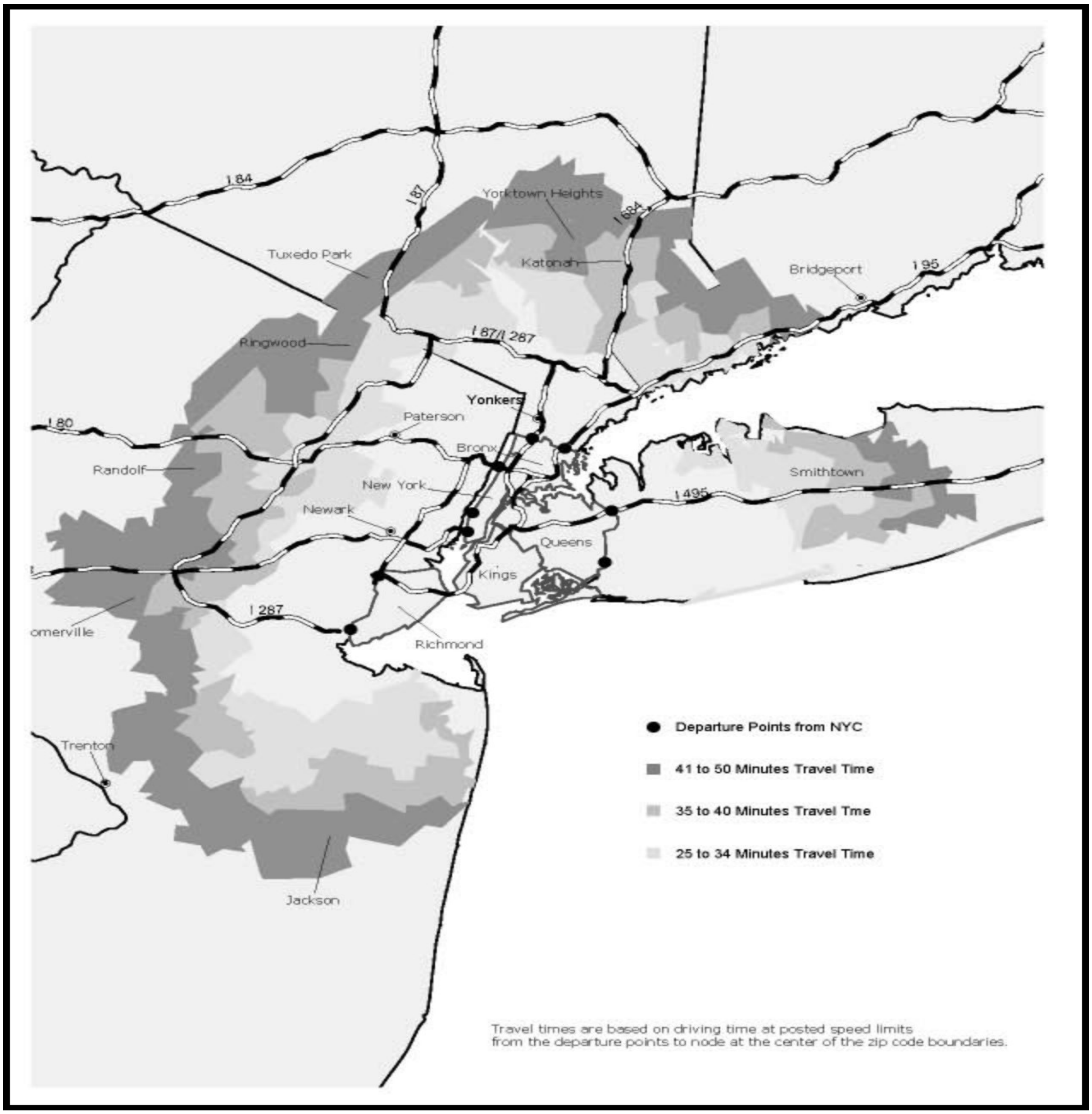
The economics of carting waste and recyclables picked up by collection vehicles directly to out-of-City facilities limits deliveries to facilities located nearby, in surrounding counties and states. Thus, the first step was to create a map with vehicle travel times and mileages radiating out from the City. Localities within a 50-minute travel time were included and those facilities located within this travel time boundary were contacted. In addition, if state documents or interviews with haulers indicated that City commercial waste was hauled directly beyond the 50-minute travel threshold, those destinations were contacted.

Figure 2.1-1 is a map depicting communities that are within several travel-time isopleths out to the 50-minute travel time limit. In New York State, facilities in Nassau, Suffolk and Westchester Counties are within this limit and were contacted. In New Jersey, sites in Bergen, Essex, Hudson, Middlesex, Passaic and Union Counties were queried, and in Connecticut, those in Fairfield County were contacted.

2.2 New York State Solid Waste and Recycling Facilities –Outside New York City

Lists of licensed transfer stations and WTE facilities outside the City were obtained from state agencies, including the New York State Legislative Commission on Solid Waste Management and the New York State Department of Environmental Conservation (NYSDEC). In addition, a partial list of construction and demolition (C&D) recyclers and recycling facilities was developed for NYSDEC Regions 1 and 3 from the same data source.

Figure 2.1-1
Travel Times from New York City Borders Map



Attempts were made to obtain information from state permitting agencies about the origins of waste coming into various facilities. However, these were unsuccessful because the state of New York was unwilling to release this information by facility, and an attempt to obtain the data by filing a Freedom of Information Act request failed. The state declared that it was unable to produce a report with the requested specificity.

2.3 New York City Recycling Processing Facilities

Several data sources were used to develop a list of facilities located within the City. The surveys collected for the Preliminary Report were reviewed to obtain data on which carters had indicated they collected recyclables.

The Preliminary Report also included some data on recovery of recyclables at Transfer Stations regulated by DSNY. Major commercial waste haulers, such as Waste Management, Sprint Recycling, and Action Carting were contacted to determine where they took the recyclables that they collected. And, the Yellow Pages listings for each borough were searched under the category of "Recycling Centers" to identify a list of facilities that were processing commercial recyclables in 2002.

2.4 Connecticut Solid Waste and Recycling Facilities

The Connecticut Department of Environmental Protection (CDEP) provided a list of Connecticut facilities that might be receiving waste directly hauled from the City. Follow-up discussions with the CDEP and with private haulers handling the City's commercial waste determined that it was highly unlikely that in 2002 carters were hauling waste directly to most Connecticut facilities, due to the travel time involved. Thus, only the Connecticut facilities in Fairfield County were contacted.

2.5 New Jersey Solid Waste and Recycling Facilities

The New Jersey Department of Environmental Protection (NJDEP) compiles a list of solid waste facilities by type of waste received and city and county location, and also tracks the origin of incoming waste. The annual reports submitted to the NJDEP by licensed waste processing facilities were reviewed to identify facilities that received waste from New York State in 2002, and each of these facilities was called to determine if the City was the source of this waste.

In addition, data on the amount of DSNY-managed Waste sent to New Jersey facilities was obtained from DSNY and cross-checked against the NJDEP data. Total waste received from the City minus the DSNY-managed residential waste was computed as the quantity of commercial waste originating in the City.

The State of New Jersey also compiles lists of MRFs, by county. However, these facilities are not required to record the state of origin of materials received. Thus, data on recycling facilities were obtained through telephone interviews.

In addition, the Yellow Pages of selected cities, including Jersey City, Newark, Clifton and Paterson were searched for recycling facilities; potential sites were added to the list. The carter data collected as part of the Preliminary Report were also reviewed to obtain the names of possible out-of-City facilities that received commercial recyclables for processing.

2.6 Survey Administration

The first step in administering the survey was to define the list of facilities to be contacted. The list included all the facilities receiving putrescible wastes in New Jersey, New York State, and Fairfield County, Connecticut.

In addition, all recycling facilities likely to be utilized by companies collecting recyclables in the City were compiled into the recycling list. These facilities were classified into categories of processors or end users. As paper in particular is often transported long distances for sale and processing, one member of the DSNY Consultant team surveyed the fiber mills in the region.

After identification and categorization, each facility was surveyed by telephone. The facilities were assured that the data would be reported only in the aggregate, and that the levels of activity of individual facilities would not be revealed. The survey instrument is Attachment 1 to this Appendix, and the list of facilities that were contacted is included in Attachment 2.

The total number of solid waste facilities by state, county and type that were contacted is shown in Table 2.6-1. A similar distribution for recycling facilities is shown in Table 2.6-2. Thirty-one (31) facilities handling municipal solid waste (MSW) were contacted, of which 24 are located in New Jersey, two are located in New York State outside of the City, and five are in Pennsylvania. One-hundred-and-twenty (120) recycling facilities were contacted, of which 54 are located in New Jersey, 10 are located in New York State outside of the City, 45 are located within the City, and 11 are located in other states.

The focus of the survey was to determine the tonnage of putrescible waste originating in the City for each facility. Recyclables are categorized into fiber (including old corrugated cardboard [OCC], old newsprint [ONP], mixed office paper [MOP], and other paper); plastics; metal; wood; glass and other. All data were converted into annual tons.

Table 2.6-1
Solid Waste Facilities Contacted by County and Type

State	County	Number	Type of Facility		
			Transfer Stations	WTE Facilities	Landfill
New Jersey	Bergen	7	7	0	0
	Camden	1	0	1	0
	Essex	4	3	1	0
	Hudson	1	1	0	0
	Passaic	4	4	0	0
	Somerset	1	1	0	0
	Union	5	4	1	0
	Warren	1	0	1	0
	Subtotal	**24**	**20**	**4**	**0**
New York	Nassau	1	0	1	0
	Suffolk	1	0	1	0
	Subtotal	**2**	**0**	**2**	**0**
Pennsylvania	Bucks	2	0	0	2
	Delaware	1	0	1	0
	Montgomery	1	0	0	1
	York	1	0	0	1
	Subtotal	**5**	**0**	**1**	**4**
Grand Total		**31**	**20**	**7**	**4**

Table 2.6-2
Recycling Facilities Contacted by County and Type

State	County	Number
New Jersey	Atlantic	1
	Bergen	12
	Essex	18
	Hudson	15
	Middlesex	1
	Monmouth	1
	Passaic	5
	Union	1
	Subtotal	**54**
New York (out-of-City)	Albany	3
	Nassau	1
	Oswego	1
	Saratoga	1
	Schenectady	1
	Suffolk	1
	Washington	1
	Westchester	1
	Subtotal	**10**
New York City	Bronx	8
	Brooklyn (Kings)	19
	Manhattan (New York)	7
	Queens	10
	Staten Island (Richmond)	1
	Subtotal	**45**
Other States	Massachusetts	4
	Missouri	1
	Pennsylvania	5
	South Carolina	1
	Subtotal	**11**
Grand Total		**120**

3.0 ANALYSIS

3.1 Commercial Solid Waste Hauled to Facilities Outside New York City

In 2002, a total of 266,642 tons of the commercial waste generated in the City were hauled directly out of the City for disposal. Table 3.1-1 shows the destinations of commercial waste carted from the City in waste collection vehicles by tons, and, where known, borough of origin.

Table 3.1-1
Commercial Waste Carted Directly Out of City

State	Total Facilities Contacted	Number of Facilities Taking New York City Commercial Waste	Tons of Commercial Waste	Borough of Origin
New Jersey	24	10	264,242	Manhattan/Staten Island
New York (non-City)	2	1	1,200	Brooklyn/Queens
Pennsylvania	5	1	1,200	NA
Total	**31**	**12**	**266,642**	

Notes:
NA = Not Available

3.2 Commercial Solid Waste Tipped at Facilities within the City and Carted to Out-of-City Facilities

The major portion of commercial putrescible waste generated within the City is tipped at in-City Transfer Stations and then transferred by truck or rail to disposal facilities throughout the region. DSNY receives Quarterly Reports from operators of in-City Transfer Stations of the waste processed at these facilities. Table 3.2-1 shows the amount of commercial putrescible waste handled by these Transfer Stations in 2000, 2001 and 2002.

Table 3.2-1
Commercial Putrescible Waste Disposed
(tons)

Time Period	2000	2001	2002
First Quarter(1)	570,102	564,876	493,818
Second Quarter(1)	678,366	558,402	528,762
Third Quarter(1)	701,610	573,690	492,570
Fourth Quarter(1)	600,522	553,800	491,166
Out-of-City Facilities(2)	205,296	235,969	266,642
Annual Totals	**2,755,896**	**2,486,737**	**2,272,958**

Notes:
(1) Quarterly data are from the DSNY Bureau of Planning & Budget Quarterly Recap column entitled "Total NYC Commercial Waste Stream" for Putrescible Transfer Stations.
(2) Out-of-City facilities data for 2000 is from the Preliminary Report, Table 2. For 2002, it is from the Facilities Estimate described herein (see Table 3.3.4-1). The out-of-City data for 2001 is estimated as the average of the 2000 and 2002 figures.

The data in Table 3.2-1 show annual tons delivered to Transfer Stations within the City plus estimated waste carted in collection vehicles directly to out-of-City disposal facilities. No recyclables are included in these totals.

The source for the in-City tons transferred is DSNY's Quarterly Reporting system, which reports data in tons per day (tpd). The tpd data have been converted to annual tons by assuming that Transfer Stations operate 6 days per week, 52 weeks per year, or 78 days per quarter.

The year 2000 estimate of annual tons carted to out-of-City facilities is taken from the Preliminary Report. Year 2002 is the Facilities Estimate in which 31 out-of-City facilities were surveyed, as discussed above. The 2001 quantity is estimated as the average of the quantities for 2000 and 2002.

Table 3.2-1 shows that the disposed commercial putrescible waste has decreased by over 480,000 tons between 2000 and 2002. The magnitude of the decrease in the commercial waste stream – a 17.5% drop – is not fully explainable. Between 2000 and 2002, there undoubtedly has been some reduction in commercial waste generation, attributable to the loss of jobs in that interval -- in part as a result of 9/11 and in part from the ongoing recession. Nevertheless, as there is not complete data on commercial recycling for either the year 2000 or the year 2001, it is impossible to reject the possibility that some of the decrease in commercial waste is attributable to an increase in recycling. What is certain is that the commercial waste disposed tonnage has decreased dramatically in this three-year period.

3.3 Commercial Recyclable Processing

3.3.1 Structure of Paper Recycling Industry

Because of the size of office sector employment in the City, paper comprises the major commodity recycled by commercial establishments in the City. In addition, most of the paper that is recovered is obtained from commercial sources. The principal grades are OCC and MOP, with some industrial scrap from printers and other businesses that convert paper into products.

The flow of paper takes one of two paths. One path involves private carters picking up paper at office buildings or other generators, then delivering these recyclables to a processing center or a recycling center where the material is sorted and baled. A second path involves paper dealers who have customers (generators) that contract separately for this service. The paper dealers' trucks (owned or hired) deliver the material to a packing plant where the paper is processed and baled. OCC is a predominant part of the business. Both the City and north New Jersey dealers receive paper in this way. In a survey of Manhattan and Brooklyn property managers, most large buildings were found to contract with the same firm for garbage collection and collection of recyclables; they typically receive a single monthly bill for both services.

There are independent brokers and dealer/brokers that buy paper for shipment to paper mills and/or exporters. There are also relationships between carters and dealers, dealers and paper mills, and independent dealers and recycling centers.

3.3.2 Commercial Recycling in the City

City regulations[2] require commercial establishments to recycle. Office buildings and institutions often separate fiber from their wet waste. Usually, a single hauler picks up both waste streams. In some cases additional materials, such as metals and containers, are separated by the hauler. In order to determine both the amount and location of commercial recyclable processing, facilities were contacted in the City, New York State, New Jersey and several other states. Table 3.3.2-1 provides estimates of the tonnages of commercial recyclables processed by the various facilities, broken down by type of material.

Table 3.3.2-1
Estimates of Commercial Recyclables

State	Number of Facilities		Tonnages Processed 2002 Annual Numbers						
	Called	Accepts Recyclables	OCC	MOP	ONP	Other Paper	Total Paper	Other(1)	Total
New Jersey	54	8	21,975	67,990	0	26,736	116,700	15,453	132,154
New York City	45	18	393,838	347,178	25,509	108,080	874,605	15,960	890,565
New York State	10	0	0	0	0	0	0	0	0
Other States	11	0	0	0	0	0	0	0	0
Total	**120**	**26**	**415,813**	**415,168**	**25,509**	**134,816**	**991,306**	**31,413**	**1,022,719**

Note:
(1) Other = 28,000 tons of glass deposit containers, 2,453 tons of mixed containers, and 960 tons of shrink-wrap.

Table 3.3.2-1 shows that most recycling by commercial establishments in the City is paper. This is expected, as large office buildings may recycle 70% of their waste stream. Typically, the papers are mixed, with only putrescible disposed separately. The mixed papers are collected at

[2] Local Law 87, 1992; Administrative Code Title 16, 16-306(a),(b).

night and taken to Transfer Stations or MRFs in the metropolitan area. Of the 26 facilities contacted who process recyclables from the City, about half indicated that they shipped the paper abroad, usually to Asia, for sorting into as many as 18 grades of paper.

3.3.3 Trends in Commercial Recycling

Because of the lack of complete commercial recycling data for the year 2000, it is not possible to determine definitively whether recycling has increased from 2000 to 2002 as disposed commercial waste has declined, or whether the opposite has occurred. However, it is possible, based on some strong anecdotal and statistical evidence (see Table 3.3.3-1), to argue that recovery of paper from the City and aggregate commercial recycling declined significantly in 2002 from 2000.

The survey of paper dealers and brokers revealed a consistent theme – that after 9/11, recovery of paper for recycling dropped dramatically. This decline continued into 2002. Table 3.3.3-1 is a summary of exports by major paper grade category for the years 1997 through 2002. Exports of recovered paper and paperboard (cardboard, not corrugated – like cereal boxes) from the Port of New York and New Jersey, a major export port, are one of the key indicators of paper recovered through recycling in the City. An analysis, included in Table 3.3.3-1, was made of these exports of paper and paperboard.

The data in Table 3.3.3-1 indicate the following:

1. Exports of paper from the Port of New York and New Jersey declined from a peak of 3 million tons in 2000 to about 2 million tons in 2001 and 2002. This decline strongly suggests (but does not prove) that there was a large decline in recyclables recovery in the City, especially Manhattan.
2. Total paper exports from the United States were comparable in 2001 to the increased tonnages reported in 2000; in 2002 they reported a considerable gain over 2001. This occurred while exports from New York/New Jersey dropped. The New York/New Jersey exports dropped from 28.9% of total exports in 2000 to 17.6% of total exports in 2002.

Table 3.3.3-1
Exports(1) of Recovered Paper Stock, 1997 through 2002

Year	OCC	Mixed(3)	News, Other Groundwood	High-Grade De-inking	Pulp Substitutes	Total(2) Port of New York	Total USA	New York % of Total
1997	770	455	735	100	138	2,198	7,505	29.3
1998	812	637	1,051	113	142	2,756	8,100	34.0
1999	757	697	1,019	172	51	2,696	8,286	32.5
2000	893	761	1,032	313	57	3,055	10,560	28.9
2001	811	525	335	262	31	1,964	10,533	18.6
2002	909	627	332	90	47	2,004	11,404	17.6

Notes:
(1) In thousands of tons.
(2) From the Port of New York and New Jersey.
(3) Includes mail.
Subtotals may not add to total due to rounding.
Source: American Forest & Paper Association, based on Export Statistics of the U.S. Department of Commerce.

3. The recyclables showing the greatest decline were newspapers and other groundwood papers, and de-inking grades. At the same time, the quantities of OCC remained steady, while mixed paper declined by about 230,000 tons in 2001 and 135,000 tons in 2002 compared to 2000.
4. The overall conclusion is that a high percentage of the decline in recovered paper exports is related to the decline in recycling City commercial waste.

3.3.4 Commercial Recycling Rates in New York City

The information on recycling and waste disposed provides a basis for computing the commercial sector recycling rate – from materials generated and normally included in the definition of MSW.

In 2002, facilities other than DSNY-licensed Transfer Stations processed 1,022,719 tons of recyclables. In 2002 the total waste disposed was 2,272,958 tons. Thus, the commercial sector generated 3,295,677 tons of waste disposed and recycled; the recycling rate was 31%. Table 3.3.4-1 displays these summary statistics.

Table 3.3.4-1
Summary of New York City Commercial Putrescible Waste Disposed and Recycled, 2000-2002

Item	2000	2001	2002
Waste Disposed (tons)			
First Tipped in City	2,550,600	2,250,768	2,006,316
Direct Hauled out of City	205,296	235,969	266,642
Total	2,755,896	2,486,737	2,272,958
Waste Recycled (tons)			
First Tipped in City	NA	NA	890,565
Direct Hauled out of City	NA	NA	132,154
Total	NA	NA	1,022,719
Grand Total (tons)	NA	NA	**3,295,677**
Recycling Rate	**NA**	**NA**	**31%**

ATTACHMENT 1

FACILITIES SURVEY

FACILITY QUESTIONAIRE FOR FACILITIES RECEIVING NYC COMMERCIAL/C&D WASTE

New York City Department of Sanitation Commercial Waste Study

Interviewer ______________________

1. Name of Facility: ______________________

Date of Interview ______________________

2. Type of Facility ________

1=Transfer Station
2=Materials Recovery Facility
3=Landfill
4=C&D Disposal Facility
5=Materials Broker
6=Material End User
7=Other, Please explain ______________________

3. Facility Address: Street ______________________

City, State, Zip ______________________

4. Contact Person

	Contact Person	Owner
Name		
Title		
Phone		
Fax		
Email		

5. Total Tonnage Throughput: -- direct hauled from New York City. Not including material from DOS.
(in 2002)

TYPE OF MATERIAL	Tons			Weighed	If weighed, what
	Total in 2002	From NYC	Borough of NYC	1=yes 2=no	is the density factor Lbs/cubic yd.
Putrescible MSW					
Yard Debris					
Recyclables(Total, if not broken down)					
Metal					
Tin Cans					
Other Ferrous Metal Scrap					
Aluminum Cans					
Aluminum Foil					
Other Non-Ferrous Scrap					
Other Metals					
Plastic					
Glass					
Fiber					
ONP					
OCC					
OMG					
Mixed Office Paper					
Mixed Paper					
Other					
C&D					
Wood					
Fill					
Bricks/Concrete					
% Residential Construction					
% Commercial Construction					
% Residential Demolition					
% Commercial Demolition					
% Residential Renovation					
% Commercial Renovation					
Other Material (Specify)					
TOTAL TONS					

ATTACHMENT 2

LIST OF FACILITIES SURVEYED

List of Facilities Surveyed

Name	Address	City	State	Zip
American Tissue Mills of Massachusetts, Inc.		Baldwinville	MA	
FiberMark, Inc.		Fitchburg	MA	
Newark Atlantic Paperboard Corp.			MA	
Perkit Folding Box Corp.			MA	
Smurfit Stone Recycling Co.		St. Louis	MO	
Marcal Paper Mills			NJ	
Atlantic Coast Paper Company (7)		Clifton	NJ	
County Wide Recycling		Hillsdale	NJ	
G&T Trading International Corp.		Clifton	NJ	
Global Fibres Inc.		Fort Lee	NJ	
Lobosco Recycling		Clifton	NJ	
M. Politinsky & Sons Inc.		Clifton	NJ	
Recycled Paperboard of Clifton		Clifton	NJ	
S Morena & Sons Inc.		Lodi	NJ	
Zozzaro Brothers	175 Circle Avenue	Clifton	NJ	07011
Garafolo Recycling and Transfer	19-33 Atlantic Street	Garfield	NJ	07026
All American			NJ	
Jem Sanitation	P.O. Box 708	Lyndhurst	NJ	07071
Advanced Enterprises Recycling	540 Doremus Street	Newark	NJ	07105
Allied Paper		Newark	NJ	
Garden State Paper Co., Inc.			NJ	
Giordano Paper Recycling	145 Manchester Place	Newark	NJ	07104
J Lobosco & Sons	964 McBride Avenue	Little Falls	NJ	
James DeMarco & Sons Inc		Newark	NJ	
KTI Recycling/Recycle America	150 Charles Street	Newark	NJ	07105
Newark Boxboard			NJ	
Patsy Ragonese & Sons Inc.		Newark	NJ	
Prins Recycling Corp.		Newark	NJ	
Recycled Fibers (Newark Group Inc)		Newark	NJ	
Recycled Fibers-- Eastern Region	60 Lockwood Street	Newark	NJ	07105

Name	Address	City	State	Zip
Recycling & Salvage Co.	170 Frelinghuysen Avenue	Newark	NJ	07114
Recycling Systems, Inc.		Newark	NJ	
Shamrock Fibres, Inc.		Upper Montclair	NJ	
T. Fiore Recycling Co.	411 Wilson Avenue	Newark	NJ	07105
Tristate Recycling Center, Inc.		Fairfield	NJ	
CRG Recycle America	104 East Peddie Street	Newark	NJ	07114
Arrow Recycling		Jersey City	NJ	07302
Atlas Paper Stock Co.		Jersey City	NJ	
Falesto Bros.		Jersey City	NJ	
Galaxy Recycling	326 New York Avenue	Jersey City	NJ	07307-1402
Interboro Disposal & Recycling		Hoboken	NJ	
Recycling Specialists, Inc (5)	375 Rte 1&99	Jersey City	NJ	07302
Recycling Ventures, Inc.	35 US Highway #1	Jersey City	NJ	07302
Reliable Paper Recycling	200 Pacific Avenue	Jersey City	NJ	07304
Rock-Tenn Co.			NJ	
Tri-State Recycling Services	111 Woodward Street	Jersey City	NJ	07304
United Recycling	55 16th Street	Hoboken	NJ	07030
Krueger Recycling			NJ	
Galaxy Recycling	325 New York Avenue	Jersey City	NJ	07307-1401
Cardella Trucking		N. Bergen Tshp	NJ	
M&M (2)	2 Fish House	Hudson	NJ	
Recycling Industries, Inc.		South Plainfield	NJ	
KC International Ltd.		Lakewood	NJ	08701-5600
Annex Paper Stock Inc. (Damato)		Paterson	NJ	
John Rocco Scrap Material Inc.		Elizabeth	NJ	
Paper Board Specialties Inc.		Paterson	NJ	
United Scrap Iron & Metal	157 East 7th Street	Paterson	NJ	07524
Zager Brothers	69 Getty Avenue	Paterson	NJ	07503
A.J. Recycling		Linden	NJ	
American Tissue Mills of Greenwich, Inc.			NY	
Fort Orange Paper Co.			NY	
American Tissue Mills of New York, Inc.			NY	

Name	Address	City	State	Zip
Hunts Point Recycling Co.	315 Casanova Street	Bronx	NY	10474 6707
Kids Waterfront Corp.	1264 Viele Avenue	Bronx	NY	
Louis Monteleone Fibres, Inc.		Bronx	NY	
Paper Services, Inc. (Benedetto)		Bronx	NY	
Pascap Co., Inc.		Bronx	NY	10475
Paper Fibers Corp.	960 Bronx River Avenue	Bronx	NY	
Triboro Fibers	770 Barry Street	Bronx	NY	10474
IESI	246-266 Canal Place	Bronx	NY	Jersey City NJ
Advance Paper Recycling	139 Plymouth Street	Brooklyn	NY	11201-8335
Alpine Paper Recycling	2 N. 5th Street	Brooklyn	NY	
American Recycle	236 12th Street	Brooklyn	NY	
Filberto Recycling, Inc.		Brooklyn	NY	
Joe's Waste Paper Corp.		Brooklyn	NY	
Point Recycling	120 Hausman Street	Brooklyn	NY	11222
Smith Recycling		Brooklyn	NY	
Tocci Bros., Inc.	P.O. Box 20500	Brooklyn	NY	11202-0500
Trans-American Paper Fibers Corp.		Brooklyn	NY	
Ursula Products, Inc.		Brooklyn	NY	11203
Waste Management		Brooklyn	NY	
Williamsburg Paper Stock Co.		Brooklyn	NY	
Parkside Recycle	236 N. 12th Street	Brooklyn	NY	11211-1101
Hi Tech Resource Recovery	130 Varick Street	Brooklyn	NY	
Rapid Recycling Paper Co	860 Humbolt Avenue	Brooklyn	NY	
A&R Lobosco		Brooklyn	NY	
Chambers Paper	139 Plymouth Street	Brooklyn	NY	11201
Metropolitan Paper	Spring Creek Shepherd Avenue	Brooklyn	NY	
Recycle America (3)	2 N Fiske Street	Brooklyn	NY	
Omni Recycling Westbury	7 Portland Avenue	Westbury	NY	11590
Durango-Georgia Paper Co.		New York	NY	
Equipment & Parts Export Inc.	745 5th Avenue, Ste. 1114	New York	NY	10151
Korexpo Corporation		New York	NY	10279
M.G. Chemical Co., Inc.		New York	NY	10274

Name	Address	City	State	Zip
Robbins Fleisig FWDG., Inc.		New York	NY	10007
Veterans Paper Stock & Mill Supply Co. Inc.		New York	NY	
Sprint Recycling	605 W. 48th Street	New York	NY	
Internation Paper Co.		Oswego	NY	
Apple Fibers	18056 Liberty Avenue	Jamaica	NY	11433-1435
Asia Business Recycling	13511 Roosevelt Avenue	Flushing	NY	11354-5305
Cross County Recycling Corporation	122-52 Montauk Street	St. Albans	NY	11413
R. Palmiere Co.		South Ozone Park	NY	
Boro Wide Recycling	3 Railroad Place	Maspeth	NY	11378
Giove	108-20 180th Street	Jamaica	NY	
EWG Glass Recycling	145-11 Liberty Avenue	Jamaica	NY	11435
Babylon Paper	South Road	Jamaica	NY	
Royal Recycling (4)			NY	
A&R Lobosco	3133 Farrington Street	Flushing	NY	11354
Visy Paper		Staten Island	NY	
International Paper Co.		Corinth	NY	
Sonoco Products Co.		Amsterdam	NY	
Omni Recycling of Babylon	114 Alder Street	West Babylon	NY	11704
Irving Tissue, Inc.		Fort Edward	NY	
Karta Container		Peekskill	NY	
Interstate Intercorr		Reading	PA	
Rock-Tenn Co.		Downingtown	PA	
Smurfit-Stone Container Corp.		York	PA	
Tarkett Inc.			PA	
Woodstream Corp.			PA	
Harmon Associates/Georgia Pacific			SC	

APPENDIX B

EMPLOYMENT-BASED ESTIMATE OF PUTRESCIBLE WASTE GENERATION YEAR 2002

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ATTACHMENTS

LIST OF TABLES

1.0 EMPLOYMENT-BASED MODEL

1.1 Introduction

There are a number of different means of estimating solid waste quantities within the commercial sector, depending on the specific reference utilized. Some studies reviewed for this analysis estimated annual waste generation based upon pounds per dollar sales or production, pounds per square feet of facility space, or pounds per employee. While the utilization of each method has its own advantages and disadvantages, in this Commercial Waste Management Study (Study), due to the existence of complete and readily available data sets from government sources, employment was used to determine waste generation and to project future quantities. Additionally, employment projections were available allowing for forecasting waste generation over a 20-year planning period.

The methodology used to estimate putrescible waste generation by New York City's (City) commercial sector based on employment is straightforward. Factors were developed for the generation of commercial wastes in tons per employee per year, by federal Standard Industrial Classification (SIC) and by material type (for example, old corrugated cardboard [OCC]). These factors were multiplied by the number of employees in the City within any given sector (e.g., food service, finance, health care) to obtain generation of commercial waste. A number of separate calculations and data sources were required to complete the model, as described below.

1.2 Development of Waste Generation Factors

A survey of literature on the subject identified a wide variety of data and reports related to urban commercial waste generation factors, usually in pounds per employee per day or tons per employee per year. Sources included the City Department of Sanitation (DSNY) Consultant's in-house documents (e.g., sampling studies), magazine articles and on-line data such as that on the California Integrated Waste Management Board web site. Sources of relevant sampling studies were contacted by phone to obtain copies of the study reports. The most desirable sources had both the results of sampling studies in tons correlated with data on employment in the sampled business or industry. In some instances it was possible to obtain employment data from a source, e.g., the federal document *County Business Patterns* (available on-line from the U.S. Census Bureau), to match published sampling data on commercial generators.

The data obtained were entered into a spreadsheet by business category, e.g., "Hotels." Sources and units (e.g., pounds or tons per employee per year) were entered into the spreadsheets. If the data source identified the relevant SIC, that was also entered.

The next step was to create a matrix spreadsheet that listed sampling data by business type vertically and material types horizontally. Data for each type of business, e.g., "Offices," were grouped together. Since the sampling studies varied in the amount of detail for different types of materials, materials were also grouped as appropriate. For example, a variety of papers were grouped together into an "Office Papers" category.

Some sampling studies reported results by materials disposed, not generated, i.e., recycled materials were not accounted for. These disposal data, by material, were converted to generation-factor data by DSNY's Consultant, using a previous report on recycling of paper in commercial sites. A Franklin Associates report characterizing national municipal solid waste generation and recycling for the United States Environmental Protection Agency (USEPA) was also used to derive reasonable recycling rates.

Disposal data were added to recycling data to obtain generation data. Construction and demolition (C&D) debris generation data were removed from the database because the City's C&D debris generation is estimated using a different methodology that is reported separately.

Because waste generated by commercial landscaping is substantially lower in the City compared to data collected on other cities, this factor was adjusted in the database by assuming that the City's commercial landscape waste represents a minimal 1% of waste composition. This was added to each employment category. The final data for generation per employee were then created by averaging commercial generation, by material, for each category, such as "Offices" and "Retail."

1.3 Development of Employment Data

Employment data were developed using data from New York Metropolitan Transportation Council (NYMTC). The data were compiled by borough and by community district (CD).

NYMTC prepared employment for the City through the year 2025 early in 2001, basing their projections on the most current employment data available at that time. These projections were revised by NYMTC over the course of 2002 and 2003 to account for the effects of the September 11, 2001 disaster. An interim update of the projections was published by NYMTC in a supplement to "Demographic and Socioeconomic Forecasting Post September 11 Impacts, Technical Memoranda 3.1 and 3.2," which reported the direct effects of September 11 -- both direct job loss in the City and geographic redistribution of employment within the City. These interim projections have been utilized as the fundamental employment projection data on which the DSNY waste estimation model relies.

Additional modifications to the interim projections, however, have been undertaken to reflect current (2002) conditions at the CD level. First, the projections, which were available at the census tract level, have been translated into CDs according to City Department of City Planning (NYCDCP) guidance. Second, the job loss resulting from the effects of economic recession in the City, which was not reflected in the NYMTC interim projections, has also been incorporated into the projections on which DSNY efforts rely. City employment statistics, at the borough level, for 2002 are shown in Table 1.3-1. Attachment 1 to this Appendix provides a detailed discussion of the derivation of the employment estimates used in this report.

1.4 Development of Final Model and Results

The generation per employee data were combined into categories to match the City's labor categories. City commercial waste generation by material categories was estimated by multiplying generation factors by employment. The "Education" and "Local Government" categories of employment were excluded because this waste is primarily collected by DSNY.

Table 1.3-1
Annual Employment in New York City by Borough and by Employment Category, 2002
(Number of Employees)

Employment Category	Bronx	Brooklyn	Manhattan	Queens	Staten Island	Total Employees
Construction	10,508	23,043	32,976	44,442	7,021	117,990
Finance & Insurance	3,291	15,014	302,617	13,459	2,536	336,917
Real Estate Rental & Leasing	10,838	14,444	75,962	15,573	1,573	118,390
Manufacturing	9,948	36,267	53,423	41,115	1,357	142,110
Wholesale Trade	10,313	22,774	87,617	24,882	1,463	147,049
Retail Trade	24,643	57,234	136,564	53,016	15,974	287,431
Transportation & Warehousing	4,817	14,369	26,894	56,716	4,550	107,346
Utilities	1,723	4,475	6,197	2,471	653	15,519
Information	4,395	8,014	143,400	10,391	2,616	168,816
Professional, Technical & Scientific	3,272	12,069	259,690	10,994	3,701	289,726
Management of Companies	962	1,207	52,267	1,798	905	57,139
Administrative Support Services	8,568	18,702	141,321	25,045	3,798	197,434
Health Care & Social Assistance	73,025	135,965	204,429	92,813	26,370	532,602
Arts, Entertainment & Recreation	2,823	3,211	47,671	4,233	1,118	59,056
Accommodation & Food Services	10,629	18,465	144,621	29,842	6,117	209,674
Other Services(1)	8,120	21,241	87,204	21,779	3,586	141,930
Unclassified & Other	1,384	5,018	8,325	4,587	823	20,137
State & Federal Government(2)	14,257	20,565	81,952	20,283	5,163	142,220
Total	203,516	432,077	1,893,130	473,439	89,324	3,091,486

Notes:
(1) Except public administration.
(2) Except local government agencies.

The employment categories, generation factors, tons generated in the City, and each category's percentage of total commercial waste generation are shown in Table 1.4-1.

Results generated by the model for the City are shown in Table 1.4-2 by employment category and tons of commercial waste by material. The origin of waste by borough was estimated from data collected by the Business Integrity Commission (BIC) and DSNY in November of 2003.

Although the model used in this analysis predicted 2002 citywide generation of commercial waste at a level similar to the 2003 BIC-DSNY survey, it would appear that the model is not as good an indicator at the borough or CD level. The 2002 estimated citywide commercial waste generation by the employment-based model is approximately 6% percent higher than the BIC-DSNY 2003 survey.

Table 1.4-1
Employment Categories, Commercial Waste Generation Factors and Tons Generated, and Category Percent of Total Commercial Waste Generation

Employment Category	Generation Factor Tons/Employee/Year	New York City 2002 Tons Generated	% of Commercial Waste Generation
Construction	0.44	51,400	1.6%
Finance & Insurance	0.44	146,770	4.5%
Real Estate Rental & Leasing	0.44	51,570	1.6%
Manufacturing	1.40	199,410	6.2%
Wholesale Trade	1.20	172,160	5.3%
Retail Trade	2.50	724,410	22.4%
Transportation & Warehousing	0.74	79,520	2.5%
Utilities	0.56	8,640	0.3%
Information	0.65	109,650	3.4%
Professional, Technical & Scientific	0.65	188,190	5.8%
Management of Companies	0.65	37,110	1.1%
Administrative Support Services	0.65	128,240	4.0%
Health Care & Social Assistance	0.63	419,530	12.9%
Arts, Entertainment & Recreation	3.40	46,090	1.4%
Accommodation & Food Services	3.40	710,340	21.9%
Other Services(1)	0.65	92,190	2.9%
Unclassified & Other	0.65	13,080	0.4%
State & Federal Government(2)	0.44	61,950	1.9%
Total New York City(3)		**3,240,250**	**100%**

Notes:
(1) Except public administration.
(2) Except local government agencies.
(3) Numbers may not add due to rounding.

Table 1.4-2
Commercial Waste Generation in New York City by Employment Category and by Material, 2002
(In Tons)

Employment Category	Paper	Plastics	Glass	Metals	Yard Wastes	Food Wastes	Other	Total Tons
Construction	39,580	2,570	1,540	1,540	520	4,110	1,540	51,400
Finance & Insurance	113,010	7,340	4,400	4,410	1,470	11,740	4,400	146,770
Real Estate Rental & Leasing	39,710	2,580	1,540	1,540	520	4,130	1,550	51,570
Manufacturing	93,720	27,920	2,000	9,970	1,990	43,870	19,940	199,410
Wholesale Trade	80,920	13,770	3,440	6,890	1,720	51,650	13,770	172,160
Retail Trade	456,380	50,710	21,730	28,980	7,240	130,390	28,980	724,410
Transportation & Warehousing	47,710	11,130	1,590	7,950	800	5,570	4,770	79,520
Utilities	5,790	1,040	430	600	90	520	170	8,640
Information	71,270	9,870	3,290	5,480	1,100	8,770	9,870	109,650
Professional, Technical & Scientific	122,320	16,940	5,650	9,410	1,880	15,050	16,940	188,190
Management of Companies	24,120	3,340	1,110	1,860	370	2,970	3,340	37,110
Administrative Support Services	83,360	11,540	3,850	6,410	1,280	10,260	11,540	128,240
Health Care & Social Assistance	255,910	33,560	8,390	20,980	4,200	46,150	50,340	419,530
Arts, Entertainment & Recreation	16,130	3,230	3,690	2,300	460	15,210	5,070	46,090
Accommodation & Food Services	248,620	49,720	56,830	35,520	7,100	234,410	78,140	710,340
Other Services[(1)]	59,920	8,300	2,760	4,610	920	7,380	8,300	92,190
Unclassified & Other	8,500	1,180	390	650	130	1,050	1,180	13,080
State & Federal Government[(2)]	47,700	3,100	1,860	1,860	620	4,950	1,860	61,950
Total Material[(3)]	**1,814,670**	**257,840**	**124,490**	**150,960**	**32,410**	**598,180**	**261,700**	**3,240,250**

Notes:
(1) Except public administration.
(2) Except local government agencies.
(3) Numbers may not add due to rounding.

On a borough level the employment model would predict more waste originating from Manhattan than the 2003 survey would suggest. An inherent problem with employment-based models is the assumption that all employees within an industry classification generate the same amount of waste (on a per employee basis). In reality, per-employee waste generation rates for a specific category of business are a function of the size of the business; generally, per-employee generation decreases as the number of employees increase. For example, on a per-employee basis, a five-employee office is likely to generate more waste per employee than an office with 50 employees.

New York State Department of Labor (NYSDOL) statistics show that, on average, Manhattan has more employees per firm than any of the other boroughs. Manhattan's finance and insurance industry averages 43 employees per firm, while the other boroughs average 13 or fewer employees per firm. Management companies average 72 employees per firm in Manhattan and 32 or fewer in the other boroughs. Therefore, the model predicts a higher quantity of waste originating from Manhattan than the BIC-DSNY survey.

Another drawback to using the employment model at the borough level is the disparity of job functions within each industry classification. For example, the health care and social assistance employment category includes employees that work in a medical office as well as employees that work in a hospital. Waste generation, on a per-employee basis, is higher for hospital employees. Due to lack of detail in the government employment statistics, the same waste generation factor was used for all employees within this category. The result is that the quantity of waste generated from a borough with a high number of hospital employees will be understated and the opposite would be true for a borough with a high concentration of medical offices.

The total tons generated in the City, distributed to the borough level, are shown in Table 1.4-3. The origin of commercial waste by borough percentages shown in this table are from the BIC-DSNY survey. Additionally, this table shows the number of employees (from Table 1.3-1) and an average commercial waste generation per employee factor for each borough.

Both drawbacks to using the employment-based model at the borough level are magnified when applied to the CD level. Therefore, to estimate waste generation, it was decided to apply the average factors developed for each borough (Table 1.4-3) to employment statistics on the CD level. Generation data for each borough by CD are shown in Tables 1.4-4 through 1.4-8.

Table 1.4-3
Commercial Waste Generation in New York City by Borough, 2002

Borough	Origin of Commercial Waste by Borough[1] Percentage	2002 Commercial Waste Generation[2] Tons/Year	2002 Employees by Borough[3] Number of Employees	Average Commercial Waste per Employee Tons/Employee/Year
Bronx	12.9%	417,990	203,516	2.05
Brooklyn	19.4%	628,610	432,077	1.45
Manhattan	42.3%	1,370,630	1,893,130	0.72
Queens	20.2%	654,530	473,439	1.38
Staten Island	5.2%	168,490	89,324	1.89
Total New York City	**100%**	**3,240,250**	**3,091,486**	**1.05**

Notes:

(1) 2003 BIC-DSNY 2003 carter survey.

(2) Borough totals derived from applying Origin of Commercial Waste by Borough Percentage to total City generation of 3,240,250.

(3) Table 1.3-1.

Table 1.4-4
Bronx
Commercial Waste Generation by Community District, 2002

Community District	2002 Number of Employees	2002 Commercial Waste Generation [(1)(2)] Tons/Year
1	21,110	43,360
2	15,544	31,930
3	9,293	19,090
4	19,076	39,180
5	9,883	20,300
6	13,037	26,780
7	24,896	51,130
8	15,121	31,060
9	16,359	33,600
10	16,284	33,440
11	23,741	48,760
12	19,172	39,380
Total Borough	**203,516**	**417,990**

Notes:
(1) Number of employees in each community district times borough average commercial waste generation factor.
(2) Numbers may not add due to rounding.

Table 1.4-5
Brooklyn
Commercial Waste Generation by Community District, 2002

Community District	2002 Number of Employees	2002 Commercial Waste Generation[(1)(2)] Tons/Year
1	40,768	59,310
2	75,904	110,430
3	18,168	26,430
4	12,556	18,270
5	22,575	32,840
6	26,850	39,060
7	25,750	37,460
8	10,643	15,480
9	11,867	17,260
10	22,153	32,230
11	21,195	30,840
12	33,738	49,080
13	13,044	18,980
14	22,932	33,360
15	24,708	35,950
16	8,356	12,160
17	17,716	25,770
18	23,154	33,690
Total Borough	**432,077**	**628,610**

Notes:
(1) Number of employees in each community district times borough average commercial waste generation factor.
(2) Numbers may not add due to rounding.

Table 1.4-6
Manhattan
Commercial Waste Generation by Community District, 2002

Community District	2002 Number of Employees	2002 Commercial Waste Generation[1][2] Tons/Year
1	289,696	209,740
2	127,248	92,130
3	40,278	29,160
4	131,132	94,940
5	778,960	563,980
6	226,576	164,040
7	66,906	48,440
8	131,935	95,520
9	32,420	23,470
10	12,373	8,960
11	30,529	22,100
12	22,391	16,210
Central Park	2,686	1,940
Total Borough	**1,893,130**	**1,370,630**

Notes:
(1) Number of employees in each community district times borough average commercial waste generation factor.
(2) Numbers may not add due to rounding.

Table 1.4-7
Queens
Commercial Waste Generation by Community District, 2002

Community District	2002 Number of Employees	2002 Commercial Waste Generation[(1)(2)] Tons/Year
1	50,132	69,310
2	51,176	70,750
3	40,470	55,950
4	25,587	35,370
5	41,364	57,190
6	65,560	90,640
7	52,697	72,850
8	26,074	36,050
9	15,368	21,250
10	10,510	14,530
11	20,370	28,160
12	47,786	66,060
13	17,456	24,130
14	8,889	12,290
Total Borough	**473,439**	**654,530**

Notes:
(1) Number of employees in each community district times borough average commercial waste generation factor.
(2) Numbers may not add due to rounding.

Table 1.4-8
Staten Island
Commercial Waste Generation by Community District, 2002

Community District	2002 Number of Employees	2002 Commercial Waste Generation[(1)(2)] Tons/Year
1	48,122	90,770
2	27,682	52,220
3	13,521	25,500
Total Borough	**89,324**	**168,490**

Notes:

(1) Number of employees in each community district times borough average commercial waste generation factor.

(2) Numbers may not add due to rounding.

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ATTACHMENT 1

Methodology—"NYMTCBASEPROJ2024, JOBLOSS&REDISTR, CD&SECTOR, FINALFORMAT 9-29-03" (released 10-01-03)

Methodology—"NYMTCBASEPROJ2024, JOBLOSS&REDISTR, CD&SECTOR, FINALFORMAT 9-29-03" (released 10-01-03)

This memo describes the data collected for and the means of preparing the file "NYMTCBASEPROJ2024, JOBLOSS&REDISTR, CD&SECTOR, FINALFORMAT 9-29-03" (released 10-02-03 by e-mail distribution), which is a projection of industry-sector employment for each community district in New York City through the year 2025. Explanation of base employment projections and the need for and the means of adjusting these projections to make them suitable for DSNY waste quantification purposes follows.

As a fundamental component of the Commercial Waste Management Study (Study) undertaken by the New York City (City) Department of Sanitation (DSNY) per Local Law 74 (LL74), and as described in the "Commercial Waste Management Study Final Scope of Work" (July 31, 2003), DSNY must develop quantified commercial waste stream projections through the year 2024. To this end, an employment-based waste estimation model is being developed as part of the Study. Projections of employment, therefore, are necessary to estimate waste, and moreover, employment projections at the local level by industry sector are essential to calibrating the waste estimation model.

Early in 2001, the New York Metropolitan Transportation Council (NYMTC) prepared employment and population projections for the City through the year 2025, basing their projections on the most current employment and population data available at that time. The resultant NYMTC projections were prepared at county and census tract levels, extending to the year 2025. The categories of employment included total employment and total basic and total non-basic industries, as well as several "land use" categories (e.g., retail employment, office employment, etc.), which were pertinent to NYMTC tasks. While the population projections were in a suitable format for DSNY purposes, there was no industry sector breakdown of employment suitable for direct use in employment-based waste estimation. Moreover, these projections were being revised by NYMTC over the course of 2002 and 2003 to account for the effects of September 11.

The 2000 NYMTC projections of both population and employment were superceded in July 2003, when an interim update of the projections was published by NYMTC in a supplement to "Demographic and Socioeconomic Forecasting Post September 11 Impacts, Technical Memoranda 3.1 and 3.2," which reported the direct effects of September 11 -- both direct job loss in the City and geographic redistribution of employment within the City. These interim projections remained in the same format as the earlier projections (i.e., by counties and census tracts and using similar employment categories), but they accounted for the job loss and in-City geographic redistribution of employment directly attributable to September 11. Altogether new projections from base years more recent than 2000 are under preparation by NYMTC; however, at the time of this report, results were not available. Therefore, the interim projections have been utilized as the fundamental employment projection data on which the DSNY waste estimation model relies.

Additional modifications to these interim projections, however, have been undertaken by DSNY in order to reflect baseline (2002) conditions at the community district (CD) level and to distribute employment according to industry sectors. First, the projections, which were available at the census tract level, have been translated into CDs according to City Department of City Planning (NYCDCP) guidance. Second, the job loss resulting from the effects of economic recession in the City, which was not reflected in the NYMTC interim projections, has also been incorporated into the projections on which DSNY efforts rely. The methodologies employed by DSNY in making these adjustments to the NYMTC interim employment projections are outlined in greater detail below.

Description of NYMTC Interim Projections

The NYMTC interim projections of both population and total employment were modified by DSNY's Consultant for use in waste estimation modeling. These projections were prepared by NYMTC in five-year intervals from 2000 to 2025 (including a revised 2002 estimate), and a straight-line projection was assumed by the Consultant to derive projections for the year 2024 from the 2020 and 2025 projections. Both population and total employment projections at the census tract level were agglomerated into corresponding City CDs by the Consultant, using census tract-to-CD correspondence lists prepared by the NYCDCP.

The population projections were then suitable for use without requiring any further modification. However, the employment numbers required adjustment to address some limitations faced by the Consultant in utilizing the employment figures as they were prepared by NYMTC, which included the following:

- While citywide figures illustrating recession-related job loss were published, including the Comptroller's Report (PR03-70-071, July 17, 2003), this job loss was not recorded at the census tract level, which is necessary to revise the CD employment figures to be used in the waste estimation model.
- There were no industry-sector employment figures available from NYMTC (either as part of the interim projections or as part of other NYMTC data products) for geographic areas smaller than boroughs. Moreover, these borough-level sector breakdowns, while referring to several primary data sources, were published in 2001, using data from 2000; considering the employment changes assumed to have resulted since 2000, this sector distribution information was not desirable.

Methodology for Adjusting Interim Projections

The NYMTC projections, which have been developed by its various associated agencies, account for such factors as regional trends in the metro area. Moreover, they have been made readily available to DSNY and are in public use. The interim projections, which also account for in-City redistribution of jobs since September 11, are the only such projections to 2025 available at the census tract level, as is necessary to aggregate CD-level data and to generate employment projections for the Study target year, 2024. Therefore, in an effort to maximize the use of existing data, the Consultant adjusted these projections only as necessary and possible to better reflect existing employment conditions, according to currently available employment data.

The interim projections, once translated by the Consultant into CD-level geographies, were further adjusted: 1) to reflect 2000-2003 employment loss attributable to economic recession; and 2) to maintain as accurately as possible the distribution of employment by industry sector.

According to the City Comptroller's Report (July 2003), there was a decrease of 218,700 jobs (excluding 22,800 jobs lost in 2003 according to the report) in the City between December 2000 and December 2002, including the citywide number of jobs lost as a direct result of September 11.

Job Loss Since 2000

In order to create a revised baseline, both the NYMTC 2002 baseline number and New York State Department of Labor (NYSDOL) data (ES202) for 2002 have been utilized. The NYSDOL data, which provide the most current estimates of industry-sector employment distribution, though at the borough level, include a record only of insured employees, which in part results in the fact that the NYSDOL data report 398,951 fewer employees in the City as of 2002 than NYMTC reports as the revised baseline in their interim projections. This difference is much greater than expected based on the comptroller's July 2003 report, which reported a loss of 218,700 jobs between December 2000 and December 2002. Of additional concern in using NYSDOL data without the integration of NYMTC 2002 estimates is that the NYSDOL 2002 total employment for Manhattan was about 127,000 jobs more than the corresponding NYMTC figure.

Therefore, it was determined that the best use of both NYMTC data and NYSDOL data was to re-estimate 2002, beginning by reducing the NYMTC total 2000 employment by 218,700 jobs according to the comptroller's report, thus arriving at an adjusted 2002 total employment figure of 3.66 million. By adjusting 2000 data, rather than 2002, the direct losses resulting from September 11 are accounted for and a revised 2002 base is created by modifying NYMTC 2002 estimates on which the NYMTC projections are based.

Then the difference between this 2002 adjusted total City employment figure of 3.66 million and the NYSDOL fourth quarter 2002 total City employment (3.50 million) was determined to account for jobs not included within the NYSDOL estimates. This difference was added onto the 2002 NYSDOL estimates, to make borough-level NYSDOL estimates equal to NYMTC borough-level estimates.

Industry Sector Employment Distribution

Borough-level total employment was arranged to represent the same industry-sector percentage of total borough employment originally represented by the NYSDOL data. Then, the industry-sector employment at the borough level was distributed among the CDs such that total employment within each CD maintained the same CD-to-borough proportion as represented by the original NYMTC projections. Thus the NYMTC distribution of total employment at a geographic level smaller than the borough is maintained, while the approximations of industry sector employment distribution within the CDs are made according the patterns known for the borough. This resulting employment data are herein referred to as the “final adjusted” employment data.

The result is that within each CD a particular sector will represent the same percentage of total CD employment as in the other CDs in the same borough and the borough itself, overall. The actual numbers of jobs associated with a particular industry will vary among CDs, however, just as the total employment in each CD does.

Projections from 2002 to 2024

This new 2002 figure was then used as the new baseline to which the NYMTC growth rates were applied (different compound growth rates for each five-year interval, as derived from the interim projections, with an annualized compound growth rate utilized for 2002-2005). For each job classification, the final adjusted 2002 employment data for each CD is projected with these compound growth rates to future years. Although this method does not incorporate projected job loss and recovery beyond 2002, it does adjust the baseline to reflect known current conditions

(2002), providing for a smaller base from which to apply growth rates derived from the most current, applicable employment projections. Thus, the percentage distribution remains unchanged for all years in the future; however, the fundamental assumptions NYMTC and involved agencies made regarding total employment in preparing the model have been maintained.

APPENDIX C

COMMERCIAL PUTRESCIBLE WASTE - DISPOSED AND RECYCLED: BIC-DSNY CARTER SURVEY

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1.0 INTRODUCTION

The Business Integrity Commission (BIC) and the New York City (City) Department Of Sanitation (DSNY) collaborated on conducting a survey of private carters in the City during the period from October to November 2003. BIC is the City agency that regulates the private carter industry within the City. It maintains a registry of carters that are licensed to collect putrescible and non-putrescible (construction & demolition debris or C&D) waste, qualifies business entities to provide carting services and regulates the rates charged for collection. DSNY is responsible for preparing a 20-year Solid Waste Management Plan (New Plan) for the City, inclusive of the needs and requirements of the City's commercial waste management industry.

The purpose of the survey was to:

- Provide an independent source of data on the quantities of commercial putrescible waste collected by private carters that were generated within the City;
- Determine the amounts of commercial putrescible waste generated that were disposed and recycled by private carters;
- Obtain, to the extent practical, borough-level data, including the amount of putrescible waste, inclusive of recyclables, collected by carters in each borough; and
- Identify the specific transfer disposal or processing facilities used by haulers, truck shifts by borough, types of vehicles used and miles driven.

The data were collected for the six-month period extending from January through June of 2003. The data were annualized by multiplying the half-year statistics by two. Examination of tonnages disposed at DSNY-licensed putrescible Transfer Stations for the first and second halves of 2000, 2001 and 2002 indicated that a simple doubling of the first half's tonnage is the best method to obtain an annual estimate.

1.1 Survey Methodology

The survey, referred to as the "BIC survey," was carried out under the auspices of BIC by DSNY personnel and DSNY's Consultant. BIC provided a list of licensed putrescible haulers that was screened to eliminate firms known to be out of business or no longer conducting business within the City. BIC also provided data from its registry database, such as the number of licensed trucks operated by each carter, and each carter's customers by street address and zip code. The total number of licensed putrescible waste haulers in the BIC registry was 165. Of this total, 41 were determined not to collect putrescible waste within the City; data from the remaining 124 firms were obtained and analyzed.

A two-step approach was used to implement the survey:

1. All haulers received a survey form by fax, with a cover letter, describing the purpose of the survey and imposing a three-day deadline for faxing back the requested data. (A copy of this form and cover letter is included in Attachment 1.) The data requested from each carter included: (i) the amount of putrescible waste collected by month, inclusive of waste disposed and recycled; and (ii) the transfer stations or disposal sites where putrescible waste was tipped, indicating the name, address, and the quantities disposed at each site. The same data was requested for recyclables collected by the hauler.

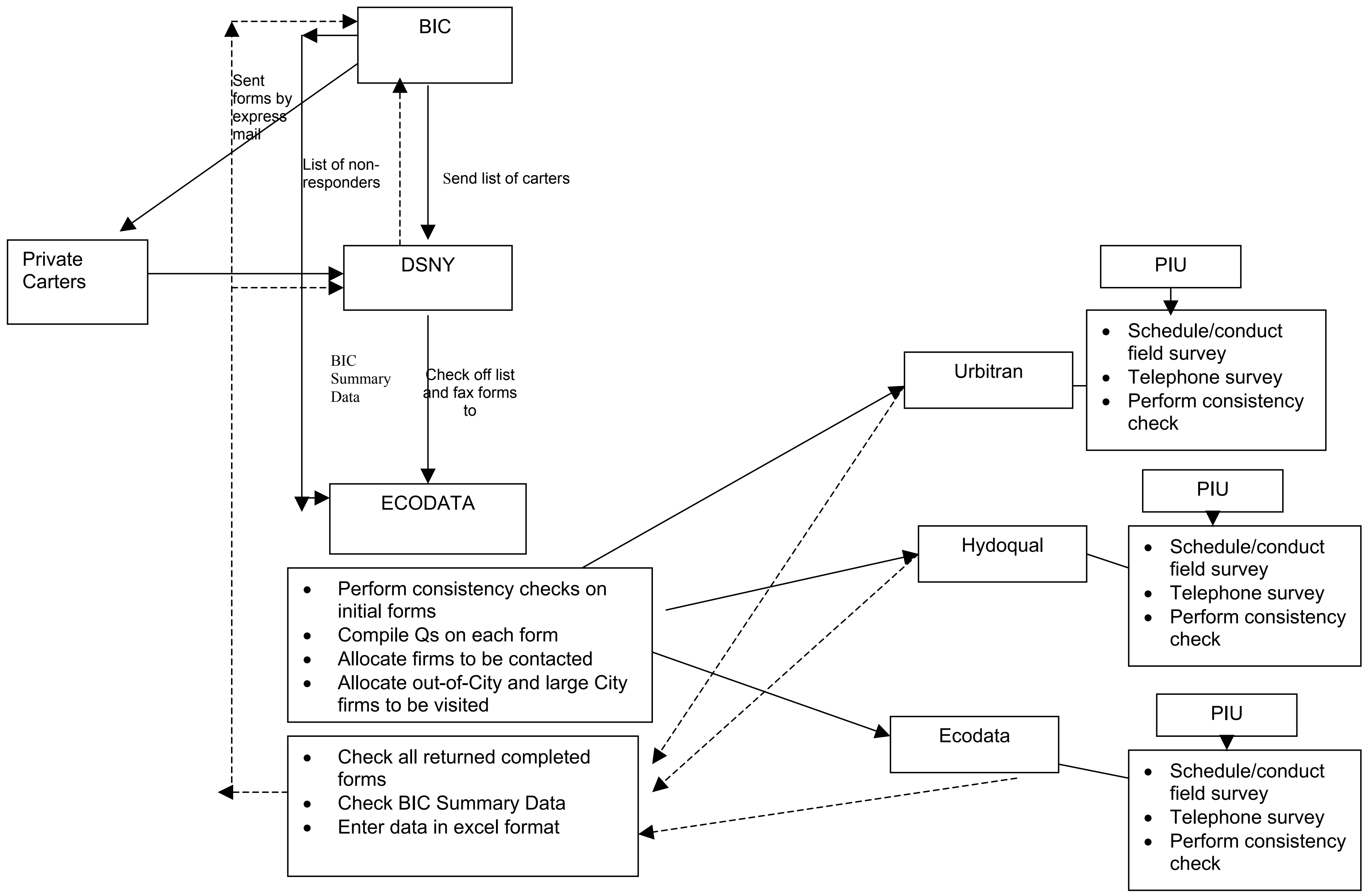
2. The information on the survey form was then corroborated and supplemented by a follow-up in-person or telephone interview with the collection company. Information gathered during these interviews included the number of truck shifts operated by the carter in each borough, the number of truckloads of refuse or recyclables picked up per shift, the types and sizes of vehicles used to pick up the refuse and recyclables, a listing of customers by borough, and the location where vehicles are parked. In-person field visits for on-site data collection were restricted to large firms, defined as those haulers with more than ten trucks. The remaining firms were contacted by telephone. Data were collected from 124 firms. (A copy of the interview questionnaire is included in Attachment 2.)

The initial survey data form was sent out during the week of October 13, 2003. Completed forms were returned by fax and initially processed by DSNY personnel. They were then checked for errors and consistency with information in the BIC registry by the DSNY Consultants.

The carter interviews occurred during the last week of October and the first two weeks of November 2003. DSNY's Consultants conducted the interviews with an inspector from DSNY's Permit and Inspection Unit (PIU) in attendance.

The data flow is summarized in the schematic in Figure 1.1-1. Interviewers filled out the interview form, checked the data for internal consistency and forwarded the form to the survey coordinator, who re-checked the calculations and entered the data into a spreadsheet for analysis.

FIGURE 1.1-1
FLOW DIAGRAM OF CARTER TELEPHONE AND FIELD SURVEY



2.0 SURVEY RESULTS

The results of the survey are summarized in Tables 2.1-1 through 2.5-1.

2.1 Collection Route Data

Table 2.1-1 breaks down the number of weekly truck shifts (defined as one truck collecting materials for one work-shift, multiplied by the number of times the truck collects per week), for putrescible waste generated, inclusive of waste disposed and recycled by borough and by type of vehicle. A total of 5,064 truck-shifts per week is required for collection of waste disposed, and 1,561 weekly truck shifts for waste recycled. For waste disposed, 41% of the truck shifts collect waste in Manhattan, 21% in Brooklyn, 20% in Queens, 14% in Bronx and 5% in Staten Island. Rear-loaders, with either a 25- or 30-cubic-yard capacity, comprise approximately three-fourths of the truck shifts for waste disposed.

With respect to recyclable waste, Manhattan again has the largest proportion of weekly truck-shifts (46%), followed by Brooklyn (25%), Queens (14%), Bronx (11%) and Staten Island (4%). Rear-loaders with 30- to 32-cubic-yard capacities and roll-offs are the vehicles most often used to collect recyclables.

2.2 Waste Generation

Data on total waste generation (disposed and recycled) is shown in Table 2.2-1. The data for the six-month period covered in the survey was annualized for these estimates, by multiplying by two. The estimated total quantity of commercial putrescible waste disposed of in 2003 is 2,244,318 tons and the estimated total amount of recyclables for the same period is 810,133 tons. The combined total of commercial waste and recyclables generated in 2003 is 3,054,451 tons. In terms of waste generation by borough, Manhattan contributes the largest proportion of the putrescible waste disposed - 41% or 926,587 tons. Brooklyn, Queens and Bronx produce fairly similar proportions of putrescible waste disposed -- Queens disposes 20% or 442,826 tons, Brooklyn disposes 19% or 420,874 tons, and Bronx disposes 14% or 317,914 tons. Staten Island disposes 6% or 136,117 tons.

Table 2.1-1
Weekly Truck Shifts for Commercial Putrescible Waste, 2003
(Number of Shifts per Week)[1]

	Manhattan	Brooklyn	Bronx	Queens	Staten Island	Total[2]
Waste Disposed						
Rear-load-25	747	391	206	263	50	1,657
Rear-load-30	930	447	212	438	102	2,129
Roll-Off	372	219	240	299	89	1,219
Other	16	1	38	4	0	59
Total[2]	2,065	1,058	696	1,004	241	5,064
Percent of Total Truck Shifts – Waste Disposed	41%	21%	14%	20%	5%	100%
Waste Recycled						
20-yard Compactor	15	3	0	0	0	18
25-yard Compactor	93	58	62	16	5	234
30- to 32-yard Compactor	450	211	58	140	28	887
Roll-Off	126	59	32.5	29	27	274
Other	36	51	25	36	0	148
Total[2]	720	382	178	221	60	1,561
Percent of Total Truck Shifts – Waste Recycled	46%	25%	11%	14%	4%	100%
Total Truck Shifts (Disposed & Recycled) [2]	2,785	1,440	874	1,225	301	6,625
Percent of Total Truck Shifts	42%	22%	13%	19%	5%	100%

Note:
(1) Truck shifts are rounded to the nearest whole number.
(2) Numbers may not add due to rounding.

Table 2.2-1
Annual Quantity of Commercial Putrescible Waste Collected in 2003 by Truck Type[(1)] (Tons)[(2)]

	Manhattan	Brooklyn	Bronx	Queens	Staten Island	Total Tons[(3)]
Waste Disposed						
Rear-load-25	311,189	152,347	73,748	101,611	25,756	664,651
Rear-load-30	418,375	158,560	107,895	206,326	45,933	937,089
Roll-Off	196,087	109,889	124,467	134,551	64,428	629,422
Other	936	78	11,804	338	0	13,156
Total[(3)]	926,587	420,874	317,914	442,826	136,117	2,244,318
Percent of Total Waste Disposed	41%	19%	14%	20%	6%	100%
Waste Recycled						
20-yard Compactor	3,224	936	0	0	0	4,160
25-yard Compactor	27,439	17,037	18,619	5,694	868	69,657
30- to 32-yard Compactor	224,864	79,862	20,113	126,175	10,524	461,538
Roll-Off	92,222	36,868	17,628	13,702	10,920	171,340
Other	18,707	37,978	19,006	27,747	0	103,438
Total[(3)]	366,456	172,681	75,366	173,318	22,312	810,133
Percent of Total Waste Recycled	45%	21%	9%	21%	3%	100%
Total Putrescible Waste Generated (Disposed & Recycled)[(3)]	1,293,043	593,555	393,280	616,144	158,429	3,054,451
Percentage Recycled of Total	28%	29%	19%	28%	14%	27%
Percentage Disposed of Total	72%	71%	81%	72%	86%	73%
Percentage of Total (Disposed & Recycled)	42%	19%	13%	20%	5%	100%

Notes:
(1) Annual estimate obtained by doubling the tonnages reported for the first six months.
(2) Tons are rounded to the nearest whole number.
(3) Numbers may not add due to rounding.

The predominance of office sector employment in Manhattan is reflected by its relatively higher contribution -- 45%, or 366,456 tons -- to putrescible recycled waste, the dominant portion of which is office paper. Brooklyn and Queens each account for 21% of the recycled tons, approximately the same as their proportions of waste. Although the share of Bronx waste disposed is approximately 14%, it recovers only 9% of the recyclable tonnages. Similarly, Staten Island's share of waste disposed is approximately 6% but its share of waste recycled is only 3%. These differences can be partially explained by the difference in the smaller proportion of office sector employment and the smaller size of Bronx and Staten Island business establishments, compared to other boroughs.

In total, the overall commercial recycling rate (tons recycled/total tons generated) is 27%. Brooklyn, Manhattan and Queens all have recycling rates in the 28% - 29% range. Bronx and Staten Island have recycling rates of 19% and 14%, respectively.

Of the total quantity of 3,054,451 tons of waste generated by the commercial sector, Manhattan generates 42%, Queens 20%, Brooklyn 19%, Bronx 13% and Staten Island 5%.

While Manhattan generates 42% of the waste (as shown in Table 2.2-1), it has 37% of the 118,117 customers, as shown in Table 2.2-2. Brooklyn has 29% of the customers, generating 19% of the waste, while Queens has 20% of the customers, generating 20% of the waste. Bronx has approximately 11% of the customers generating approximately 13% of the waste, and Staten Island has approximately 4% of the customers generating approximately 5% of the waste.

Table 2.2-2
Number of Customers by Borough

	Manhattan	Brooklyn	Bronx	Queens	Staten Island	Total
# of Customers	44,116	34,043	12,649	23,093	4,270	118,171
% of Total Customers	37%	29%	11%	20%	4%	100%

2.3 Commercial Waste Transport

Commercial refuse collection vehicles collectively drive millions of miles on City streets in any given year. Tables 2.3-1, 2.3-2 and 2.2-3 break down mileage by time of day, type of truck and type of waste for vehicles in each borough. Table 2.3-1 shows the mileage driven during the day. For purposes of this Study, a night shift is defined as one in which trucks collect waste generally between 6:00 p.m. and 6:00 a.m. A day shift is considered to be one in which waste is collected generally between 6:00 a.m. and 6:00 p.m. Table 2.3-2 shows mileage driven at night and Table 2.3-3 shows the total number of miles driven.

During the day, about 1.1 million miles were driven by putrescible waste collection trucks. Of this amount, the largest proportion of miles, or almost 90%, was logged by roll-offs. This is due to the fact that roll-off vehicles often drive significant distances between customers, as each box is individually hauled to the tip location, then returned to the customer, and as boxes may be scattered in many different locations. Thirty-six percent (36%) of the number of total miles driven during the day for putrescible waste collection are driven in Manhattan, with 20% in Queens, 19% in Bronx, 16% in Brooklyn and only 9% in Staten Island.

With respect to recyclables collection, 363,621 miles were driven by recycling vehicles servicing commercial customers during the day in 2003. By borough, most of these miles (approximately 41%) were driven in Manhattan, followed by Brooklyn (26%), Bronx (15%), Queens (14%) and Staten Island (4%).

While 1.4 million miles in total were driven during the day by refuse collection and recyclables collection vehicles picking up commercial waste in 2003, about six times that amount, or 8.2 million miles, were driven at night. Carters can operate more efficiently at night, when there is minimal interference from traffic and most businesses have ceased operations. As shown in Table 2.3-2, 4.8 million miles were driven by putrescible waste collection vehicles at night and 3.4 million miles were driven by vehicles collecting recyclables. The highest percentage of nighttime miles are driven in Manhattan (43%) and the lowest in Staten Island (6%).

Table 2.3-1
Commercial Putrescible Waste
Annual Miles Driven by Collection Trucks During the Day, 2003[(1)(2)(3)]
(Miles/Year)

	Manhattan	Brooklyn	Bronx	Queens	Staten Island	Total
Waste Disposed						
Rear-load-25	49,749	27,472	11,684	22,505	4,686	116,096
Rear-load-30	29,684	10,287	5,995	13,421	4,468	63,855
Roll-Off	306,942	130,301	183,520	180,797	87,071	888,631
Other	3,138	94	4,488	345	0	8,065
Total	389,513	168,154	205,687	217,068	96,225	1,076,647
Percent of Total Day Miles	36%	16%	19%	20%	9%	100%
Waste Recycled						
20-yard Compactor	5,009	1,092	0	0	0	6,101
25-yard Compactor	23,583	15,962	17,374	6,691	2,640	66,250
30- to 32-yard Compactor	32,596	14,935	6,036	13,293	2,945	69,805
Roll-Off	71,592	37,219	19,477	11,339	9,338	148,965
Other	15,562	25,875	11,110	19,953	0	72,500
Total	148,342	95,083	53,997	51,276	14,923	363,621
Percent of Total Day Miles	41%	26%	15%	14%	4%	100%
Total Day Miles (Disposed & Recycled)	537,855	263,237	259,684	268,344	111,148	1,440,268
Percentage of Total Day Miles	37%	18%	18%	19%	8%	100%

Notes:
(1) Miles are rounded to the nearest whole number.
(2) Day shifts are those in which trucks collect waste generally between 6:00 a.m. and 6:00 p.m.
(3) Numbers may not add due to rounding.

Table 2.3-2
Commercial Putrescible Waste
Annual Miles Driven in Each Borough During the Night, 2003[(1)(2)(3)]
(Miles/Year)

	Manhattan	Brooklyn	Bronx	Queens	Staten Island	Total
Waste Disposed						
Rear-load-25	704,030	388,769	165,352	318,485	66,320	1,642,956
Rear-load-30	959,642	332,610	193,828	433,935	144,460	2,064,475
Roll-Off	353,432	150,036	211,316	208,182	100,259	1,023,225
Other	22,862	686	32,692	2,515	0	58,755
Total	2,039,966	872,101	603,188	963,117	311,039	4,789,411
Percent of Total Night Miles	43%	18%	13%	20%	7%	100%
Waste Recycled						
20-yard Compactor	25,047	5,460	0	0	0	30,507
25-yard Compactor	145,500	98,482	107,192	41,284	16,288	408,746
30- to 32-yard Compactor	868,018	397,700	160,728	353,996	78,435	1,858,877
Roll-Off	347,008	180,400	94,403	54,961	45,262	722,034
Other	83,498	138,835	59,610	107,057	0	389,000
Total	1,469,071	820,877	421,933	557,298	139,985	3,409,164
Percent of Total Night Miles	43%	24%	12%	16%	4%	100%
Total Night Miles (Disposed & Recycled)	3,509,037	1,692,978	1,025,121	1,520,415	451,024	8,198,575
Percentage of Total Night Miles	43%	21%	13%	19%	6%	100%

Notes:
(1) Miles are rounded to the nearest whole number.
(2) Night shifts are those in which trucks collect waste generally between 6:00 p.m. and 6:00 a.m.
(3) Numbers may not add due to rounding.

Table 2.3-3
Commercial Putrescible Waste
Annual Miles Driven Day and Night in Each Borough, 2003[1][3]
(Miles/Year)

	Manhattan	Brooklyn	Bronx	Queens	Staten Island	Total	Percent of Miles at Night[2]
Waste Disposed							
Rear-load-25	753,779	416,241	177,036	340,990	71,006	1,759,052	93.40%
Rear-load-30	989,326	342,897	199,823	447,356	148,928	2,128,330	97.00%
Roll-Off	660,374	280,337	394,836	388,979	187,330	1,911,856	53.52%
Other	26,000	780	37,180	2,860	0	66,820	87.93%
Total	2,429,479	1,040,255	808,875	1,180,185	407,264	5,866,058	83.06%
Percent of Total Miles	41%	18%	14%	20%	7%	100%	
Waste Recycled							
20-yard Compactor	30,056	6,552	0	0	0	36,608	83.33%
25-yard Compactor	169,083	114,444	124,566	47,975	18,928	474,996	86.05%
30- to 32-yard Compactor	900,614	412,635	166,764	367,289	81,380	1,928,682	96.38%
Roll-Off	418,600	217,620	113,880	66,300	54,600	871,000	82.90%
Other	99,060	164,710	70,720	127,010	0	461,500	84.29%
Total	1,617,413	915,961	475,930	608,574	154,908	3,772,786	90.36%
Percent of Total Miles	43%	24%	13%	16%	4%	100%	
Total Miles (Disposed & Recycled)	4,046,892	1,956,216	1,284,805	1,788,759	562,172	9,638,844	
Percentage of Total Miles	42%	20%	13%	19%	6%	100%	

Notes:
(1) Miles are rounded to the nearest whole number.
(2) Night shifts are those in which trucks collect waste generally between 6:00 p.m. and 6:00 a.m.
(3) Numbers may not add due to rounding.

With respect to nighttime mileages attributed to the collection of recyclables, the largest proportion, or 43% of the 3.4 million miles driven, occurs in Manhattan. Trucks picking up recyclables at night in Brooklyn contribute 24% of miles, 16% in Queens and 12% in Bronx. Due to its small size, Staten Island comprises only 4% of the nighttime miles driven for recyclable pick-up by haulers.

Table 2.3-3 consolidates the day and nighttime miles driven data, showing in aggregate that commercial sector waste collection and recycling operations involve approximately 10 million miles annually. The table provides break-downs by borough and by waste disposal and recycling routes. As shown in the final column of the table, most driving across all truck classifications and for both putrescible and recyclable pick-up, is done at night -- more than 85% of all mileage is driven at night. The one exception is roll-off containers for refuse pick-up. In this case, about 54% of the miles driven are at night. This is due to the fact that customers call for box pick-up when the box is full, which may be at any time. Routes are scheduled for both day and night pick-up, depending on the customer.

2.4 Recovered Recyclables By Type

Table 2.4-1 shows weekly truck-shifts by borough by recyclable material type. As indicated in the last column of the table, nearly all the weekly truck shifts, or about 92%, are devoted to mixed office paper (MOP) and old corrugated cardboard (OCC) recycling. Approximately 4% of the truck shifts are dedicated to sorted office paper and 2% to old newsprint (ONP). Other materials collected in smaller quantities are textiles and wooden pallets, each of which accounts for 1% of the truck shifts. Collectively, organics, bakery waste, bottles and cans, plastic bags and metals make up 1% of the truck shifts (and are reported in one category as "Other"). Nearly one-half the weekly recycling truck shifts (46%) are in Manhattan. The next highest proportion is Brooklyn with 24%. Queens and Bronx contribute 14% and 11%, respectively, and Staten Island has the lowest percentage at 4%.

Table 2.4-1
Commercial Putrescible Waste
Weekly Truck Shifts for Recycled Waste by Borough, 2003[1][3]
(Shifts/Week)

Material	Manhattan	Brooklyn	Bronx	Queens	Staten Island	Total	Percent of Total Truck Shifts
Mixed Office Paper	438	173	60	86	4	761	48%
Old Corrugated Cardboard	234	181	112	109	49	685	44%
Sorted Office Paper	25	9	4	12	7	57	4%
Newspaper	16	6	3	6	0	31	2%
Textiles	5	5	0	5	0	15	1%
Wooden Pallets	8	3	0	0	0	11	1%
Other [2]	4	8	0	4	0	16	1%
Total	730	385	179	222	60	1,576	100%
Percent of Total Truck Shifts	46%	24%	11%	14%	4%	100%	

Notes:
(1) Truck shifts are rounded to the nearest whole number.
(2) "Other" includes organics, bakery waste, bottles and cans, plastic bags and metals.
(3) Numbers may not add due to rounding.

The total quantity of recyclables collected by licensed carters from the commercial sector in the City in 2003 was 810,133 tons. As shown in Table 2.4-2, 98% of this amount was various types of paper. The major categories of paper collected were MOP -- 441,341 tons -- and OCC -- 316,600 tons. Less than 5,000 tons of material reported as "Other," including metal, glass and plastic (MGP), were collected from commercial waste generators.

In Manhattan, MOP makes up 73% of the tonnage collected and OCC comprises 22% of this stream. In Brooklyn, MOP drops to 57%. In Bronx, this percentage is 37%; in Queens, 27%; and in Staten Island, 5%. OCC constitutes about one-third of the recyclables picked up in Brooklyn. However, in Bronx, Queens and Staten Island, it is the largest portion of the recyclable stream, ranging from 60% in Bronx, to 66% in Queens, to 91% on Staten Island. For sorted office paper and ONP, percentages mimic the citywide numbers. The exception is sorted office paper on Staten Island, which constitutes approximately 7% of the recyclable amounts collected; citywide; this percentage is only 2%.

The differences in composition are related to the nature of commercial activity in each of the boroughs. Manhattan, with its high-density office buildings, naturally generates a high proportion of MOP. Commercial entities in the outer boroughs tend to be food stores, small delis and light manufacturing, which tend to generate a higher percentage of OCC as compared to MOP.

Table 2.4-2
Commercial Putrescible Waste
Tons of Recycled Waste, 2003(1)(2)(3)
(Tons/Year)

Material	Manhattan	Brooklyn	Bronx	Queens	Staten Island	Total	Percent of Total Tons
Mixed Office Paper	266,709	98,774	28,746	46,176	936	441,341	55%
Old Corrugated Cardboard	78,761	58,929	44,597	114,543	19,770	316,600	39%
Sorted Office Paper	8,528	4,004	1,040	4,628	1,456	19,656	2%
Newspaper	4,498	3,432	650	3,432	0	12,012	2%
Textiles	3,640	3,640	0	3,640	0	10,920	1%
Wooden Pallets	4,719	39	0	0	0	4,758	1%
Organics	0	655	0	655	0	1,310	<1%
Bakery Waste	0	2,808	0	0	0	2,808	<1%
Bottles and Cans	312	0	0	0	0	312	<1%
Plastic Bags	156	156	0	0	0	312	<1%
Metal	104	0	0	0	0	104	<1%
Total	367,427	172,437	75,033	173,074	22,162	810,133	100%
Percent of Total Tons	45%	21%	9%	21%	3%	100%	

Notes:
(1) Tons are rounded to the nearest whole number.
(2) Attachments 3 and 4 contain an expanded version of this table, including recycling from two other sources: returns of deposit containers and materials separated for recycling from mixed loads delivered to Transfer Stations in the City.
(3) Numbers may not add due to rounding.

2.5 Destination of Commercial Putrescible Waste

Table 2.5.1 presents annual commercial putrescible waste generation, disposed and recycled, according to borough of origin, and destination according to geographic location where the collection vehicles are first tipped. The generation data is derived from the interviews with the collection companies, based on detailed information about truck routes in each of the five boroughs. These data have been discussed previously (see Table 2.2-1). In the aggregate, 3,054,451 tons of waste disposed and recycled are generated in the five boroughs.

The destinations of the disposed and recycled wastes are derived from the tipping records faxed to DSNY in response to the BIC Directive dated October 9, 2003. The total tonnages are disaggregated even further in Table 2.5.2 according to the specific Transfer Station within the City to which the putrescibles were delivered. Table 2.5.3 presents further detailed information on waste disposed, which was first tipped at transfer stations or disposal facilities located outside the City limits. These data are presented in tons per day and annual tons.

Tables 2.5-2 and 2.5-3 summarize data collected from the carter survey on the in-City and out-of-City destinations of commercial putrescible waste disposed by the City's carters. (The in-City Transfer Station totals do not include DSNY-managed Waste disposed under Interim Export Contracts.) Note that these data vary somewhat from the totals given for DSNY's Quarterly Transfer Station Reports (Quarterly Reports) in Volume II, Appendix A, Facilities Estimate of Putrescible Waste Generation Year 2002. However, the differences are not very large, and the distributions shown by the BIC-DSNY survey compare in magnitude to those appearing in the DSNY's Quarterly Reports. This is supportive of the accuracy of the data obtained in this survey of collection companies. The Volume II Summary Report provides a comparison of these data.

Table 2.5-1
Origins and Destinations of New York City's Commercial Putrescible Waste, 2003(1)

	Waste Disposed		Waste Recycled		Disposed & Recycled	
	Tons	% of Total	Tons	% of Total	Tons	% of Total
ORIGINS						
Manhattan	926,587	41%	367,427	45%	1,294,014	42%
Brooklyn	420,874	19%	172,437	21%	593,311	19%
Bronx	317,914	14%	75,033	9%	392,947	13%
Queens	442,826	20%	173,074	21%	615,900	20%
Staten Island	136,117	6%	22,162	3%	158,279	5%
New York City	*2,244,318*	*100%*	*810,133*	*100%*	*3,054,451*	*100%*
DESTINATIONS						
Manhattan	0	0%	0	0%	0	0%
Brooklyn	730,340	35%	211,457	30%	941,797	34%
Bronx	769,700	37%	68,326	10%	838,026	30%
Queens	279,407	13%	76,752	11%	356,159	13%
Staten Island	0	0%	72,120	10%	72,120	3%
New York City	*1,779,447*	*85%*	*428,655*	*61%*	*2,208,102*	*79%*
Out-of-City:						
Long Island	29,768	1%	20,632	3%	50,400	2%
Westchester	7,977	0%	580	0%	8,557	0%
New Jersey	273,999	13%	256,090	36%	530,089	19%
Other	12,404	1%	69	0%	12,473	0%
Total Out-of-City	*324,148*	*15%*	*277,371*	*39%*	*601,519*	*21%*
Grand Total	**2,103,595**	**100%**	**706,026**	**100%**	**2,809,621**	**100%**
Percent difference	6.69%		14.75%		8.71%	

Notes:
(1) Numbers may not add due to rounding.
Source: Origins = BIC-DSNY survey interviews.
Destinations = Fax-Back BIC-DSNY survey.

Table 2.5-2
BIC-DSNY Carter Survey Responses
In-City Destinations of Waste Disposed

In-City Commercial Transfer Stations				2003 CARTER SURVEY RESULTS Waste Disposed (Tons per Day)
Putrescible Stations	**Address**	**Borough**	**BIC Code**	
IESI (Atlantic) (Solid Waste Mgt. Corp.)	110 50th St.	BKLYN	***D11***	**94**
Browing Ferris (Thames St.) (Waste Management)	115 Thames St.	BKLYN	***D8***	**427**
Browning Ferris (J.L.J. Recycling)	598 Scholes St.	BKLYN	***D9***	**178**
Hi-Tech	130 Varick Ave.	BKLYN	***D10***	**367**
Waste Serv. N.Y. (Allied) (Rutigliano)	941 Stanley Ave.	BKLYN	***D15***	**44**
IESI (Waste Mgt. of NYC) (N. Vaccaro)	577 Court St.	BKLYN	***D12***	**248**
Waste Mgt. of NYC (N.Y. Acq.) (B.Q.E. Service)	485 Scott Ave.	BKLYN	***D14***	**22**
Waste Mgt. of NYC (N.Y. Acq.) (Star)	215 Varick	BKLYN	***D13***	**961**
			Brooklyn Subtotal:	**2,341**
			Percent of Total:	**41%**
IESI (Casanova St. Proc.)	325 Casanova St.	BRONX	***D1***	**200**
Metropolitan Transfer Station	287 Halleck St.	BRONX	***D2***	**743**
Paper Fibers Corp.	960 Bronx River Ave.	BRONX	***D3***	**1**
U.S.A. Waste of New York City (Harlem River Yard)	132nd St.	BRONX	***D4***	**223**
U.S.A. Waste of New York City	98 Lincoln Ave.	BRONX	***D5***	**679**
Republic Ser. (Waste Mgt. of NYC Oakpoint)	Oakpoint Ave.	BRONX	***D6***	**45**
Waste Ser. of NY (Waste Mgt. of NYC) (S.P.M.)	920 E. 132 St.	BRONX	***D7***	**576**
			Bronx Subtotal:	**2,467**
			Percent of Total:	**43%**
A&L Cesspool	38-40 Review Ave.	QUEENS	***D16***	**0**
Cross County	122-52 Montauk St.	QUEENS	***D18***	**27**
Crown (Five Counties)	172-33 Douglas Ave.	QUEENS	***D17***	**618**
New Style	49-10 Grand Ave.	QUEENS	***D19***	**38**
Regal Recycling	172-02 Douglas Ave.	QUEENS	***D20***	**206**
Waste Mgt. of NYC Qns. (Review Ent.)	38-50 Review Ave.	QUEENS	***D22***	**0**
Tully Environment Inc.	127-20 34th Ave.	QUEENS	***D21***	**6**
			Queens Subtotal:	**895**
			Percent of Total:	**16%**
			Putrescible Total:	**5,703**

Table 2.5-3
BIC-DSNY Carter Survey Responses
Out-of-City Destinations of Waste Disposed[(1)]

Out-of-City Disposal Sites From Carter Survey Form	State	Fax-Back Total Tons 2003	Fax-Back Tons/Day 2003	Percent of Exported Waste
WESTERN NEW JERSEY GROUP				
Covanta, Warren County	NJ			
Warren County Landfill, Union, NJ	NJ			
PCFA,Oxford, NJ	NJ			
Waste Management Hunterdon County, NJ	NJ			
BFI, Fairview, NJ	NJ			
Bridgewater Resources, Somerset	NJ			
Union County Disposal, Union County, NJ	NJ			
Subtotal		**144,013**	**462**	**NA**
NEWARK FACILITIES				
Recycling & Salvage, Newark, NJ	NJ			
American Refuel, Newark, NJ	NJ			
Hi Tech, Newark, NJ	NJ			
DJM South Kearny, NJ	NJ			
NJMC, Arlington, NJ	NJ			
Subtotal		**51,935**	**166**	**NA**
NEAR STATEN ISLAND				
Automated Modular Systems, Linden, NJ	NJ			
Waste Management Julia St., Elizabeth	NJ			
SWTR, Elizabeth, NJ	NJ			
Subtotal		**51,389**	**165**	**NA**
NORTH METRO AREA				
Onyx, Totowa, NJ	NJ			
Garafola Transfer Station, Garfield, NJ	NJ			
Waste Management of NJ, Fairlawn NJ	NJ			
Allegro Sanitation, Secaucus, NJ	NJ			
Subtotal		**4,794**	**15**	**NA**

Table 2.5-3 (continued)
BIC-DSNY Carter Survey Responses
Out-of-City Destinations of Waste Disposed[1]

Out-of-City Disposal Sites From Carter Survey Form	State	Fax-Back Total Tons 2003	Fax-Back Tons/Day 2003	Percent of Exported Waste
SOUTHERN NEW JERSEY				
Midco, New Brunswick, NJ	NJ			
Camden County	NJ			
Woodhur Ltd, Wrightstown, NJ	NJ			
Subtotal		**21,868**	**70**	
NEW JERSEY TOTAL		**273,999**		**85%**
NEW YORK STATE				
American Refuel, Westbury, NY	NY			
Capital Compost, Menands, NY	NY			
Town of North Hempstead	NY			
Waste Management, Yonkers, NY	NY			
BFI Suburban, Westchester, NY	NY			
Sanitary District #1, Lawrence, NY	NY			
A1 Compaction, Yonkers, NY	NY			
Winter Brothers, West Babylon, NY	NY			
RIC, Mamaroneck, NY	NY			
Wheelabrator, Westchester, Peekskill, NY	NY			
Subtotal		**39,782**	**128**	**12%**
OTHER LOCATIONS				
Better Management Corp. of Ohio	OH			
American Ref Fuel, Chester, PA	PA			
Subtotal		**10,366**	**33**	**3%**
Total		**324,147**		**100%**
Facilities Not in Fax-Back Form				
Pen Pac Fulton	NJ			
Onyx Robros	NJ			

Notes:
(1) Numbers may not add due to rounding.
NA = Not applicable.

Table 2.5-2 shows daily tons arriving at each of the DSNY's licensed putrescible Transfer Stations, obtained from the disposal information faxed by each of the licensed putrescible collection firms surveyed by BIC-DSNY. All data concerned disposed tons for the period January to June, 2003. The data were converted to tons per day by dividing the aggregate for the six months by 156 days. Forty-one percent (41%) of in-City disposed tons (the tons are tipped in-City, but then are transported outside the City for final disposal) are tipped in Brooklyn, 43% are tipped in Bronx and 16% are tipped in Queens. There were no putrescible Transfer Stations operating in Manhattan or Staten Island during the first half of 2003.

Direct export of putrescible solid waste occurs when the collection vehicle first tips its load at a transfer station or disposal facility located outside the City boundaries. Table 2.5-3 displays the out-of-City disposal of commercial waste, as reported by the licensed collection companies. Most of the companies that directly export waste are themselves located outside the City; their trucks tip at a disposal facility near their firm's deployment location. As many firms from New Jersey collect waste in the City, and, particularly, in Manhattan, it is not surprising that the majority of directly exported waste is tipped in New Jersey; New Jersey receives 85% of the waste that is directly exported from the City. In 2003, the DSNY's Consultants estimate that 324,147 tons were directly exported from the City, based upon the results from the fax-back survey. Thus, New Jersey received just under 275,000 tons from the City. New York State outside the City, including Long Island and Westchester Counties, received 12% of directly exported commercial putrescible waste, and 3% went to other locations (Pennsylvania and Ohio).

The out-of-City disposed waste going to New Jersey is concentrated in those areas near the City. Over 50% goes to counties in western New Jersey, including Warren, Hunterdon and Union Counties. An additional 19% of the waste going to New Jersey goes to facilities in Newark and another 19% to facilities located in proximity to Staten Island. The remaining 8% of the waste is delivered to scattered locations, including southern New Jersey and the north Metro Area.

2.6 Garaging of Collection Vehicles

Table 2.6-1 shows where the haulers park their refuse and recycling vehicles and whether the vehicles are parked outdoors or indoors, by community district (CD). About 44% of the 823 vehicles reported in the survey are parked indoors. The largest proportion, 40%, are parked in Brooklyn. This location is followed by Bronx, in which 19% of the vehicles are parked, Queens 18%, and New Jersey with 14%. Manhattan and Staten Island each have 3% of the vehicles. Nassau and Suffolk Counties together have 2% and Westchester County has 2%. Overall, about 82% of all the refuse and recyclable collection vehicles servicing the commercial sector in the City are parked within City limits, with 18% parked outside the City limits.

Table 2.6-1
Truck Parking by Borough, Community District, Town &/or Zip Code, 2003

Borough, Community District, Town, &/or Zip Code	Number Parked Indoors (Number of Trucks)	Total Trucks	Percentage of Trucks in CD/Town	Percentage of Total Trucks (In and Out of City)
Manhattan				
CDs 4,5 – 10001	0	18	86%	
CDs 10,11 – 10035	0	3	14%	
Total Manhattan	0	21	100%	3%
Brooklyn				
CDs 2,6 – 11201	0	9	3%	
CDs 9,7,18 – 11203	0	3	1%	
CDs 1,2,3 – 11205	4	4	1%	
CDs 1,3,4 – 11206	8	11	3 %	
CDs 5,9,10 – 11208	0	24	7%	
CDs 14,15,17,18 – 11210	3	3	1%	
CDs 3,8,9,17 – 11213	3	3	1%	
CDs 11,13 – 11214	2	2	1%	
CDs 6,7,9,14 – 11215	11	14	4%	
CDs 2,6,8 – 11217	4	7	2%	
CDs 7,10,11,12 – 11219	11	11	3%	
CDs 7,10,12 – 11220	0	1	>1%	
CD 1 – 11222	9	32	10%	
CD 6 – 11231	16	21	6%	
CDs 7,12 – 11232	18	18	5%	
CDs 5,16,17,18 – 11236	9	10	3%	
CDs 1,4 – 11237	5	159	48%	
Total Brooklyn	103	332	100%	40%
Bronx				
CDs 1,3,4 – 10451	54	54	35%	
CDs 1,2 – 10454	6	6	4%	
CDs 9,11 – 10461	2	2	1%	
CDs 6,9,10,11 – 10462	12	15	10%	
CDs 10,11 – 10465	0	3	2%	
CDs 7, 8,11,12 – 10467	6	6	4%	
CDs 10,11,12 – 10469	0	2	1%	
CDs 2,9,10 – 10473	2	4	3%	
CD 2 – 10474	39	62	40%	
CDs 12 – 11466	0	1	1%	
Total Bronx	121	155	100%	19%

Table 2.6-1 (Continued)
Truck Parking by Borough, Community District, Town &/or Zip Code, 2003

Borough, Community District, Town, &/or Zip Code	Number Parked Indoors (Number of Trucks)	Total Trucks	Percentage of Trucks in CD/Town	Percentage of Total Trucks (In and Out of City)
Queens				
CDs 1,2 – 11101	5	5	3%	
CD 1 – 11102	2	4	3%	
CD 1 – 11105	4	12	8%	
CD 1 – 11106	0	1	1%	
CDs 1,3 – 11370	1	2	1%	
CDs 1,2,3,4,5 – 11377	1	1	1%	
CD 5 – 11378	3	23	16%	
CD 5 – 11385	13	20	14%	
CDs 8,12 – 11423	1	21	14 %	
CDs 8,12 – 11432	10	10	7%	
CD 12 – 11433	18	23	16%	
CDs 12,13 – 11434	5	24	16%	
Total Queens	63	146	100%	18%
Staten Island				
CD 1 - 10302	3	6	29%	
CD 1 – 10310	12	12	57%	
CDs 1,2,3 – 10314	0	3	14%	
Total Staten Island	15	21	100%	3%
New York City Total	302	675	82%	82%
New Jersey				
Newark – 07104	0	8	7%	
Newark – 07114	17	17	15%	
Jersey City – 07305	0	2	2%	
Hackensack – 07601	0	4	4%	
Jersey City - 07304	0	2	2%	
Jersey City - 07305	0	10	9%	
Jersey City - 07307	9	14	12%	
Hoboken - 07030	2	3	3%	
Lyndhurst, Kearny - 07071	0	14	12%	
Kearny - 07032	0	8	7%	
Elizabeth - 07201	2	4	4%	
East & South Brunswick, Sayerville - 08816	5	5	4%	
North Bergen - 07047	0	8	7%	

Table 2.6-1 (Continued)
Truck Parking by Borough, Community District, Town &/or Zip Code, 2003

Borough, Community District, Town, &/or Zip Code	Number Parked Indoors (Number of Trucks)	Total Trucks	Percentage of Trucks in CD/Town	Percentage of Total Trucks (In and Out of City)
Clifton - 07014	8	8	7%	
Secaucus - 07094	0	4	4%	
Millstone, Monroe, Englishtown, Marlboro, Manalapan - 07726	0	2	2%	
Total New Jersey	43	113	100%	14%
Nassau & Suffolk Counties				
Babylon, Suffolk – 11704	0	8	47%	
Babylon, Suffolk – 11757	0	1	6%	
Hempstead, Nassau – 11096	0	4	24%	
Hempstead, Nassau – 11559	2	2	12%	
Hempstead, Nassau – 11783	0	2	12%	
Total Nassau & Suffolk Counties	2	17	100%	2%
Westchester County				
Croton-on-Hudson, Cortlandt, Yorktown - 10520	3	3	17%	
Mount Vernon - 10550	2	2	11%	
Mount Vernon - 10553	11	11	61%	
Yonkers, Greenburgh - 10710	2	2	11%	
Total Westchester County	18	18	100%	2%
Total Outside New York City	68	153	18%	18%
Total Trucks	365	823		

Attachment 1

BIC Directive and Fax-Back Tonnage Form

The City of New York

BUSINESS INTEGRITY COMMISSION
100 Church Street · 20th Floor
New York · New York 10007
Tel. (212) 676-6219 · Fax (212) 676-6204

October 9, 2003

COMMISSION DIRECTIVE

TO ALL LICENSED TRADE WASTE CARTERS AND THOSE OPERATING WITH TEMPORARY PERMISSION OR IN GRANDFATHERED STATUS

This directive is accompanied by a two-page survey form. You are required to complete both pages, which call for you to supply information on the amount of refuse and recyclables your company tipped in the first six (6) months of 2003, and to list the transfer stations at which you tipped refuse and/or recyclables during the same timeframe.

This form must be completed and returned by fax no later than October 17, 2003. It is to be faxed to 212-788-4019 or 212-788-3949.

If you have any questions regarding the content of the survey form, how to complete it or any other aspect of this order, call **Linda Urbanski of the NYC Sanitation Department, at tel.** 646-885-4809.

A data collection team may conduct an in-person, follow-up interview. If you are going to be interviewed, you will receive a telephone call to schedule the interview. Your company must make a senior manager available for the follow-up interview.

This survey is being conducted as part of New York City's commercial waste study, about which the commission has previously informed you. The data you are supplying is a vital part of the study and will be used in formulating the city's comprehensive solid waste management plan.

Failure to return the completed survey form, failure to supply all of the required information or failure to cooperate with the follow-up interview will be considered a violation of commission rules, 17 RCNY, section 1-09, and will subject you to a fine.

José Maldonado
Chairman

CWS2-1

New York City Comprehensive Commercial Waste Management Study Phase II
Summary Sheet

Carter's Name & Address: ____________________

Preparer/Contact Person: ____________________

Phone Number/Fax Number ____________________

Summary of Transfer Stations:

January 1-June 30, 2003	Number of Stations	Total Refuse Collected		Total Recycling Collected		(A) Grand Total
			+		=	

Destinations:

Enter totals from the detail sheet prepared for each transfer station to which you delivered garbage or recyclables.

Name of Transfer Station	Garbage Quantity Tons	Recycling Quantity Tons
GRAND TOTALS		

Fax completed sheets to NYC DOS per instructions in cover letter.

New York City Comprehensive
Commercial Waste Management Study Phase II

CWS2-2

Detail Sheet

Fill in one sheet for each location at which you delivered garbage and recyclables from January 1 through June 30, 2003

Company Name: ____________ Preparer/Contact Person: ____________

Company Address: ____________

Phone Number ____________ Fax Number: ____________

Transfer Station:
Name ____________
Address ____________
Borough (if in NYC) ____________
State ____________

FILL OUT A SEPARATE SHEET FOR EACH LOCATION WHERE YOU DELIVERED GARBAGE OR RECYCLABLES

Year 2003 Month:	Garbage Quantity Tons
January	
February	
March	
April	
May	
June	
GARBAGE TOTALS	

Year 2003 Month	Specify type of material (eg. Cardboard)	Recyclables Quantity Tons
January		
February		
March		
April		
May		
June		
RECYCLABLE TOTALS	X	

Attachment 2

Survey Form for On-Site or Telephone Hauler Interviews

NEW YORK CITY COLLECTOR DATA

Name of Firm ____________________
Street Address ____________________
Borough or City, State ____________________
Phone _____-_____-_____
Fax _____-_____-_____
Cell _____-_____-_____
e-mail ____________________
Business Integrity # ____________________
Name/title of Contact ____________________
Interview completed by: ____________________
Date: ____________________

I. TRADE WASTE ONLY

Trucks	Rear Load	Rear Load	Front Load	Roll Off	Other ________	Other ________	Other ________	Total
# owned								
# leased								
% Deployed at night								
% Deployed during day								
Cubic yard capacity								
Truck shifts/week:*								
Manhattan								
Brooklyn								
Bronx								
Queens								
Staten Island								
TOTAL								
# of loads (pulls)/truck shift								
Manhattan								
Brooklyn								
Bronx								
Queens								
Staten Island								
Average miles/truck shift								
Average weight/load								
Jan-June MSW tons 2003								
* A truck shift = a truck and crew deployed for a day or night's work								

II. NEW YORK CITY RECYCLING COLLECTION – PAGE 2

COMMODITY	TRUCKS USED			WEEKLY TRUCK SHIFTS BY BOROUGH					TONS/ LOAD	LOADS/ TS**	TOTAL JAN-JUNE 2003 TONS
	TYPE*/ YDS3	% DEPLOYED AT NIGHT /DAY	MILES/ TRUCK SHIFT	MANHATTAN	BROOKLYN	BRONX	QUEENS	STATEN ISLAND			
OFFICE PAPER		/									
NEWSPRINT		/									
CORRUGATED		/									
MIXED PAPER		/									
OTHER PAPER____		/									
WOOD PALLETS		/									
GLASS		/									
METAL CANS (NON AL)		/									
ALUMINUM CANS		/									
PLASTIC #__________		/									
OTHER ____________		/									
Other ____________		/									
Other ____________		/									
Other ____________		/									

*** TYPE – INDICATE LOADING LOCATION & TYPE (E.G. RL PACKER; OPEN TOP (OT) ROLL OFF; STAKE BODY, ETC.)**
****TS= TRUCK SHIFT**

1. Where are vehicles parked? Zip code: ___ ___ ___ ___ ___ Borough or City: ___________________
2. Are they parked indoors? (1=yes; 0=no) [ ]
3. Totals for first half 2003:# of Customers Miles Driven

	# of Customers	Miles Driven			
Manhattan	______________	______________	Queens	_______________	____________
Brooklyn	______________	______________	Staten Island	_______________	____________
Bronx	______________	______________			

NEW YORK CITY COLLECTOR DATA – PAGE 3

II. TRUCK SHIFT WORK SHEETS

A. GARBAGE TRUCK SHIFT WORK SHEET

Truck Type & Cubic Yard Capacity	Borough	Truck shifts per day							
		Sun.	Mon.	Tues.	Wed	Thurs.	Fri.	Sat.	Total
1. Rear load ___yds	Manhattan								
	Brooklyn								
	Queens								
	Bronx								
	Staten Island								
	Total								
2. ____________ ___yds	Manhattan								
	Brooklyn								
	Queens								
	Bronx								
	Staten Island								
	Total								
3. ___________ ___yds	Manhattan								
	Brooklyn								
	Queens								
	Bronx								
	Staten Island								
	Total								
4. _____________ __yds	Manhattan								
	Brooklyn								
	Queens								
	Bronx								
	Staten Island								
	Total								

NEW YORK CITY COLLECTOR DATA – PAGE 4

B. RECYCLING TRUCK SHIFT WORK SHEET

Truck Type & Cubic Yard Capacity	Borough	Truck shifts per day							
		Sun.	Mon.	Tues.	Wed	Thurs.	Fri.	Sat.	Total
1. Rear load ___yds	Manhattan								
	Brooklyn								
	Queens								
	Bronx								
	Staten Island								
	Total								
2. ___________ ___yds	Manhattan								
	Brooklyn								
	Queens								
	Bronx								
	Staten Island								
	Total								
3. ___________ ___yds	Manhattan								
	Brooklyn								
	Queens								
	Bronx								
	Staten Island								
	Total								
4. ___________ ___yds	Manhattan								
	Brooklyn								
	Queens								
	Bronx								
	Staten Island								
	Total								

NEW YORK CITY COLLECTOR DATA – PAGE 5

CONSISTENCY CHECK QUESTIONS

Note questions and resolution of any inconsistencies in analyzing the faxed CWS2 forms and the BIC summary form:

COMMENTS AND SUGGESTIONS

What would you like to see done differently in New York City regarding waste collection and disposal?

Attachment 3

Expanded Tables of Recycling by Commodity

Table A.3-1
Commercial Putrescible Waste
Tons of Recycled Waste, 2003[(1)(2)(3)]
(Tons/Year)

Material	Manhattan	Brooklyn	Bronx	Queens	Staten Island	Total	Percent of Total Tons
Mixed Office Paper	267,344	99,070	28,873	46,472	992	442,751	51%
Old Corrugated Cardboard	80,934	59,943	45,032	115,557	19,963	321,429	37%
Sorted Office Paper	8,528	4,004	1,040	4,628	1,456	19,656	2%
Newspaper	4,498	3,432	650	3,432	0	12,012	1%
Textiles	4,164	3,885	105	3,885	46.6	12,085	1%
Wooden Pallets	16,707	5,633	2,398	5,594	1,066	31,397	4%
Organics	0	655	0	655	0	1,310	<1%
Bakery Waste	0	2,808	0	0	0	2,808	<1%
Bottles and Cans	14,709	6,719	2,879	6,719	1,280	32,306	4%
Plastic Bags	156	156	0	0	0	312	<1%
Metal	104	0	0	0	0	104	<1%
Total	397,144	186,305	80,976	186,942	24,803	876,170	100%
Percent of Total Tons	45%	21%	9%	21%	4%	100%	

Notes:
(1) Tons are rounded to the nearest whole number.
(2) Total tons include estimates from the carter survey, plus materials recycled from Transfer Stations from mixed loads, plus estimated deposit containers.
(3) Numbers may not add due to rounding.

Table A.3-2
Materials Recycled from Transfer Stations from Mixed Loads, 2003

Material	Non-Putrescible Transfer Stations	Putrescible Transfer Stations	Total Tons	Tons/day
Wood chips[(1)]	26,057	582	26,639	85
Old Corrugated Cardboard	4,481	348	4,829	15
Mixed Office Paper	931	479	1,410	5
Plastic bottles, jugs	994	0	994	3
Textiles	1,165	0	1,165	4
Totals	33,627	1,409	35,037	112

Notes:
(1) 50% of wood chips is assumed to come from commercial sector.
(2) Numbers may not add due to rounding.

Attachment 4

Discussion of Commercial Recycling through the Deposit System

Table A.4-1
Estimated Beverage Containers Recycled from the Commercial Sector through the Deposit System, 2003

	Glass (tons)	Plastic (tons)	Aluminum (tons)	Total (tons)[1]
Beer and Wine Products	28,000		450	28,450
Soda		1,400	1,150	2,550
Total	28,000	1,400	1,600	31,000

Note:
[1] Numbers may not add due to rounding.

The deposit container estimate was developed from a survey of recycling facilities and an analysis of beverage consumption market data combined with New York State Department of Environmental Conservation (NYSDEC) deposit initiation and redemption data for Region 2. Since the NYSDEC tracks deposits initiated or redeemed by dollars, the market consumption data is necessary to determine point of consumption (residential or commercial) and the material and size of the containers. The types of the various containers, by material and size, will impact the tons generated and recovered. The most recent data available were used in this analysis.

An estimated 28,000 tons of deposit glass containers were recovered through recycling facilities in 2002 (see Volume II, Appendix A). This same quantity was assumed for 2003. Although most of the deposit glass containers are from beer products, some wine products are also included. An analysis of beer consumption market data[1] would suggest an 85% commercial recycling rate of glass deposit containers in the City. NYSDEC deposit redemption data estimates a combined residential and commercial return rate of 72% for beer containers in 2001.[2] This suggests that the commercial sector recovers glass beer bottles at a higher rate than the residential sector.

The quantity of aluminum beer container generation was first estimated from The Beer Institute market consumption data, by gallons, for New York State adjusted to the City by population. On-premise sales of beer in aluminum packaging were estimated from national data.[3] The number of containers estimated from the marketing consumption data was then adjusted to match the NYSDEC deposit initiation data. Although the initiation of a deposit in the City, as tracked by NYSDEC, doesn't guarantee consumption within the City, the NYSDEC data is the best available information.[4] The adjusted number of containers was converted to tons with the factor 33.8 cans per pound.[5] The generation estimate was then combined with the NYSDEC average

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[1] The Beer Institute data by gallons consumed and packaging mix for New York State 2000 adjusted to 2001 from U.S. consumption data (www.beerinstitute.org). The data year 2000 was the latest available at the state level. Commercial on-premise sales by volume estimated from Miller Brewing Company 2002 national data (Chapters 1 and 2 www.sabmiller.com/beer%20is%20volume%20with%20profit.).

[2] NYSDEC. Beverage Container Deposit and Redemption Statistics, October 1, 2000 – September 30, 2001.

[3] Commercial on-premise sales by volume and packaging estimated from Miller Brewing Company 2002 national data (Chapters 1 and 2 www.sabmiller.com/beer%20is%20volume%20with%20profit.).

[4] The market consumption data estimate was 6% lower than the NYSDEC deposit initiation data.

[5] The Aluminum Association, 2004, www.aluminum.org.

redemption rate of 72% to estimate commercial aluminum beer container recycling in the City. The NYSDEC 2001 Region 2 redemption rate which combines both residential and commercial redemption was assumed for 2003. This analysis estimated 450 tons of aluminum beer containers were recycled from the City's commercial sector through the deposit system.

Similar to aluminum beer containers, aluminum and plastic deposit soda containers were estimated from a combination of market consumption data,[6] packaging data,[7] and NYSDEC deposit data. The Northeast regional market consumption data combined with the packaging data predicted a number of deposit containers in the City greater than the NYSDEC statistics. The City estimate, based on regional consumption, was reduced approximately 50% to match NYSDEC deposit initiation data. A call to a soft drink industry representative verified that the City does consume soft drinks at a level below the Northeast regional average. The specific level of consumption is not available to the public. The estimated generation of containers developed from the market consumption data and NYSDEC deposit initiation data was then combined with NYSDEC deposit redemption data. The NYSDEC estimated that soda containers were redeemed at a 49% rate in 2001. This rate was assumed for 2003. This analysis estimated 1,400 tons of plastic soda containers and 1,150 tons of aluminum soda containers were recycled from the commercial sector through the deposit system.

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[6] Beverage World, Regional soft drink consumption, May 2002. Gallons consumed per person per year.
[7] Datamonitor, United States - Soft Drinks Industry Profile, October 2002, www.datamonitor.com.

APPENDIX D

COMMERCIAL PUTRESCIBLE WASTE 20-YEAR FORECAST

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1.0 COMMERCIAL PUTRESCIBLE WASTE PROJECTIONS

This section of the Commercial Waste Management Study (Study) includes projections of commercial putrescible waste through the year 2024. The purpose of the commercial putrescible waste forecasts is to provide New York City (City) with an estimation of the quantity of waste that will have to be transferred and disposed over a 20-year planning period, as mandated by the Comprehensive Solid Waste Management Plan (New SWMP).

These projections are based on the following assumptions:

- Waste generation, on an average tons per employee basis, remains at 2003 levels for each borough;
- Waste generation, on an average tons per employee basis, remains constant across the community districts (CDs) within each borough; and
- The percentage recycling of waste generation, by borough, remains at 2003 levels.

By maintaining waste generation and recycling rates at 2003 levels, the projections in this section increase by the projected change in employment. Since world markets impact recycling, the more conservative approach of holding recycling rates at 2003 levels was chosen. No one can foresee with accuracy changes in the economy (e.g., booms and recessions), which affect the amounts of waste generation. In addition, it is difficult to predict how innovations and new products will affect the amounts. However, in spite of inherent limitations, for planning purposes it is still useful to look at projections.

These projections of the putrescible fraction of the City's commercial waste are based upon:

- Quarterly in-City putrescible Transfer Station reports for 2003 (City Department of Sanitation [DSNY] Quarterly Transfer Station Reports, or Quarterly Reports);
- The estimate of commercial putrescible waste recycling quantities developed from the Business Integrity Commission (BIC) and DSNY 2003 survey data, plus estimated recycling at City Transfer Stations, plus estimated recycling through the deposit container redemption system; and
- Current and projected employment statistics.

1.1 2003 Baseline Estimate of Commercial Putrescible Waste

An employment-based generation model was used, for comparison purposes, to estimate 2003 commercial putrescible waste quantities. Current employment statistics (2003) were entered into the model and the model results were then compared to the generation estimate developed from the BIC-DSNY carter survey conducted in 2003 and reported in this Study in Volume II, Appendix C. The employment-based generation model estimate is approximately 12% higher than the 2003 BIC-DSNY carter survey results.

The employment-based generation model results were also compared to the generation estimate developed from the Quarterly Reports plus the recycling estimates. The Quarterly Reports disposal estimate was based on the first three quarters of 2003; the data were annualized. The employment-based generation model estimate is approximately 10% higher than the Quarterly Reports plus the recycling estimate.

It was determined that the 2003 Quarterly Reports plus the recycling estimate provided a baseline estimate that was more realistic than the employment-based model. Therefore, the 2003 Quarterly Reports plus the commercial recycling estimate was chosen as the baseline for the New SWMP Planning Period forecast estimates.

For the projection estimates, the 2003 generation estimate developed from the Quarterly Reports plus the commercial recycling estimate was used to create factors that were then applied to City employment forecast data. Employment was chosen as the forecast indicator because job growth (or loss) will directly affect waste generation. Additionally, since employment forecast data are readily available, the waste quantity projections can be adjusted when the City employment forecast data are updated. The factors remained constant through the time series. The forecast estimates are in four- or five-year intervals through 2024.

1.2 Development of City Employment Forecast Data

Employment data were developed by Parsons Brinckerhoff using data from the New York Metropolitan Transportation Council (NYMTC). (See Volume II, Appendix B, Attachment 1.) NYMTC prepared employment projections for the City through the year 2025 early in 2001, basing their projections on the most current employment data available at that time. The categories of employment included total employment, total basic and total non-basic industries, and several "land use" categories (e.g., retail employment, office employment, etc.), which were pertinent to NYMTC tasks. The resultant NYMTC projections were prepared at county and census tract levels.

The 2000 NYMTC projections of employment were revised by NYMTC over the course of 2002 and 2003 to account for the effects of September 11 and superceded in July 2003 when an interim update of the projections was published by NYMTC in a supplement titled, "Demographic and Socioeconomic Forecasting Post September 11 Impacts, Technical Memoranda 3.1 and 3.2." This reported and accounted for the direct effects of September 11 -- both direct job loss in the City and geographic redistribution of employment within the City. These interim projections remained in the same format as the earlier projections (i.e., by counties and census tracts and using similar employment categories).

New projections from base years more recent than 2000 are under preparation by NYMTC at the time of this Study; however, at the time of this report, results were not available. Therefore, the interim projections have been utilized as the fundamental employment projection data on which the City Department of Sanitation (DSNY) waste estimation model relies.

Additional modifications to these interim projections, however, have been made in order to reflect baseline (2002) conditions at the CD level. First, the projections, which were available at the census tract level, have been translated into CDs according to City Department of City Planning (NYCDCP) guidance. Second, the job loss resulting from the effects of economic recession in the City, which was not reflected in the NYMTC interim projections, has also been incorporated into the projections on which the projections herein rely.

The NYMTC projections, which have been developed by its various associated agencies, account for such factors as regional trends in the metro area. They have also been made readily available to DSNY and are in public use. The interim projections, which also account for in-City redistribution of jobs since September 11, are the only such projections to 2025 available at the census tract level. These interim projections are necessary to generate employment projections for the New SWMP Planning Period. Therefore, in an effort to maximize the use of existing data, DSNY adjusted these projections only as necessary and possible to better reflect existing employment conditions, according to currently available employment data. Since the projections were prepared in five-year intervals from 2005 to 2025, a straight-line projection was assumed to derive projections for the year 2024.

The interim projections, once translated into CD-level geographies, were further adjusted to:

- Reflect 2000-2003 employment loss attributable to economic recession; and
- Maintain as accurately as possible the distribution of employment by industry sector.

Table 1.2-1 shows the employment forecast data, by borough, for 2003 through 2024.

1.3 Distribution of Commercial Putrescible Waste Generation to the Borough Level

The 2003 carter survey conducted by BIC-DSNY tabulated the origin of the commercial putrescible waste, by borough, as well as the quantities generated. These percentages were applied to the 2003 citywide waste generation total to estimate borough commercial putrescible waste generation. The origin of commercial putrescible waste by borough shown in this section reflects the percentages estimated through the survey.

The total quantity of waste generated in each borough in 2003 was divided by the total number of employees in each borough in 2003. These borough-specific average waste generation factors remained constant through 2024. The factors, on a tons per employee per year basis, are:

- Bronx 1.951;
- Brooklyn 1.381;
- Manhattan 0.677;
- Queens 1.312; and
- Staten Island 1.780.

Table 1.2-1
New York City Employment Forecast by Borough, 2003 through 2024

Borough	2003	2005	2010	2015	2020	2024
Bronx	203,965	204,865	211,763	217,157	227,169	234,905
Brooklyn	433,236	435,556	442,393	448,092	457,946	463,513
Manhattan	1,929,010	2,000,769	2,038,921	2,077,099	2,111,357	2,136,387
Queens	474,963	478,011	488,959	497,629	513,198	523,274
Staten Island	89,742	90,579	94,610	97,363	100,796	102,676
Total[(1)]	**3,130,916**	**3,209,780**	**3,276,646**	**3,337,340**	**3,410,466**	**3,460,755**

Note:
(1) Employment forecast data exclude education employees and local government employees.

The waste generation factors developed at the borough level were also assumed at the CD level. Tables showing commercial putrescible waste generation, at the CD level, are included as an attachment to this appendix. However, these estimates should be used with caution. The borough average generation factor may not be a good indicator for every CD within that borough, as one single large employer can greatly impact the average.

1.4 Commercial Putrescible Waste Recycled and Disposed Estimates

The commercial putrescible waste generation is that quantity of waste generated prior to any recycling efforts.[1] The 2003 BIC-DSNY survey of commercial collection firms, the estimated recycling at City Transfer Stations and estimated recycling through the deposit container redemption system were the sources for the recycled quantity estimates (for detail see Volume II, Summary Report, Table 3.2-1). The estimated recycling rates were developed from the 2003 data, which documented the quantity of materials recovered for recycling. To calculate the recycling rate, the quantity of recycled material was divided into the sum of recycled material plus waste disposed as determined from the 2003 Quarterly Reports. The data allowed for this calculation at the borough level. The recycling rates, by borough, are assumed to remain constant through 2024. For example, Manhattan recycled approximately 29% of the commercial putrescible waste that they generated in 2003 (71% was disposed); this rate (29%) was assumed through 2024 for Manhattan. The recycling percentages then were applied to the forecasted waste generation to obtain tonnage estimates for each four- or five-year interval.

The disposal estimates equal commercial putrescible waste generation minus commercial putrescible recycling for each borough.

1.5 Development of Final Database and Results

The final database for the commercial putrescible waste projections combined the generation factors developed from 2003 data collected by the in-City putrescible Transfer Stations in the Quarterly Reports plus the recycling estimate, the employment forecasts by borough and CD, waste origin (from the BIC-DSNY survey) and estimated recycling rates developed from the 2003 recycling data.

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[1] Generation equals recycling plus disposal.

Table 1.5-1 shows citywide generation, recycling and disposal estimates for 2003 and 2005 through 2024 at four- or five-year intervals. Waste origin, by borough, is included in Table 1.5-2. Commercial putrescible waste generation by borough is shown in Table 1.5-3. The estimated recycling rate for each borough is shown in Table 1.5-4, and commercial putrescible waste recycling and disposal estimates, by borough, are shown in Tables 1.5-5 and 1.5-6.

Table 1.5-1
New York City Estimated Commercial Putrescible Waste Generation, Recycling and Disposal, 2003 through 2024

New York City	2003 (tons)	2005 (tons)	2010 (tons)	2015 (tons)	2020 (tons)	2024 (tons)
Generation	3,086,000	3,145,000	3,214,000	3,275,000	3,358,000	3,414,000
Recycling	824,000	840,000	858,000	874,000	895,000	909,000
Disposal	2,262,000	2,305,000	2,356,000	2,401,000	2,463,000	2,505,000

Table 1.5-2
Origin of Commercial Putrescible Waste Generation by Borough, 2003[(1)(2)]

	Percent of Generation
Bronx	12.9%
Brooklyn	19.4%
Manhattan	42.3%
Queens	20.2%
Staten Island	5.2%
New York City	100%

Notes:
(1) Numbers may not add due to rounding.
(2) Source: Commercial Waste Management Study, Volume II, Appendix C.

Table 1.5-3
Generation of Commercial Putrescible Waste by Borough, 2003 through 2024[(1)(2)(3)]

	2003 (tons)	2005 (tons)	2010 (tons)	2015 (tons)	2020 (tons)	2024 (tons)
Bronx	398,000	400,000	413,000	424,000	443,000	458,000
Brooklyn	599,000	602,000	611,000	619,000	633,000	640,000
Manhattan	1,306,000	1,355,000	1,380,000	1,406,000	1,429,000	1,446,000
Queens	623,000	627,000	642,000	653,000	673,000	687,000
Staten Island	160,000	161,000	168,000	173,000	180,000	183,000
Total (tons/yr)	**3,086,000**	**3,145,000**	**3,214,000**	**3,275,000**	**3,358,000**	**3,414,000**

Notes:
(1) 2003 numbers derived by multiplying generation quantities (Table 1.5-1) by borough of origin (Table 1.5-2). 2005 through 2024 numbers derived from employment generation factors.
(2) Numbers may not add due to rounding.
(3) Numbers for 2003 are preliminary, and not based upon a full year's worth of data. These numbers will be updated when data are available.

Table 1.5-4
Estimated Commercial Putrescible Waste Recycling Rate by Borough[(1)]

	Percent of Generation
Bronx	19.3
Brooklyn	29.2
Manhattan	28.6
Queens	28.3
Staten Island	14.4
New York City	26.7

Notes:
(1) Source: Percentages calculated from 2003 BIC-DSNY carter survey data or recycling at City Transfer Stations plus estimated recycling through the deposit container redemption system. It should be noted that these percentages are based upon preliminary data for 2003, and will be updated as more information becomes available.

Table 1.5-5
Recycling of Commercial Putrescible Waste by Borough, 2003 through 2024[(1)(2)]

	2003 (tons)	2005 (tons)	2010 (tons)	2015 (tons)	2020 (tons)	2024 (tons)
Bronx	77,000	77,000	80,000	82,000	86,000	89,000
Brooklyn	175,000	176,000	179,000	181,000	185,000	187,000
Manhattan	373,000	387,000	394,000	402,000	408,000	413,000
Queens	176,000	177,000	181,000	184,000	190,000	194,000
Staten Island	23,000	23,000	24,000	25,000	26,000	26,000
Total (tons/yr)	**824,000**	**840,000**	**858,000**	**874,000**	**895,000**	**909,000**

Notes:
(1) Derived by multiplying generation quantities (Table 1.5-3) by borough estimated recycling rate (Table 1.5-4).
(2) Numbers may not add due to rounding.

Table 1.5-6
Disposal of Commercial Putrescible Waste by Borough, 2003 through 2024[(1)(2)]

	2003 (tons)	2005 (tons)	2010 (tons)	2015 (tons)	2020 (tons)	2024 (tons)
Bronx	321,000	323,000	333,000	342,000	357,000	369,000
Brooklyn	424,000	426,000	432,000	438,000	448,000	453,000
Manhattan	933,000	968,000	986,000	1,004,000	1,021,000	1,033,000
Queens	447,000	450,000	461,000	469,000	483,000	493,000
Staten Island	137,000	138,000	144,000	148,000	154,000	157,000
Total (tons/yr)	**2,262,000**	**2,305,000**	**2,356,000**	**2,401,000**	**2,463,000**	**2,505,000**

Notes:
(1) Derived by subtracting recycling quantities (Table 1.5-5) from generation quantities (Table 1.5-3).
(2) Numbers may not add due to rounding.

Attachment 1

Estimated Commercial Putrescible Waste Generation, 2003 through 2024, by Borough

Bronx
Estimated Commercial Putrescible Waste Generation, 2003 through 2024

Community District	2003 (tons)	2005 (tons)	2010 (tons)	2015 (tons)	2020 (tons)	2024 (tons)
1	41,200	41,300	42,800	43,900	46,000	47,600
2	30,800	31,700	32,500	33,200	34,400	35,300
3	18,200	18,200	18,800	19,300	20,200	20,900
4	37,300	37,400	38,800	39,900	42,000	43,700
5	19,300	19,400	20,200	21,000	21,900	22,800
6	25,500	25,500	26,300	26,900	28,000	28,900
7	48,600	48,700	50,500	51,800	54,300	56,200
8	29,500	29,600	30,800	31,700	33,300	34,600
9	32,000	32,000	33,300	34,200	36,000	37,300
10	31,800	31,900	32,900	33,600	35,100	36,200
11	46,400	46,500	47,800	48,800	50,700	52,200
12	37,400	37,500	38,700	39,600	41,300	42,600
Total[(1)]	**398,000**	**399,700**	**413,400**	**423,900**	**443,200**	**458,300**

Notes:
(1) Numbers may not add due to rounding.

Brooklyn
Estimated Commercial Putrescible Waste Generation, 2003 through 2024

Community District	2003 (tons)	2005 (tons)	2010 (tons)	2015 (tons)	2020 (tons)	2024 (tons)
1	56,500	56,800	57,700	58,400	59,700	60,400
2	105,100	105,700	107,400	108,800	111,100	112,500
3	25,200	25,300	25,700	26,000	26,600	26,900
4	17,400	17,500	17,800	18,000	18,400	18,600
5	31,300	31,400	31,900	32,300	33,100	33,500
6	37,200	37,400	38,000	38,500	39,300	39,800
7	35,700	35,900	36,400	36,900	37,700	38,200
8	14,700	14,800	15,100	15,300	15,600	15,800
9	16,400	16,500	16,800	17,000	17,400	17,600
10	30,700	30,900	31,300	31,700	32,400	32,800
11	29,400	29,500	30,000	30,400	31,000	31,400
12	46,700	47,000	47,700	48,300	49,400	50,000
13	18,100	18,200	18,500	18,700	19,100	19,300
14	31,800	31,900	32,400	32,900	33,600	34,000
15	34,200	34,400	35,000	35,400	36,200	36,600
16	11,600	11,600	11,800	12,000	12,200	12,400
17	24,500	24,700	25,100	25,400	25,900	26,300
18	32,100	32,300	32,800	33,200	33,900	34,300
Total[1]	**598,600**	**601,800**	**611,400**	**619,200**	**632,600**	**640,400**

Notes:
(1) Numbers may not add due to rounding.

Manhattan
Estimated Commercial Putrescible Waste Generation, 2003 through 2024

Community District	2003 (tons)	2005 (tons)	2010 (tons)	2015 (tons)	2020 (tons)	2024 (tons)
1	198,800	204,100	206,900	209,800	212,300	214,200
2	86,500	87,200	87,600	88,000	88,300	88,500
3	27,400	27,700	27,900	28,000	28,200	28,300
4	99,900	122,300	134,100	146,000	156,600	164,400
5	533,500	545,900	552,500	559,100	565,000	569,400
6	155,400	159,300	161,400	163,500	165,400	166,800
7	45,900	47,000	47,600	48,300	48,800	49,200
8	89,700	90,500	90,900	91,400	91,700	92,000
9	22,000	22,000	22,000	22,000	22,000	22,000
10	8,600	9,100	9,300	9,500	9,800	9,900
11	21,200	22,400	23,000	23,600	24,100	24,500
12	15,200	15,200	15,200	15,200	15,200	15,300
Central Park	1,800	1,800	1,800	1,800	1,800	1,800
Total(1)	**1,305,900**	**1,354,500**	**1,380,200**	**1,406,200**	**1,429,200**	**1,446,300**

Notes:
(1) Numbers may not add due to rounding.

Queens
Estimated Commercial Putrescible Waste Generation, 2003 through 2024

Community District	2003 (tons)	2005 (tons)	2010 (tons)	2015 (tons)	2020 (tons)	2024 (tons)
1	66,000	66,400	68,000	69,300	71,600	73,100
2	67,400	67,800	69,300	70,600	72,700	74,200
3	53,300	53,600	54,800	55,800	57,500	58,600
4	33,700	33,900	34,700	35,300	36,400	37,100
5	54,400	54,800	56,000	57,000	58,800	59,900
6	86,300	86,800	88,800	90,400	93,200	95,000
7	69,400	69,800	71,400	72,600	74,900	76,400
8	34,300	34,500	35,300	35,900	37,100	37,800
9	20,200	20,400	20,800	21,200	21,800	22,300
10	13,800	13,900	14,200	14,500	14,900	15,200
11	26,800	27,000	27,600	28,100	29,000	29,500
12	62,900	63,300	64,700	65,900	67,900	69,200
13	23,000	23,100	24,000	24,100	24,800	25,300
14	11,700	11,800	12,000	12,300	12,600	12,900
Total(1)	**623,200**	**627,100**	**641,600**	**653,000**	**673,200**	**686,500**

Notes:
(1) Numbers may not add due to rounding.

Staten Island
Estimated Commercial Putrescible Waste Generation, 2003 through 2024

Community District	2003 (tons)	2005 (tons)	2010 (tons)	2015 (tons)	2020 (tons)	2024 (tons)
1	86,100	86,900	90,700	93,400	96,700	98,500
2	49,500	50,000	52,200	53,700	55,600	56,600
3	24,200	24,400	25,500	26,200	27,200	27,700
Total[1]	**159,800**	**161,300**	**168,400**	**173,300**	**179,500**	**182,800**

Notes:
(1) Numbers may not add due to rounding.

APPENDIX E

NON-PUTRESCIBLE COMMERCIAL WASTE QUANTIFICATION AND PROJECTIONS

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1.0 ESTIMATED QUANTITIES OF CONSTRUCTION AND DEMOLITION DEBRIS AND CLEAN FILL

1.1 Introduction

This report estimates and projects through 2024 the quantities of non-putrescible waste and clean fill generated in New York City (City). Together, these two waste stream components are generally referred to as construction and demolition (C&D) debris. The City defines non-putrescible waste[1] and clean fill[2] according to the type of materials being discarded. Both waste streams consist of inert materials and both might include materials from building construction, demolition or renovation or materials resulting from non-building construction such as road or bridge work. Clean fill loads mostly consist of single materials such as dirt, concrete, asphalt millings or gravel. Non-putrescible waste tends to include these same materials, but generally in loads with multiple materials. Non-putrescible waste also includes many building-related materials, such as sheetrock, plaster, electrical cables, piping, window frames, etc.

Most communities in the United States do not separate C&D debris into the categories used by the City. Rather, C&D debris is broken down into two major categories: 1) building-related debris generated from building construction, demolition and renovation; and 2) non-building debris generated from activities such as road construction, sewer installation and bridge renovation or construction. In order to project C&D quantities for the City, predictive data series were obtained from F.W. Dodge, enabling predictions of building- and non-building-related C&D debris. As these are the only predictive data series available, the City Department of Sanitation's (DSNY) Consultant developed estimates of the sum of non-putrescible and clean fill for the City. Clean fill is projected by utilizing its historic percentage and applying that percentage to the sum of building-related and non-building-related C&D.

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[1] Non-putrescible solid waste, as defined in DSNY regulations (Subchapter A of 4 RCNY 16), is solid waste, whether or not contained in receptacles, that does not contain organic matter having the tendency to decompose with the formation of malodorous by-products, including but not limited to dirt, earth, plaster, concrete, rock, rubble, slag, ashes, waste timber, lumber, Plexiglas, fiberglass, ceramic tiles, asphalt, sheetrock, tar paper, tree stumps, wood, window frames, metal, steel, glass, plastic pipes and tubes, rubber hoses and tubes, electric wires and cables, paper and cardboard.

[2] Fill material, as defined in DSNY regulations, is only clean material consisting of earth, ashes, dirt, concrete, rock, gravel, asphalt millings, stone or sand, provided that such material shall not contain organic matter having the tendency to decompose with the formation of malodorous by-products.

1.2 Report Organization

This report is organized as follows. First, aggregate current quantities of C&D debris are determined, as reported in the DSNY's non-putrescible and fill material Quarterly Transfer Station Reports (Quarterly Reports). Next, future generation amounts are projected. To project C&D quantities into the future, however, it is necessary to relate the quantity of C&D to activities that result in the generation of this waste. The factors utilized are the projected amount of building activity and non-building construction and maintenance activity. Section 3.0 presents estimates of C&D in the City categorized as building-related and non-building-related, using data from F. W. Dodge regarding the level of such activities. These projections are used to derive an overall C&D estimate range, which in turn is separated into DSNY's categories using the relative proportions observed in recent years. The results are summarized and compared to those obtained in several other jurisdictions.

2.0 C&D DEBRIS IN NEW YORK CITY

2.1 Background

In 2000, there were 30 non-putrescible Transfer Stations (TSs) in the City. By early 2003, the number had been reduced to 28. These non-putrescible Transfer Stations typically receive C&D debris in roll-off containers. C&D debris consists of all the inert materials generated during building construction, demolition or remodeling. These materials include wood, metals, sheetrock, concrete, porcelain fixtures, appliances, carpeting, tiles, roofing materials, and, from non-building sources, asphalt, fill and large metals. Some Transfer Stations sort the materials to recover recyclables, such as metal, wood and aggregate. C&D debris, less quantities recycled, must be disposed of in landfills outside the City limits. After recycling and/or densification, the residuals of C&D processing are hauled out of the City in transfer trailers for disposal.

Most new construction in the City takes place on sites that require the demolition of existing buildings, while renovation is common in commercial and residential buildings when there is a change of tenancy. Typically, C&D debris is collected by a firm in the waste hauling (carter) or recycling business, hired as a subcontractor by the firm doing the construction, demolition or renovation work. C&D carters are licensed by the Business Integrity Commission (BIC). A small minority of the C&D debris is self-hauled by the firm or resident doing the work.

2.2 DSNY Quarterly Transfer Station Reports

The private non-putrescible Transfer Stations in the City are required to provide Quarterly Reports to the DSNY on the quantities of materials received, processed, recycled and disposed. As of early 2003, four (4) of these Transfer Stations did not use scales to weigh inbound loads; their reports list cubic yards received, which are converted to tons using density factors for various materials. Mixed C&D debris is converted to tons at a density of 1,500 pounds per cubic yard (lbs/cy).[3] Loads of recyclables are converted at a density of 500 lbs/cy. Most loads of a

[3] This is the density factor for C&D debris provided by the New York State Department of Environmental Conservation (NYSDEC).

single type of fill material (road building material, gravel, dirt, rocks, asphalt, and concrete) are converted at densities of approximately 2,200 lbs/cy. In 2000, approximately 49% of the materials received by non-putrescible Transfer Stations was weighed. By 2003, the figure rose to approximately 60%.

In early 2003, there were 20 fill material Transfer Stations licensed by the DSNY. None of these stations weighed incoming or outgoing debris. These materials are converted to tons either by the Transfer Station itself or by the DSNY, using the density factors for various materials referred to above.

Table 2.2-1 presents a summary of reported and estimated tons received by non-putrescible and fill material Transfer Stations for the first quarter of 2003. As indicated, there is a difference in the average weight of mixed C&D arriving at non-putrescible Transfer Stations and fill material Transfer Stations. In early 2003, approximately 60% of the non-putrescible Transfer Stations weighed incoming materials received just over 80% of aggregate non-putrescible materials. These stations provide DSNY with both cubic yards and tons of this material. When the density is actually computed for these weighed tons of mixed C&D debris, the density is 732 lbs/cy (calculated density). The DSNY uses 1,500 lbs/cy to estimate the weight of materials reported by non-putrescible Transfer Stations without scales. For the first quarter of 2003, estimated tons of mixed C&D debris are equal to 526,623 tons at the default density of 1,500 lbs/cy, and 443,927 tons at the calculated density of 732 lbs/cy. Assuming the unweighed tons approximate the provided density of 732 lbs/cy for the weighed tons, this results in an aggregate overestimate equal to 82,676 tons. It should be noted that these estimates are preliminary, as a full year's worth of data was not available at the time that this estimate was prepared, and are only utilized for comparative purposes.

Table 2.2-1
2003 DSNY C&D Debris
Utilizing Data for First Quarter of 2003

Input Material	Default Density (lbs/cy)	Tons by Type of Transfer Station		
		Non-Putrescible	Clean Fill	Total
Mixed C&D				
Weighed tons		351,085	78,789	429,874
calculated density (lbs/cy)		732	2,173	
Estimated tons	1,500			
@ calculated density		78,780	154,935	233,715
@ default density		161,456	224,422	385,878
Concrete	2,260	2,547	233,255	234,227
Road building material	2,320	991	76,833	77,824
Rock/Dirt/Fill	2,420	3,432	578,384	582,948
Gravel/Stone/Rocks	2,420	0	15,521	15,521
Bulk metal	500	963	0	1,281
Wood	500	4,717	0	6,274
Total tons				
@ calculated density		442,515	1,137,718	1,581,665
@ default density		526,191	1,207,205	1,733,828
Overestimate (Underestimate)		**82,676**	**(69,487)**	**13,189**
As a percent of total at calculated density		18.7%	-5.8%	0.8%

Notes:
lbs/cy = pounds per cubic yard

For fill material, the provided density is 2,173 lbs/cy for mixed C&D while the default density used by DSNY remains at 1,500 lbs/cy. Thus, fill is underestimated by 277,949 tons, which amounts to 5.8% of the total quantity of fill.

When aggregated, these overestimates and underestimates approximately cancel each other out. There is a less than 1% difference in the total tons computed using the provided density and the total tons computed using the default density. Some variation may be expected given the varying densities of the various components comprising C&D. As greater quantities of the heavier clean fill are delivered, DSNY may be underestimating the tonnage by utilizing the default density of 1,500 lbs/cy. The DSNY's aggregate C&D figures will be utilized as the baseline to project the total quantity of non-putrescible waste from the year 2003 through 2024.

2.3 Total Estimated Quantities of C&D Debris

Table 2.3-1 presents the daily average tonnages of fill and non-putrescible material by quarter, for the years 2000 through the first three quarters of 2003. As shown by this table, the amount of non-putrescible waste has increased by approximately 8.9% since the year 2000. Fill material, however, has increased dramatically over the same period of time, increasing by 70.1%. This same rate of growth cannot be expected to continue through the New SWMP Planning Period, and shows the high degree of variability in C&D generation from year to year. This variability makes it difficult to predict the future generation of C&D quantities and leads to the conclusion that a range of values may be more appropriate for predicting future C&D quantities.

Table 2.3-2 also presents the DSNY-reported quantities of clean fill and non-putrescible waste, which together equal the total quantity of C&D waste in the City, for the years 2000, 2001, 2002 and 2003, both on a tons per day and tons per year basis. C&D ranged from 6.35 million tons in 2000 to 7.91 million tons in 2002. For 2003, total tons are estimated at 8.64 million, by utilizing data from the first three quarters of 2003, and assuming that the 4th quarter would average 100% of the 3rd quarter for fill, and 90% of the 3rd quarter for C&D (as was the case in years 2000-2002). Average daily tonnage is in the 20,000 to 27,000 range, and it has increased steadily over these four years. It is not known if the trend will continue to rise, or if tonnages will, over time, revert to quantities more typical of the year 2000. The average of the three years for which complete data is available is just under 7 million tons. As also shown by the table, on average, clean fill represented approximately 60% of the total amount of C&D for the years 2000 through 2002, and non-putrescible C&D represented the remaining 40%. However, as shown by the 2003 data, clean fill appears to be accounting for an ever larger percentage of C&D debris, totaling almost 70%. Therefore, in allocating the total quantity of non-putrescible waste into C&D and clean fill constituents, a range will be shown with clean fill constituting between 60% and 70% of the total material, and C&D constituting between 30% and 40% of the total.

Table 2.3-1
DSNY Quarterly Reports
Year 2000-2003

DSNY Quarterly Reports Data - Fill Material				
Period	**2000 (tpd)**	**2001 (tpd)**	**2002 (tpd)**	**2003 (tpd)**
Quarter 1	8,847	9,192	12,347	14,801
Quarter 2	11,819	13,024	15,875	20,054
Quarter 3	11,687	12,258	19,186	20,718
Quarter 4	11,210	12,348	19,505	N/A
Average of all Quarters	10,891	11,706	16,728	18,524
% Change Year to Year		7.5%	42.9%	10.7%
% Change from Year 2000 to Year 2003				**70.1%**
DSNY Quarterly Reports Data - Non-Putrescible (C&D) Material				
Period	**2000 (tpd)**	**2001 (tpd)**	**2002 (tpd)**	**2003 (tpd)**
Quarter 1	8,022	9,438	8,065	7,020
Quarter 2	9,854	10,562	8,567	9,303
Quarter 3	10,726	10,078	9,222	9,580
Quarter 4	9,301	8,862	8,587	N/A
Average of all Quarters	9,475	9,735	8,610	8,634
% Change Year to Year		2.7%	11.6%	0.3%
% Change from Year 2000 to Year 2003				**-8.9%**

Table 2.3-2
Total Estimated Quantity of C&D in New York City

Item	Year			Average	2003[2]
	2000	2001	2002		
Tons per day input[1]					
Non-Putrescible C&D	9,475	9,735	8,610	9,274	8,626
Clean Fill C&D	10,891	11,706	16,729	13,109	19,069
Total C&D	20,366	21,441	25,340	22,382	27,695
Tons per year input					
Non-Putrescible C&D	2,956,200	3,037,398	2,686,398	2,893,332	2,691,390
Clean Fill C&D	3,398,070	3,652,194	5,219,526	4,089,930	5,949,450
Total C&D	6,354,270	6,689,592	7,905,924	6,983,262	8,640,840
Clean fill as percent of Total C&D	53.5%	54.6%	66.0%	58.6%	68.9%

Notes:
(1) Based upon 312 days per year of operation.
(2) 2003 consists of first three quarters, plus fourth quarter estimated at 90% of third quarter for non-putrescible and 100% of third quarter tonnages for fill material.

3.0 RESIDENTIAL CONSTRUCTION AND DEMOLITION DEBRIS ESTIMATES

This section provides estimates of the generation of C&D debris from residential construction, demolition and renovation. In order to approximate the difference in the characteristics of the City's housing stock in Staten Island compared to the other four boroughs, single-family C&D generation factors are used for Staten Island, and multi-family/commercial figures are used for the remaining boroughs.

3.1 Residential C&D Generation Factors

In order to estimate residential construction, demolition and renovation debris, one must first obtain waste generation factors specific to these activities in the residential sector. These waste generation factors were assembled, using a combination of sources obtained from the literature and surveys of construction firms and C&D haulers in the New York region. Next, the square footage of residential construction, demolition and renovation is projected through the year 2024. Finally, the appropriate residential waste generation factor is multiplied by the square footage to estimate C&D generation.

Table 3.1-1 presents the data used to derive waste generation factors. In summary, these averages used to estimate C&D from construction, demolition and renovation are:

- Residential construction debris at a rate of 4.10 pounds per square foot for single-family construction and 3.99 pounds per square foot for multi-family construction. This is combined into a weighted average of 4.02 pounds per square foot.
- Residential demolition debris at a rate of 85.10 pounds per square foot for single-family dwellings and 50.50 pounds per square foot for multi-family dwellings.
- Residential renovation at a weighted average rate of 27.30 pounds per square foot.

Table 3.1-1
Residential Construction, Demolition and Renovation Waste Generation Factors

Generation Factor (Pounds per Square Foot)	Comments	Source
4.00	National single-family	Jim Johnson, "OCC Means Volume at Sites," *Waste News*, March 31, 2003. Source: National Association of Home Builders Research Center.
5.47	Converted from 0.012 to 0.02 cubic yards/square foot @ 342 lbs/cubic yard. (See Table A-2)	*Illinois Construction and Demolition Site Recycling Guidebook,* Illinois Department of Commerce and Community Affairs. November 1997.
4.38	National single-family	Franklin Associates, Ltd. *Characterization of Building-Related Construction and Demolition Debris in the United States,* United States Environmental Protection Agency (USEPA), Office of Solid Waste, EPA530-R-98-010. June 1998.
2.96	Illinois sample. Average of range 1.92 –4.0 pounds per square foot.	*DuPage County Construction and Demolition Waste Survey and Education Program Report*, DuPage County Solid Waste Department and Illinois Department of Commerce and Community Affairs, November 1997.
3.35	1.5 pounds of wood /square foot, comprising 44.8% of residential construction debris.	Jim Johnson, "All Roads Lead to Landfill," *Waste News*, March 31, 2003. Source: National Association of Home Builders Research Center.
4.47	Average of 1.3 to 2.1 lbs. of wood /square foot, comprising 44.8% of residential construction debris.	Lynn Merrill, "Small Guys, Big Business," *Waste Age,* October 2000 Source: National Association of Home Builders Research Center.
4.10	National single-family. Average of 3.0 to 5.2 pounds per square foot.	*Residential Construction Waste Management: A Builder's Field Guide,* National Association of Home Builders Research Center.
4.10	**Average Single-Family Construction**	
3.99	**Average Multi-Family Construction (New York City)**	**Interviews with five construction companies in New York City.**
115.00	National single-family [(1)]	Franklin Associates, Ltd. *Characterization of Building-Related Construction and Demolition Debris in the United States,* USEPA, Office of Solid Waste, EPA530-R-98-010. June 1998.
55.20	Single-family demolition, 0.1 cubic yards per square foot, converted at 552 pounds per sq. ft.	Interview with Haggard Construction and WLNNS Demolition, Hopatcong, New Jersey.
85.10	**Average Single-Family Demolition**	
64.40	Multi-family public housing in Hartford, CT.	USEPA, *Building Savings: Strategies for Waste Reduction of Construction and Demolition Debris from Buildings, June 2000.*
36.56	Multi-family demolition, estimated at 0.0666 cubic yards per square foot, converted at 549 pounds per square foot.	Interview with URS Engineers, New York, New York (Chief Estimating Engineer).
50.50	**Average Multi-Family Demolition**	
9.0	Average of 7 to 11 pounds for whole house remodeling. 10% weighting.	*A Field Guide for Residential Remodelers,* National Association of HomeBuilders Research Center.
35.5	Average of 4 to 67 pounds per square foot, kitchen remodeling. 40% weighting.	*A Field Guide for Residential Remodelers,* National Association of HomeBuilders Research Center.
37.5	Average of 5 to 70 pounds per square foot, bathroom remodeling. 30% weighting.	*A Field Guide for Residential Remodelers,* National Association of HomeBuilders Research Center.
4.0	Average of 3 to 5 pounds per square foot, roof remodeling. 10% weighting.	*A Field Guide for Residential Remodelers,* National Association of HomeBuilders Research Center.
5.5	Average of 3 to 8 pounds per square foot, deck remodeling. 10% weighting.	*A Field Guide for Residential Remediless,* National Association of Homebuilders Research Center.
27.3	**New York City Residential Renovation Weighted Average**	

Note:

(1) This estimate includes concrete from basements, slabs, and driveways. Without these inclusions, the Franklin Associates figure for single-family is 49.5 pounds per square foot.

The waste generation factors for residential construction debris in Table 3.1-1 indicate that there is a general consensus on the waste generation rates per square foot of residential construction. Of the seven sources, four are in the 4.00 to 4.50 pounds per square foot range. The average waste generation is 4.10 pounds per square foot.

For multi-family construction waste generation, the average of information obtained during interviews with five City construction firms is used. This is derived based on the following average scenario: container use over the course of an average multi-family construction job averages one 30-cubic-yard container per week. This would apply to construction of a 25-story building with 375,000 square feet, occurring over 18 to 24 months, or in 21 months on average. Over the course of this 1.75-year period, 2,730 cubic yards of debris would be generated, which equates to 749 tons of debris, using a construction debris density of 549 lbs/cy. (See Attachment 1 and Table A-2.) This equates to a generation rate of 3.99 pounds per square foot. This is the generation factor used for multi-family construction.[4] Except for Staten Island, which has a high proportion of single-family housing, most of the City's residential construction is multi-family units. A weighted average generation factor of 4.02 pounds per square foot was applied to account for the relative weighting of projected square footage of single- and multi-family construction in the City.

3.2 Projections of Residential Construction, Demolition and Renovation Activity

Data on the annual square feet of residential construction in each of the City's five boroughs was obtained from F.W. Dodge. These data are actual figures through 2002, and estimates through 2007. A least squares regression was fitted to the available data and the resulting equation was used to estimate square feet of construction in the City through 2024. The square feet of residential construction within the City between 1997 and 2007 can be estimated using the following equation:

[4] As most of the United States is housed in single-family or low-rise multi-family structures, there are few estimates of higher-rise multi-family C&D generation rates in the literature.

$$MRSF = 10.4583 + 3.92963 * \ln(t) \qquad R^2=0.83$$
$$\quad (10.09) \quad (6.60)$$

where:

MRSF = millions of residential square feet

10.4583 = the intercept of the equation computed by least squares regression

ln(t) = the natural logarithm of the variable t, which represents time and takes the value of 1 for 1997, 2 for 1998, and so on through 28 for 2024

3.92963 = the coefficient of the variable ln(t), computed by least squares regression

The values of the t-statistics show the precision with which the intercept and the coefficient of the independent variables have been estimated and are presented in parentheses below the estimated constants. These values indicate significance at a 99% level of confidence. The R^2 indicates the percentage of the overall variation in the data, which is explained by the equation – more than 83% of the variation is explained by this simple estimating equation. This methodology is used to estimate the new square footage of residential construction that is shown in Table 3.2-1.

With respect to demolition debris, given the City's built environment, new construction generally requires the demolition of existing buildings. Most often, the replacement building is larger than the demolished building. A timeline for demolition on any plot of land was hypothesized as a basis for estimating the quantity of residential demolition debris. That timeline is:

- 50% would have been demolished in the year prior to construction;
- 30% two years before construction;
- 10% three years before construction; and
- 10% four years before construction.

The square footage demolished is assumed to equal 90% of new construction. These assumptions generated a time series for residential square feet demolished that closely mirrors that of residential construction. The square feet demolished are multiplied by the per square foot demolition debris factor to estimate residential demolition debris. The residential square feet of demolition are shown in the third column of Table 3.2-1.

Table 3.2-1
Projected Residential Construction, Demolition and Renovation in New York City

Year	Residential Construction (Millions of Square Feet)	Residential Demolition (Millions of Square Feet)	Residential Renovation (Millions of Square Feet)
2000	16.688	15.69	4.75
2001	18.932	16.37	3.93
2002	17.163	15.82	3.10
2003	16.944	16.31	0.52
2004	18.904	17.40	1.06
2005	20.225	17.77	0.44
2006	19.626	17.29	0.80
2007	18.529	16.91	1.26
2008	18.870	17.20	1.36
2009	19.184	17.46	1.51
2010	19.474	17.71	1.69
2011	19.745	17.94	1.91
2012	19.998	18.16	2.17
2013	20.235	18.36	2.45
2014	20.460	18.56	2.76
2015	20.672	18.74	3.10
2016	20.873	18.91	3.46
2017	21.064	19.08	3.85
2018	21.246	19.24	4.26
2019	21.420	19.39	4.70
2020	21.587	19.54	5.16
2021	21.747	19.68	5.64
2022	21.901	19.81	6.14
2023	22.049	19.94	6.66
2024	22.192	20.06	7.21

The square footage demolished is assumed to equal 90% of new construction. These assumptions generated a time series for residential square feet demolished that closely mirrors that of residential construction. The square feet demolished are multiplied by the per square foot demolition debris factor to estimate residential demolition debris. The residential square feet of demolition are shown in the third column of Table 3.2-1.

Data on the square feet of residential renovations are not readily available. However, F.W. Dodge does collect data reporting the total value of residential renovation and new construction for each of the City's boroughs. The estimated square footage of residential renovation can be derived from this overall estimate. (See Attachment 1 for a description of how these computations were performed.)

Residential expenditures for renovation and new construction are projected from 2008 to 2024 at the average rate of growth projected from 2003 to 2007 -- 2.18%. Table 3.2-1 presents estimates of annual square footage of residential renovation, using a generation factor per square foot of residential space renovated, shown in Table 3.1-1. This factor is computed by taking a weighted average of generation rates for different types of remodeling. Kitchens, with an average of 35.5 pounds per square foot, and baths, with an average of 37.5 pounds of waste per square foot, are rooms most frequently remodeled, and they are accorded 40% and 30%, respectively, in the weighted average. The other types of remodeling are: whole house, generating an average of 9 pounds per square foot; roof renovation, generating an average of 4 pounds per square foot; and deck renovation, generating an average of 5.5 pounds per square foot. Each of these categories is weighted 10% in the average. The weighted average debris generation factor is 27.3 pounds per square foot of residential renovation.

3.3 Projected Residential C&D Debris

Estimates of residential C&D debris are presented in Table 3.3-1. The form of the equation used to predict future construction activity in the residential sector is one that does not create any peaks or troughs, but rather generates a steady increase over time. Although the construction industry is known for its cyclical behavior, it is beyond the scope of this Commercial Waste Management Study (Study) to predict when economic cycles will occur. Thus, what will actually occur can be expected to differ from the steady trend predicted in this estimate.

Estimates of residential construction debris increases from 21,003 tons in 1997 to 31,952 in 2000, with further increases occurring at a slower rate of growth. Thus, in 2024, 44,589 tons of residential construction debris are predicted. How much of this material will require disposal will depend on recycling activities. What is certain is that transfer stations will be necessary to process the materials, either for reuse or for disposal.

As indicated in Table 3.1-1, the quantity of demolition debris generated per square foot demolished is much greater than the quantity of debris generated per square foot constructed. (Note: Debris generated during construction is 4.10 pounds per square foot for single-family and 3.99 pounds per square foot for multi-family residential structures, as shown in Table 3.1-1.) For single-family buildings, the average waste per square foot demolished is 85.10 pounds, with a range of 55.20 to 115.00 pounds per square foot. The comparable number for multi-family housing is 50.50 pounds per square foot demolished, with a range of 36.56 to 64.40 pounds. The amount of waste generated by a square foot of demolition is 12 to 20 times the quantity generated from constructing a square foot of residential space.

Estimates of annual generation of residential demolition debris are contained in Table 3.3-1. The estimated quantities increase from 431,526 tons in 1999 to 597,653 in 2024. The estimates are made using a blended waste generation rate, reflecting the mix of multi-family and single-family type housing stock in the City of 59.6 pounds per square foot demolished. The proportion of residential construction debris that will require disposal will depend on recycling activities; however transfer stations will be necessary to process this waste.

Table 3.3-1
Projected Residential Construction, Demolition and Renovation Debris for New York City, 1997-2024

Year	Residential Construction Debris in Tons	Residential Demolition Debris in Tons	Residential Building Renovation Debris in Tons	Total Residential Sector C&D Debris
1997	21,003	NA	NA	NA
1998	26,492	NA	NA	NA
1999	29,686	431,526	96,765	557,977
2000	31,952	467,262	64,865	564,079
2001	33,710	487,773	53,685	575,168
2002	35,146	471,105	42,397	548,648
2003	36,360	485,872	7,180	529,412
2004	37,412	518,212	14,524	570,148
2005	38,339	529,421	6,088	573,848
2006	39,169	515,098	11,029	565,296
2007	37,230	503,626	17,267	558,123
2008	37,915	512,223	18,673	568,811
2009	38,546	520,167	20,652	579,365
2010	39,130	527,549	23,178	589,857
2011	39,673	534,444	26,181	600,298
2012	40,181	540,913	29,621	610,715
2013	40,659	547,006	33,483	621,148
2014	41,109	552,765	37,729	631,603
2015	41,535	558,223	42,329	642,087
2016	41,939	563,410	47,297	652,646
2017	42,323	568,354	52,607	663,284
2018	42,689	573,074	58,231	673,994
2019	43,040	577,592	64,182	684,814
2020	43,375	581,922	70,434	695,731
2021	43,696	586,081	77,000	706,777
2022	44,005	590,082	83,866	717,953
2023	44,302	593,936	91,032	729,270
2024	44,589	597,653	98,485	740,727

As can be observed, residential renovation and construction debris waste quantities are roughly of the same magnitude. Renovation debris peaks in 1999, declines through 2005, and gradually increases through 2024, when it is roughly equivalent to the quantity produced in 1999.

Quantities of residential demolition debris are projected at 8 to 10 times the quantity of residential construction debris. Residential demolition debris increases from approximately 500,000 tons in the early 2000s to just under 600,000 tons per year in 2024. In the aggregate, residential C&D debris from all three activities is projected to increase from approximately 550,000 tons in 1999 to approximately 740,000 tons per year in 2024.

4.0 COMMERCIAL CONSTRUCTION, DEMOLITION AND RENOVATION DEBRIS

4.1 Commercial C&D Generation Factors

Commercial construction, demolition and renovation debris is estimated using a methodology comparable to that used to estimate residential C&D debris. First, waste generation factors specific to construction, demolition and renovation are assembled, using a combination of sources obtained from the literature and surveys of construction firms and C&D haulers in the New York region. Next, the square footage of commercial construction, demolition and renovation is projected through the year 2024. Finally, the appropriate commercial waste generation factor is multiplied by the square footage to estimate C&D generation.

Table 4.1-1 presents the data used to derive waste generation factors. In summary, these averages used to estimate C&D from construction, demolition and renovation are:

- Commercial construction debris at a rate of 3.8 pounds per square foot;
- Commercial demolition at a rate of 130.3 pounds per square foot; and
- Commercial renovation at a rate of 11.3 pounds per square foot.

4.2 Projections of Commercial Construction, Demolition and Renovation Activity

F.W. Dodge provided data indicating the number of square feet of new construction from 1993 to 2002, with predictions through 2007. They also provided dollar expenditures for commercial renovation and construction for the same period. In order to predict the square footage of commercial construction for the period 2008 through 2024, a least squares regression was fitted to the available data, and the resulting equation was used to project forward in time. The square feet of commercial construction within the City between 1993 and 2007 can be estimated using the following equation:

Table 4.1-1
Commercial Construction, Demolition and Renovation Waste Generation Factors

Pounds per Square Foot	Comments	Source
4.11	Commercial construction. New York City data. C&D generation ranges from 0.005-0.01 cubic yards per square foot, which averages 0.0075 cubic yards, converted to pounds as 549 lbs/cy (see Table 2.2-2)	Summary of information provided by local construction contractors.
3.08	Commercial construction. Madison, Wisconsin.	Jenna Kunde and Sonya Newenhouse, "Leading the Way to New C&D Markets," *Resource Recycling,* January 2002.
3.89	Commercial construction. National Data.	Franklin Associates, Ltd. *Characterization of Building-Related Construction and Demolition Debris in the United States,* USEPA, Office of Solid Waste, EPA530-R-98-010, June 1998.
4.10	Commercial construction. Four Times Square, New York City.	USEPA, *Building Savings: Strategies for Waste Reduction of Construction and Demolition Debris from Buildings, June 2000.*
3.80	**Average Commercial Construction**	
116.9	Commercial demolition. Four Times Square, New York City.	USEPA, *Building Savings: Strategies for Waste Reduction of Construction and Demolition Debris from Buildings, June 2000.*
186.2	Commercial demolition. Salem, Oregon.	USEPA, *Building Savings: Strategies for Waste Reduction of Construction and Demolition Debris from Buildings, June 2000.*
155.0	Commercial demolition. National data.	Franklin Associates, Ltd. *Characterization of Building-Related Construction and Demolition Debris in the United States,* USEPA, Office of Solid Waste, EPA530-R-98-010. June 1998.
63.2	Commercial demolition. New York City. 0.088 cubic yards converted @ 711 lbs/cy. (See Attachment 1, Table A-2)	Summary of information provided by local construction contractors. (URS Engineers)
130.3	**Average for Commercial Demolition**	
10.0	Commercial renovation. San Diego, CA.	USEPA, *Building Savings: Strategies for Waste Reduction of Construction and Demolition Debris from Buildings, June 2000.*
7.1	Commercial renovation. Austin, TX.	USEPA, *Building Savings: Strategies for Waste Reduction of Construction and Demolition Debris from Buildings, June 2000.*
16.0	Commercial renovation, New York City. A 2,500-square-foot building generates about 20 tons of C&D debris – or 16 pounds per square foot.	Summary of information provided by local construction contractors.
12.0	Commercial renovation, New York City. A 15,000-square-foot building generates about 90 tons of C&D, or 12 pounds per square foot.	Summary of information provided by local construction contractors.
11.3	**Average for Commercial Renovation**	

$$TCSF = 2891.564 + 4683.209 * \ln(t) \qquad R^2 = .65$$

$$(1.50) \qquad (4.91)$$

where:

TCSF = thousands of commercial square feet constructed

2891.564 = the intercept of the equation computed by least squares regression

ln(t) = the natural logarithm of the variable t, which represents time and takes the value of 1 for 1993, 2 for 1994, and so on through 32 for 2024

4683.209 = the coefficient of the variable ln(t), computed by least squares regression

Values for t-statistics showing the precision with which the intercept and the coefficient of the independent variables have been estimated are presented in parentheses below the estimated constants. The value of the intercept is not significantly different from zero. The coefficient of ln(t) is estimated with sufficient precision that one can be 99% confident that its value is different from zero and positive. The R^2 indicates the percentage of the overall variation in the data which is explained by the equation – more than 65% of the variation is explained by this simple estimating equation. This methodology was used to estimate the new square footage of commercial construction in the City from 1999 to 2024 that is presented in Table 4.2-1.

Because almost all new commercial construction takes place on sites where other buildings once stood, the following assumptions and timeline over which demolition occurs prior to new construction were assumed.

- 70% of commercial construction is preceded by demolition. (This is consistent with either new buildings being larger than the ones they replace and/or with some buildings being constructed on previously long-vacant plots.)
- 50% of the demolition occurs in the year prior to new construction;
- 30% two years before construction;
- 10% three years prior to construction; and
- 10% four years before construction.

Table 4.2-1
Projected Commercial Construction, Demolition and Renovation

Year	Commercial Construction (Thousands of Square Feet)	Commercial Demolition (Thousands of Square Feet)	Commercial Renovation (Thousands of Square Feet)
1999	12,418	9,561	107,651
2000	12,727	10,887	107,570
2001	21,204	12,491	108,120
2002	15,109	10,047	107,828
2003	13,178	9,594	108,114
2004	13,918	9,977	108,430
2005	14,525	10,261	108,771
2006	14,891	10,350	109,134
2007	14,469	10,326	109,466
2008	14,770	10,576	109,805
2009	15,054	10,831	110,153
2010	15,322	11,093	110,509
2011	15,575	11,361	110,873
2012	15,815	11,635	111,247
2013	16,044	11,916	111,629
2014	16,261	12,204	112,021
2015	16,470	12,499	112,422
2016	16,669	12,801	112,833
2017	16,860	13,110	113,253
2018	17,044	13,427	113,684
2019	17,220	13,751	114,126
2020	17,391	14,083	114,578
2021	17,555	14,424	115,040
2022	17,714	14,772	115,515
2023	17,867	15,129	116,000
2024	18,016	15,494	116,497

These assumptions are the basis of a time series projecting the square feet of commercial space demolished in the City each year, as a function of the square feet constructed in each of the next four years. That time series is presented in Table 4.2-1.

Projections of commercial square footage renovated in the City involved the following steps:

1. Data on number of employees in broad categories of employment were developed for the City.
2. A literature search yielded estimates of the square feet of workspace per employee in specific employment categories.
3. The number of employees and square foot per employee yielded an estimate of the total amount of commercial space in the City.
4. It was assumed that 8% of the City's commercial space was renovated each year.

Table 4.2-2 presents the factors used to derive total estimated square footage by employment category. Attachment 2 to this report provides a more detailed description of this methodology.

Table 4.2-2
Estimated Commercial Space in New York City

Type of Employment	Commercial Floor Space in Northeast (Millions of Square Feet)[(1)(2)]	Thousands of Employees in Northeast[(1)(3)]	Square Feet Per Employee	Thousands of Employees In New York City[(3)]	Estimated Commercial Floor Space in New York City (Millions of Square Feet)
Education and Health Services	2,162	3,949	547	626.2	342.8
Transportation, trade and utilities	3,156	4,693	672	526.1	353.8
Hospitality and leisure	1,807	1,888	957	576.4	551.8
Office	2,389	8,524	280	1,578.2	442.3
Total	**9,514**	**19,054**	**499**	**3,306.9**	**1,690.7**

Notes:

(1) Northeast Region includes Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont in New England, and New Jersey, New York and Pennsylvania in the Middle Atlantic Regions.

(2) Commercial square feet of floor space from Department of Energy, Energy Information Administration, 1999. Commercial Buildings Energy Consumption Survey: Building Characteristics Table B3: Census Region, Number of Buildings and Floor space, 1999.

(3) Number of employees from Bureau of Labor Statistics, Current Employment Statistics Survey, Table 5. Employees on non-farm payrolls by state and selected industry division, for the Northeast Region. Number of employees from Bureau of Labor Statistics, Current Employment Statistics Survey. Current Employment by Industry for New York City.

The estimates appear reasonable. Office space is estimated at 442.3 million square feet for the year 2002. This total compares relatively closely with that reported by the Citizen's Budget Commission -- 408.6 million square feet in 1999. The total commercial square footage in the City is estimated at 1,690.7 million square feet in 2002. Because DSNY collects from educational and institutional customers, these categories were excluded from the above square footage estimates. Then, for each year going forward from 2002, the aggregate commercial square footage is computed as the previous year's total, plus the new construction in the current year, less the demolition in the current year. A similar computation to subtract net additions is employed to move back to years before 2002.

Once the aggregate commercial square footage is computed for each year from 1999 to 2024, the estimated square footage that is renovated is computed. Usually, commercial space is renovated when there is a change in tenancy, e.g., at the end of a lease which is not renewed, or when a restaurant goes out of business and is replaced with another restaurant or business of a different type. Some space may go several decades without renovation, while other spaces may turn over and consequently be renovated several times a decade. The analysis assumes that 8% of the commercial space is renovated each year.[5] Thus, for 2002, the aggregate commercial space in the City is 1,690.7 million square feet, less the space in the education and health services industry (342.8 million square feet), or 1,347.9 million square feet. Eight percent (8%) of this space amounts to 107,828 square feet. The figures represent 8% of commercial space excluding education and health services space.

4.3 Projected Commercial C&D Debris

The final computation necessary to estimate C&D debris for commercial construction, demolition and renovation is to multiply the square feet presented in Table 4.2-1 by the average generation factors presented in Table 4.1-1. These results are presented below in Table 4.3-1.

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[5] This figure was obtained in the course of conversations with property managers of office buildings. Information about other types of commercial buildings was not available.

Table 4.3-1
Projected Commercial Construction, Demolition and Renovation Debris in New York City, 1999-2024

Year	Commercial Construction (Tons)	Commercial Demolition (Tons)	Commercial Renovation (Tons)	Commercial Total (Tons)
1999	23,563	622,924	606,884	1,253,371
2000	24,149	709,347	606,425	1,339,921
2001	40,234	813,838	609,525	1,463,597
2002	28,670	654,580	607,879	1,291,129
2003	25,005	625,097	609,495	1,259,597
2004	26,409	650,021	611,273	1,287,703
2005	27,560	668,533	613,196	1,309,289
2006	28,255	674,335	615,244	1,317,834
2007	27,455	672,804	617,112	1,317,371
2008	28,118	689,057	619,025	1,336,200
2009	28,797	705,702	620,985	1,355,484
2010	29,493	722,750	622,992	1,375,235
2011	30,205	740,209	625,047	1,395,461
2012	30,935	758,089	627,152	1,416,176
2013	31,682	776,403	629,308	1,437,393
2014	32,447	795,158	631,516	1,459,121
2015	33,231	814,366	633,778	1,481,375
2016	34,034	834,039	636,094	1,504,167
2017	34,856	854,186	638,466	1,527,508
2018	35,698	874,820	640,895	1,551,413
2019	36,560	895,953	643,383	1,575,896
2020	37,444	917,596	645,931	1,600,971
2021	38,348	939,762	648,541	1,626,651
2022	39,285	962,464	651,213	1,652,962
2023	40,223	985,714	653,950	1,679,887
2024	41,195	1,009,525	656,754	1,707,474

Note:
Because data presented in Tables 4.1-1 and 4.2-2 are rounded, and the data in Table 4.3-1 are computed from underlying spreadsheets where data are not rounded, a simple multiplication of waste generation factors by square feet, and adjusting for tons rather than pounds, will yield slightly different estimates than those presented in Table 4.3-1. For example, for 1999, commercial construction of 3.8 pounds per square foot multiplied by 12,418 thousand square feet yields an estimated C&D tonnage of 23,594 tons for that year. The computation reflected in the table above is actually 12,417.8 x 3.795 x 1000/2000= 23,563 tons.

Demolition and renovation account for almost all of the C&D debris in the commercial sector. For example, in 1999, commercial construction is 2% of all commercial sector C&D debris, while demolition accounts for just under half, and renovation accounts for the remaining approximately 48%.

Commercial demolition debris is projected to increase from 622,924 tons in 1999 to 1,009,525 tons by the year 2024. In that year it would amount to 60% of the aggregate C&D debris from the commercial sector. In 1999, commercial C&D debris totaled 1,253,371 tons; it is projected to increase to approximately 1,707,474 tons by 2024. Commercial construction debris is relatively small, whereas commercial demolition and renovation account for roughly equal proportions of the commercial waste stream and together account for almost 98% of all commercial C&D debris.

5.0 SUMMARY OF RESULTS FOR BUILDING-RELATED C&D

Table 5-1 summarizes the estimates of building-related C&D debris for both the residential and commercial sectors. C&D debris was more than 1.75 million tons in each of the last five years. The building-related C&D debris peaked in 2001 at 2.04 million tons, and then decreased rapidly in 2002 and 2003 with the recession. On a per capita basis, the City generates between 0.228 and 0.253 tons of building-related C&D debris per resident.

Table 5-1
Building-Related C&D Debris

Item	1999	2000	2001	2002	2003
Residential:					
Construction	29,686	31,952	33,710	35,146	36,360
Demolition	431,526	467,262	487,773	471,105	485,872
Renovation	96,765	64,865	53,685	42,397	7,180
Subtotal	557,977	564,079	575,168	548,648	529,412
Commercial:					
Construction	23,563	24,149	40,234	28,670	25,005
Demolition	622,924	709,347	813,838	654,580	625,097
Renovation	606,884	606,425	609,525	607,879	609,495
Subtotal	1,253,371	1,339,921	1,463,597	1,291,129	1,259,597
Total	1,811,348	1,904,000	2,038,765	1,839,777	1,789,009
City Population [(1)]	7,947,660	8,108,546	8,062,027	8,084,316	
Per capita building debris	0.22791	0.23481	0.25288	0.22757	

Notes:
(1) 1999 population from Bureau of Economic Analysis, Population and Income Survey; 2000, 2001 and 2002 population data from U.S. Census Bureau, GCT-T1. Population Estimates.

Table 5-2 shows a breakdown of the quantities of commercial and residential C&D projected for the New SWMP Planning Period.

Table 5-2
Total Projected Building-Related C&D Debris, 2000-2024

Year	Commercial C&D Debris Total	Residential C&D Debris Total	Total Building-Related C&D
2000	1,340,000	564,000	1,904,000
2001	1,464,000	575,000	2,039,000
2002	1,291,000	549,000	1,840,000
2003	1,260,000	529,000	1,789,000
2004	988,000	570,000	1,558,000
2005	1,309,000	574,000	1,883,000
2006	1,318,000	565,000	1,883,000
2007	1,317,000	558,000	1,875,000
2008	1,336,000	569,000	1,905,000
2009	1,355,000	579,000	1,935,000
2010	1,375,000	590,000	1,965,000
2011	1,395,000	600,000	1,996,000
2012	1,416,000	611,000	2,027,000
2013	1,437,000	621,000	2,059,000
2014	1,459,000	632,000	2,091,000
2015	1,481,000	642,000	2,123,000
2016	1,504,000	653,000	2,157,000
2017	1,528,000	663,000	2,191,000
2018	1,551,000	674,000	2,225,000
2019	1,576,000	685,000	2,261,000
2020	1,601,000	696,000	2,297,000
2021	1,627,000	707,000	2,333,000
2022	1,653,000	718,000	2,371,000
2023	1,680,000	729,000	2,409,000
2024	1,707,000	741,000	2,448,000

6.0 NON-BUILDING-RELATED C&D

Non-building debris includes waste materials generated in the process of constructing, demolishing and renovating bridges; dams, reservoirs and river banks; power plants and gas and communications facilities; sewerage and waste disposal facilities; streets and highways; water supply systems; and "other" non-building activities. Data on the value of this construction in the City from 1993 to 2007 (the 2003 through 2007 data are projections) were obtained from F.W. Dodge, McGraw Hill Construction. The data are expressed in constant 1996 dollars.

6.1 Methodology

Non-building debris generation resulted from the expenditure of $1.5 billion dollars in the City in 1993, increasing to a maximum of $3.4 billion in 2002. The methodology to estimate the quantity of debris associated with these expenditures is as follows:

1. Obtain the total quantity of C&D and non-building debris from the City's non-putrescible and fill material Transfer Stations for 2000, 2001 and 2002, and available data from 2003.
2. Estimate the quantity of non-building-related C&D debris by subtracting the estimated building-related C&D debris for each of these years from the City total.
3. Subtract the building-related C&D debris generation from the total of all reported debris generation (both C&D and non-building-related as used herein) to obtain an estimate of non-building debris generation.
4. Correlate the tons of non-building debris generation in each of the years to the dollar value of non-building debris-generating activities (tons per thousand dollars of expenditures on non-building-related construction, demolition and renovation).
5. Average these ratios for the three years.
6. Based on F.W Dodge data, project the City's expenditures for non-building-related construction, demolition and renovation using a least squares equation estimated over the period 1993 to 2007, projecting forward to 2024.
7. Use the average tons per thousand dollars of expenditures on non-building construction, demolition and renovation to estimate non-building debris quantities for the City for the period through 2024.

6.1.1 Deriving Non-Building-Related Debris Generation Factors

Table 6.1.1-1 presents the data used to compute the tons of non-building debris per thousand dollars of expenditures on the activities generating these waste materials. Starting with the total C&D estimates in Table 7.1-1, the building-related component, as presented in Table 5-2 is subtracted to estimate the non-building related component. The non-building component is then divided by the F.W. Dodge estimated value of non-building construction (in 1996 dollars), which yields a factor of non-building related debris per $1,000 of expenditure. Reported total annual C&D debris generation increased from 6.4 million tons in 2000 to an estimated 8.6 million tons in 2003. For the three years with full data available (2000 – 2002), the non-building-related debris generation factor is 1.96 tons per thousand dollars of expenditures on such projects. For the year 2003, the rate increases to 2.97 tons per $1,000 expenditure.

6.1.2 Projecting Non-Building Debris Generation

F.W. Dodge provided data for the City indicating the dollars of activity in non-building construction from 1993 to 2002, with predictions through 2007. In order to predict non-building activity for the period 2008 through 2024, a least squares regression is fitted to the available data. The resulting equation is used to project forward in time. The value of non-building-related construction, demolition and renovation activity within the City between 1993 and 2007 can be estimated using the following equation:

$$TDNBA = 14.1419 + 0.20628 * \ln(t) \qquad R^2 = .50$$

$$(123.42) \quad (3.61)$$

where:

TDNBA = thousands of constant dollars of activity in non-building-related construction, demolition and renovation

14.1419 = the intercept of the equation computed by least squares regression

ln(t) = the natural logarithm of the variable t, which represents time and takes the value of 1 for 1993, 2 for 1994, and so on through 32 for 2024

0.20628 = the coefficient of the variable ln(t), computed by least squares regression

Table 6.1.1-1
Non-Building-Related Debris Generation Factors

Item	Applicable Year				
	2000	2001	2002	Average (2000-2002)	2003
Total C&D (building & non-building) debris: Generated(1)	6,354,270	6,689,592	7,905,924	NA	8,640,840
Aggregate building debris generation(2)	1,904,000	2,038,765	1,839,777	NA	1,789,009
Estimated tons of non-building-generated debris(3)	4,450,270	4,650,827	6,066,147	NA	6,851,831
Value of non-building-related construction, demolition and renovation(4)	$2,535,203	$2,079,637	$3,236,764	NA	$2,306,670
Tons of non-building-related debris per $1,000 of expenditure	1.76	2.24	1.87	1.96	2.97

Notes:
(1) From DSNY Quarterly Transfer Station Reports.
(2) See Table 5-1.
(3) Obtained by subtracting building-related C&D debris from total C&D debris.
(4) Data obtained from F.W. Dodge, McGraw Hill Construction. In thousands of 1996 constant dollars.

The value for the t-statistics, in parentheses below the estimated constants, shows the precision with which the intercept and the coefficient of the independent variables have been estimated. The value of the intercept is significantly different from zero, at a 99% confidence level. The coefficient of ln(t) is estimated with sufficient precision that one can be 99% confident that its value is different from zero and positive.

The R^2 indicates the percentage of the overall variation in the data which is explained by the equation – 50% of the variation is explained by this simple estimating equation.

Table 6.1.2-1 presents the dollar value of non-building-related construction, demolition and renovation in the City from 1999 to 2024. This table also contains the estimated tons of non-building-related C&D debris, which will be generated as a result of the predicted level of economic activity, based both upon the average level for the years 2000 – 2002 (1.96 tons per $1,000) as well as for the latest level determined for the year 2003, or 2.97 tons per $1,000 expended on non-building-related construction, demolition and renovation. The quantity of non-building-related C&D tons is projected to decline in 2004, and then increase steadily over the New SWMP Planning Period.

Table 6.1.2-1
Projected Non-Building-Related Construction, Demolition and Renovation Debris in New York City, 2000-2024

Year	Value of Non-Building-Related Construction (000s of 1996 $)	Non-Building-Related C&D Debris[1] (1.96 * Value) (Tons)	Non-Building-Related C&D Debris (2.97 * Value) (Tons)
2000	$2,535,203	4,450,000	NA
2001	$2,079,637	4,651,000	NA
2002	$3,236,764	6,066,000	NA
2003	$2,306,670	NA	6,852,000
2004	$2,143,400	4,201,000	6,366,000
2005	$2,177,569	4,268,000	6,467,000
2006	$2,281,721	4,472,000	6,777,000
2007	$2,340,870	4,588,000	6,952,000
2008	$2,455,527	4,813,000	7,293,000
2009	$2,486,428	4,873,000	7,385,000
2010	$2,515,918	4,931,000	7,472,000
2011	$2,544,135	4,987,000	7,556,000
2012	$2,571,197	5,040,000	7,636,000
2013	$2,597,205	5,091,000	7,714,000
2014	$2,622,248	5,140,000	7,788,000
2015	$2,646,404	5,187,000	7,860,000
2016	$2,669,739	5,233,000	7,929,000
2017	$2,692,316	5,277,000	7,996,000
2018	$2,714,186	5,320,000	8,061,000
2019	$2,735,399	5,361,000	8,124,000
2020	$2,755,997	5,402,000	8,185,000
2021	$2,776,019	5,441,000	8,245,000
2022	$2,795,500	5,479,000	8,303,000
2023	$2,814,473	5,516,000	8,359,000
2024	$2,832,965	5,553,000	8,414,000

Notes:
(1) Utilized actual tons of non-building-related debris per $1,000 of expenditure for the years 2000-2002, from Table 6.1.1-1.

7.0 SUMMARY OF TOTAL C&D ESTIMATES AND CONCLUSIONS

7.1 Summary of Estimated Total C&D Generation

The previous sections have provided separate estimates for residential, commercial and non-building-related debris generation in the City. Table 7.1-1 summarizes the estimates derived for residential and commercial building-related C&D debris, and the non-building-related C&D, which together constitute total C&D waste. The total estimated building-and non-building-related C&D for 2003 is shown to be 8,641,000, as reported in the 2003 Quarterly Reports, with the fourth quarter estimated as mentioned previously in this report. This quantity was utilized for the baseline in projecting waste quantities for the New SWMP Planning Period. A low-to-high range is shown in this table to account for the differences between data for non-building-related C&D for the years 2000 to 2002 and for 2003, as discussed in the previous section. Relative quantities of building-related residential and commercial waste and non-building-related materials will vary over time in accordance with the methodologies previously described.

As discussed in Section 2.3, clean fill has historically constituted approximately 60% of the total quantity of C&D material, but in 2003 constituted almost 70% of total C&D. Hence, both of these percentages were utilized in Tables 7.1-2 through 7.1-5, which disaggregate the total estimate for C&D debris into the clean fill and non-putrescible categories used by the City in regulating its Transfer Stations. Tables 7.1-2 and 7.1-3 utilize the lower estimate of 1.96 tons per $1,000 expended, and show non-putrescible material ranging from 2.4 to 3.2 million tons in 2024 (or 7,690 to 10,260 tpd). Clean fill material would range from 4.8 to 5.6 million tons, or 15,390 to 17,950 tpd. Tables 7.1-4 and 7.1-5 utilize the higher estimate of 2.97 tons per $1,000 for non-building-related material expended, and show quantities of non-putrescible waste ranging from approximately 3.3 to 4.3 million tons in 2024, or 10,440 to 13,930 tons per day. Clean fill material would range from 6.5 to 7.6 million tons per year, or 20,890 to 24,370 tons per day.

Table 7.1-1
Aggregate Estimate of C&D Debris, 2000 to 2024[(1)]

Year	Total C&D Debris			
	Average (2000-2002) Estimate (Using 1.96)	Upper Estimate (Using 2.97)	Average (2000-2002) Estimate (Using 1.96)	Upper Estimate (Using 2.97)
	(Tons)	(Tons)	(tpd)	(tpd)
2000[(2)]	6,354,000	NA	20,400	NA
2001[(2)]	6,690,000	NA	21,400	NA
2002[(2)]	7,906,000	NA	25,300	NA
2003[(2)]	NA	8,641,000	NA	27,700
2004	5,759,000	7,924,000	18,500	25,400
2005	6,151,000	8,351,000	19,700	26,800
2006	6,355,000	8,660,000	20,400	27,800
2007	6,464,000	8,828,000	20,700	28,300
2008	6,718,000	9,198,000	21,500	29,500
2009	6,808,000	9,320,000	21,800	29,900
2010	6,896,000	9,437,000	22,100	30,200
2011	6,982,000	9,552,000	22,400	30,600
2012	7,066,000	9,663,000	22,600	31,000
2013	7,149,000	9,772,000	22,900	31,300
2014	7,230,000	9,879,000	23,200	31,700
2015	7,310,000	9,983,000	23,400	32,000
2016	7,390,000	10,086,000	23,700	32,300
2017	7,468,000	10,187,000	23,900	32,700
2018	7,545,000	10,287,000	24,200	33,000
2019	7,622,000	10,385,000	24,400	33,300
2020	7,698,000	10,482,000	24,700	33,600
2021	7,774,000	10,578,000	24,900	33,900
2022	7,850,000	10,674,000	25,200	34,200
2023	7,926,000	10,768,000	25,400	34,500
2024	8,001,000	10,862,000	25,600	34,800

Notes:
(1) This table was derived by determining the annual changes for each of the discrete categories of waste (e.g., residential construction, renovation, etc.), quantifying the aggregate annual change and applying those changes to the 2003 baseline number.
(2) The actual tons of non-building-related debris per $1,000 of expenditure was utilized for the years 2000-2003, as derived in Table 6.1.1-1.

Table 7.1-2
Range of Quantities of Non-Putrescible and Fill Material, 2004-2024
(based upon average data for 2000-2002, in tons per year)

	Average (2000-2002) Estimate (Using 1.96)			
Year	Non-Putrescible		Fill	
	30%	40%	60%	70%
2004	1,728,000	2,304,000	3,455,000	4,031,000
2005	1,845,000	2,460,000	3,691,000	4,306,000
2006	1,907,000	2,542,000	3,813,000	4,449,000
2007	1,939,000	2,585,000	3,878,000	4,525,000
2008	2,015,000	2,687,000	4,031,000	4,702,000
2009	2,042,000	2,723,000	4,085,000	4,766,000
2010	2,069,000	2,759,000	4,138,000	4,827,000
2011	2,095,000	2,793,000	4,189,000	4,888,000
2012	2,120,000	2,827,000	4,240,000	4,947,000
2013	2,145,000	2,860,000	4,289,000	5,004,000
2014	2,169,000	2,892,000	4,338,000	5,061,000
2015	2,193,000	2,924,000	4,386,000	5,117,000
2016	2,217,000	2,956,000	4,434,000	5,173,000
2017	2,240,000	2,987,000	4,481,000	5,227,000
2018	2,264,000	3,018,000	4,527,000	5,282,000
2019	2,287,000	3,049,000	4,573,000	5,335,000
2020	2,310,000	3,079,000	4,619,000	5,389,000
2021	2,332,000	3,110,000	4,665,000	5,442,000
2022	2,355,000	3,140,000	4,710,000	5,495,000
2023	2,378,000	3,170,000	4,755,000	5,548,000
2024	2,400,000	3,200,000	4,800,000	5,601,000

Table 7.1-3
Range of Quantities of Non-Putrescible and Fill Material, 2004-2024
(based upon average data for 2000-2002, in tons per day)

Year	Average (2000-2002) Estimate (Using 1.96)			
	Non-Putrescible		Fill	
	30% (tpd)	40% (tpd)	60% (tpd)	70% (tpd)
2004	5,540	7,380	11,070	12,920
2005	5,910	7,890	11,830	13,800
2006	6,110	8,150	12,220	14,260
2007	6,210	8,290	12,430	14,500
2008	6,460	8,610	12,920	15,070
2009	6,550	8,730	13,090	15,270
2010	6,630	8,840	13,260	15,470
2011	6,710	8,950	13,430	15,670
2012	6,790	9,060	13,590	15,850
2013	6,870	9,170	13,750	16,040
2014	6,950	9,270	13,900	16,220
2015	7,030	9,370	14,060	16,400
2016	7,110	9,470	14,210	16,580
2017	7,180	9,570	14,360	16,750
2018	7,260	9,670	14,510	16,930
2019	7,330	9,770	14,660	17,100
2020	7,400	9,870	14,800	17,270
2021	7,480	9,970	14,950	17,440
2022	7,550	10,060	15,100	17,610
2023	7,620	10,160	15,240	17,780
2024	7,690	10,260	15,390	17,950

Table 7.1-4
Range of Quantities of Non-Putrescible and Fill Material, 2004-2024
(based upon 2003 data, in tons per year)

Year	Upper Estimate (Using 2.97)			
	Non-Putrescible		Fill	
	30%	40%	60%	70%
2004	2,377,000	3,169,000	4,754,000	5,547,000
2005	2,505,000	3,340,000	5,010,000	5,845,000
2006	2,598,000	3,464,000	5,196,000	6,062,000
2007	2,648,000	3,531,000	5,297,000	6,180,000
2008	2,759,000	3,679,000	5,519,000	6,439,000
2009	2,796,000	3,728,000	5,592,000	6,524,000
2010	2,831,000	3,775,000	5,662,000	6,606,000
2011	2,866,000	3,821,000	5,731,000	6,686,000
2012	2,899,000	3,865,000	5,798,000	6,764,000
2013	2,932,000	3,909,000	5,863,000	6,841,000
2014	2,964,000	3,952,000	5,927,000	6,915,000
2015	2,995,000	3,993,000	5,990,000	6,988,000
2016	3,026,000	4,034,000	6,052,000	7,060,000
2017	3,056,000	4,075,000	6,112,000	7,131,000
2018	3,086,000	4,115,000	6,172,000	7,201,000
2019	3,115,000	4,154,000	6,231,000	7,269,000
2020	3,145,000	4,193,000	6,289,000	7,337,000
2021	3,173,000	4,231,000	6,347,000	7,405,000
2022	3,202,000	4,269,000	6,404,000	7,471,000
2023	3,230,000	4,307,000	6,461,000	7,538,000
2024	3,259,000	4,345,000	6,517,000	7,603,000

Table 7.1-5
Range of Quantities of Non-Putrescible and Fill Material, 2004-2024
(based upon 2003 data, in tons per day)

Year	Upper Estimate (Using 2.97)			
	Non-Putrescible		Fill	
	30% (tpd)	40% (tpd)	60% (tpd)	70% (tpd)
2004	7,620	10,160	15,240	17,780
2005	8,030	10,710	16,060	18,740
2006	8,330	11,100	16,650	19,430
2007	8,490	11,320	16,980	19,810
2008	8,840	11,790	17,690	20,640
2009	8,960	11,950	17,920	20,910
2010	9,070	12,100	18,150	21,170
2011	9,180	12,250	18,370	21,430
2012	9,290	12,390	18,580	21,680
2013	9,400	12,530	18,790	21,920
2014	9,500	12,670	19,000	22,160
2015	9,600	12,800	19,200	22,400
2016	9,700	12,930	19,400	22,630
2017	9,800	13,060	19,590	22,860
2018	9,890	13,190	19,780	23,080
2019	9,990	13,310	19,970	23,300
2020	10,080	13,440	20,160	23,520
2021	10,170	13,560	20,340	23,730
2022	10,260	13,680	20,530	23,950
2023	10,350	13,810	20,710	24,160
2024	10,440	13,930	20,890	24,370

7.2 Comparison to Other Jurisdiction

C&D debris can be expressed as pounds per capita per day, facilitating comparisons across jurisdictions. Table 7.2-1 presents comparative data for various jurisdictions. The data presented in this report estimate building-related C&D debris for the City in 2000 at 1.29 pounds per capita per day and 1.25 pounds per capita per day in 2002. The slight decrease is due to a decrease in construction and renovation attributable to the economic recession. Overall, including non-building debris, C&D debris increased from 4.64 pounds per capita per day in 2000 to 5.54 pounds per capita per day in 2002. This increase is due to the extra debris from 9/11 and to a slight decrease in the City's population in the interval.

The estimates presented for other jurisdictions include two for the United States and one for Massachusetts. With the exception of the United States estimate published by Chartwell, all the sources are in the 4.0 to 5.5 pounds per capita per day range. The United States estimate is almost 8 pounds per capita per day. This obviously reflects rural areas, where the quantity of asphalt per resident is undoubtedly greater than in strictly urban areas such as the City. The estimates from this report coincide closely with those in the 2000 Preliminary Report and the 2002 update of the Preliminary Report. These reports provide daily tons of non-putrescible waste, daily tons of clean fill, and recyclables. A per capita C&D debris estimate derived from these data is 4.29 and 4.85 pounds per capita per day for 2000 and 2002, respectively.[6]

[6] Including material delivered to a rock crushing plant at Fresh Kills Landfill, where clean fill and aggregates that are processed and recycled on site increases the C&D per capita by 0.09 pound in 2000 and 0.07 pounds in 2002.

Table 7.2-1
Comparative Data on Construction and Demolition Debris Generation

Jurisdiction	Year	Pounds per Capita per Day		Source
		Building-Related C&D Debris	Total C&D Debris	
New York City	2000	1.29	4.64	This report
New York City	2002	1.25	5.54	This report
New York City	2000	NA	4.29	(1)
New York City	2002	NA	4.85	(2)
United States	1996	2.8	NA	(3)
United States	2002	NA	7.84	(4)
Massachusetts	2001	NA	4.99	(5)

Sources:
(1) Data obtained from New York City Department of Sanitation and Urbitran Associates, Inc., *New York City Comprehensive Commercial Waste Management Study, Preliminary Report.* New York City Department of Sanitation. June 2002. Appendices. Tonnages for individual Transfer Stations were summed to obtain the annual totals. Increase the pounds per capita per day by 0.09 to account for materials processed at the rock crushing plant at Fresh Kills Landfill.
(2) Update of Preliminary Report. {[(23116.47*312) – 60000)]*2000/365}/8084316. Increase the pounds per capita per day by 0.07 to account for materials processed at the rock crushing plant at Fresh Kills Landfill.
(3) Franklin Associates, *Characterization of Building-Related Construction and Demolition Debris in the United States.* USEPA, Municipal and Industrial Solid Waste Division, Office of Solid Waste, # EPA 530-R98-010. June 1998.
(4) Chartwell Information, *Solid Waste Digest.* Vol 13, Number 7-8 (July/August 2003) p. 1. 153,430,312 tons of C&D at landfills or other waste disposal sites, plus an estimated 100,000,000 tons of concrete and 150,000,000 tons of asphalt (97% of which is recycled).
(5) Massachusetts Department of Environmental Protection, *Beyond 2000 Solid Waste Master Plan,* Section 1: 2001 Solid Waste Data and Waste Management Capacity Projections.

Franklin Associates' 1998 report for the United States Environmental Protection Agency (USEPA) estimates only building-related C&D debris. Their estimate of 2.8 pounds per capita per day is significantly higher than that obtained from any other jurisdiction. However, it should be noted that their methodology did not allow for any on-site use of C&D debris. They assumed that all C&D generated in the course of construction, demolition or renovation would be hauled off to a disposal site. In fact, much of the excavation and fill material created in building or demolishing a structure is frequently put to use for site grading and preparation of roadbeds or driveway beds. Thus, it is to be expected that estimates derived using this methodology would be greater than those estimating only those materials delivered to a disposal site.

One final comment is appropriate concerning the quantity of C&D debris in the City. Only those materials delivered to Transfer Stations are included in these totals. In renovating large buildings, it is not uncommon for many appliances and fixtures to be stripped from the building and taken to a recycling center – bathroom fixtures are often recycled in this way – and they are some of the heaviest components of C&D debris. This would be an additional explanation as to why the Franklin Associate estimates would exceed those of jurisdictions measuring C&D debris as delivered to the disposal site.

Attachment 1

Construction and Demolition Debris Density Derivations and Discussion and Note on Calculation of Residential Renovation Activity

C&D DEBRIS ESTIMATION METHODOLOGY

A.1 Non-Putrescible Mixed C&D Estimations (From Licensed New York City Non-Putrescible Transfer Stations)

All private non-putrescible Transfer Stations in the City are required to provide quarterly reports to the DSNY on the quantities of materials received, processed, recycled and disposed. In 2003, four (4) of these Transfer Stations did not use scales to weigh inbound loads; they estimate tons by multiplying the cubic yards received by a density factor (lbs/cy). The density factor for C&D debris that these Transfer Stations have been instructed to use is 1,500 lbs/cy.[1] By 2003, approximately 80% of C&D handled by non-putrescible Transfer Stations was weighed.

In order to more accurately estimate C&D debris tonnages, an analysis of typical weights of C&D loads in the City was conducted with the cooperation of Waste Management at their facility at 123 Varick Street in Brooklyn. The analysis consisted of recording the volume, type of C&D debris and weight of more than 500 loads during one week in July 2003. From these data, density factors were computed for the following types on inbound C&D loads:

- Residential and commercial construction;
- Demolition and renovation debris, and
- Non-building debris.

Table A-1 presents the results of this analysis. There is a very wide range in the density of C&D debris. For commercial construction debris, for example, the average density was 532 pounds, with a range of 77 to 2,536 pounds. The standard deviations of the samples are typically relatively large – ranging from one third of the sample mean to almost as large as the mean itself.

[1] This is the density factor for C&D provided by the NYSDEC.

Table A-1
C&D Debris Density in New York City, July 2003

Item	Pounds per Cubic Yard by Type of C&D Debris				
	Single-Family	Multi-Family	Commercial	Non-Building	Other
Construction (*n*)[(1)]	*40*	*48*	*112*	*23*	*9*
Average	517	481	532	881	446
Standard deviation	270	296	404	790	225
Minimum	62	116	77	227	160
Maximum	1,345	1,535	2,536	3,512	842
Demolition (*n*)	*57*	*55*	*131*	*33*	*15*
Average	656	546	582	610	542
Standard deviation	433	269	522	421	482
Minimum	152	173	55	136	91
Maximum	2,110	1,188	2,422	2,629	1,707
Renovation (*n*)	*35*	*44*	*50*	*8*	*14*
Average	470	476	461	860	707
Standard deviation	304	251	264	1,223	549
Minimum	54	27	121	177	39
Maximum	1,518	1,188	1,168	3,864	1,679
Other (*n*)	*6*	*5*	*16*	*NA*	*5*
Average	337	494	365	NA	272
Standard deviation	122	486	210	NA	176
Minimum	206	106	79	NA	87
Maximum	553	1,319	768	NA	559

Note:
[(1)] *n = Number of samples.*

The data in Table A-1 are somewhat useful in determining the density of C&D debris. However, given the wide variance in density factors observed here, and given that this Transfer Station is one of the few C&D Transfer Stations with a scale, additional sources were desired.[2] Accordingly, literature searches and interviews with selected C&D haulers operating in the City were conducted to identify additional sources of data for comparison with this sample data. The density data from these sources are displayed in Table A-2.

[2] The Varick Street Transfer Station has a scale. Many Transfer Stations receiving C&D debris do not have scales. It is possible that drivers with loads of particularly heavy materials would go to the Transfer Stations without scales.

Table A-2
C&D Densities, Multiple Sources

Type of C&D	Pounds/Cubic Yard	Source & Comments
Single-Family Construction	517 160 350 Average = 342	New York City data (1) Probably single-family (2) Probably single-family (3)
Single-Family Renovation	470 433 133 Average = 345	New York City data (1) New York City data (4) New York City data (5)
Single-Family Demolition	656 150 930 472 Average = 552	New York City data (1) Unknown location (6) Unknown location (7) Shredded residential material (6)
Commercial/Multi-Family Construction	481 532 600 581 Average = 549	New York City multi-family (1) New York City commercial (1) New York City commercial (4) New York City commercial (9)
Commercial/Multi-Family Renovation	461 476 Average = 469	New York City multi-family (1) New York City commercial (1)
Commercial/Multi-Family Demolition	546 582 867 850 Average = 711	New York City multi-family (1) New York City commercial (1) New York City commercial (4) New York City commercial (8)
Non Building Construction, Renovation and Demolition	881 610 860 950 Average = 825	New York City construction (1) New York City demolition (1) New York City renovation (1) New York City non-building (9)

Sources:

(1) New York City Data Collection, Varick Street, July 2003.
(2) Peter Yost, "C&D/Wood Debris Management Trends," *Resource Recycling,* November 1998.
(3) National Association of Home Builders Research Center, "Does Grinding and Buying at the Construction Site Work?" *Construction Materials Recycler,* February 12, 1999.
(4) Interview with Boro Wide Recycling, New York City (Michael Christina).
(5) Interview with Alta Recycling, New York City (Omar Diez).
(6) Shred Max web site http://www.shredmax.com.
(7) Bette K. Fishbein, Building for the Future: Strategies to Reduce Construction and Demolition Waste in Municipal Projects, INFORM Special Report, June 1998.
(8) Interview with Kids Waterfront Corporation (Louis Sanzo).
(9) One week's worth of C&D load tickets, from Point Recycling.

As shown in Table A-2, density figures from the literature and interviews are generally lower than those derived from the Varick Street observations.

Table A-2 combines and summarizes the data obtained from all sources for specific types of C&D and non-building materials. Averaging the data on density from all sources for specific material types results in estimated densities as follows:

- Single-family residential construction at 342 lbs/cy.
- Single-family residential renovation at 345 lbs/cy.
- Single-family residential demolition at 552 lbs/cy.
- Commercial and multi-family construction at 549 lbs/cy.
- Commercial and multi-family renovation at 469 lbs/cy.
- Commercial and multi-family building demolition debris at 711 lbs/cy.
- Non-building construction, renovation and demolition at 825 lbs/cy, obtained from the survey at a non-putrescible Transfer Station, which receive mainly mixed C&D waste. The City also licenses clean fill Transfer Stations. Most of the material they receive is heavy concrete, asphalt, rocks and dirt, with weights per cubic yard in the 2,400 pound range. Many of these stations report incoming tons as mixed C&D, which the DSNY converts to tons at the 1,500-pounds-per-cubic-yard factor described above. If the unweighed C&D debris at the non-putrescible Transfer Stations is in the 800-pounds-per-cubic-yard density range, and that at the fill material Transfer Stations in the 2,200-pounds-per-cubic-yard density range, then an average of 1,500 pounds for both stations appears reasonable.

A.2 Residential Renovation Estimation Computations

1. Multiply the known square footage of new residential construction by the cost/square foot ($83).
2. Subtract this estimated cost of new construction from the combined cost of new construction and renovation.
3. Divide the resulting estimated cost of renovation by the cost per square foot to renovate ($70).
4. Result: Estimated square feet renovated.

NOTE: The value of construction and renovation is presented in constant 1996 dollars.

Attachment 2

Commercial Renovation Estimation Computations

Commercial Renovation Estimation Computations

1. From the 1999 Department of Energy's Energy Information Administration's 1999 Commercial Buildings Energy Consumption Survey, data were obtained regarding total commercial floor space by type of industry in the Northeast Region.

2. The numbers of employees for each of these categories employed in the Northeast Region and in New York City (City) were obtained from the Bureau of Labor Statistics, Current Employment Statistics Survey.

3. From these data, the square feet of commercial space occupied by different types of employees in the Northeast Region was computed.

4. The computed square feet of space per employee was then applied to the City employment figures to estimate commercial square footage by type of industry.

NOTE:

These data series are displayed in Table 4.2-2. The City's service employees (these data exclude producers of goods) are about 48% employed in the Office category. For the Northeast region, a slightly smaller percentage of employees, 45%, are employed in this category. The Northeast has 25% of its workers in transportation, trade and utilities, compared to just 16% for the City. Though the percentage representation of each of these industries in the employment base may differ between the region and the City, one may assume that the square feet occupied by each employee in different industries would be comparable between the region and the City. There is a significant difference in the space occupied by employees is different industries. For example, transportation, trade and utility workers each occupy an average of 672 square feet whereas office workers occupy just 280 square feet each. Using the actual employment figures for the City and the average square footage occupied by each employee in the four different industry groupings, the estimated commercial square footage for the City was computed.

Attachment 3

Weighted Average Densities, Non-Putrescible Waste

Weighted Average Densities, Non-Putrescible Waste

Item	Year 2000 Tons	Percent of Total	Density	Weighted Average Pounds
Residential				
Construction	31,952	1.70%	342	6
Demolition	467,262	24.90%	552	137
Renovation	37,353	2.00%	345	9
Commercial				
Construction	24,149	1.29%	549	7
Demolition	709,347	37.80%	711	269
Renovation	606,425	32.3%	469	152
Total Building-Related C&D	1,876,488	100.00%		580
Non-Building Related C&D			825	825

See Table A-2 for the density figures and their sources. Tonnages derived from various tables in text.

COMMERCIAL WASTE MANAGEMENT STUDY

VOLUME III

CONVERTED MARINE TRANSFER STATIONS -

Commercial Waste Processing and Analysis of Potential Impacts

March 2004

Prepared for:

New York City Department of Sanitation for submission to the New York City Council

Prepared by:

Henningson, Durham & Richardson Architecture and Engineering, P.C.

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This report was prepared by

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PREFACE

Local Law 74 of 2000 (LL74) mandated the conduct of a comprehensive study of commercial waste management (Commercial Waste Management Study or Study) in New York City (City) by a Consultant funded by the City Department of Sanitation (DSNY). This Study undertaken to comply with LL74 will assist the City in managing the commercial waste stream in the most efficient and environmentally sound manner, and assist in the development of the City's Solid Waste Management Plan (New SWMP) for the New SWMP Planning Period.

As stated in LL74, the Study should include an analysis of *"whether putrescible and non-putrescible solid waste transfer stations and city-owned marine transfer stations should receive and process both residential and commercial solid waste and the options for transporting such solid waste to and from such transfer stations, including an analysis of potential environmental, economic and public health impacts."* The Commercial Waste Management Study Final Scope of Work describes the approach used to address this issue.

In addition to this Volume III, the Study consists of five other volumes:

- Volume I: Private Transfer Station Evaluations;
- Volume II: Commercial Waste Generation and Projections;
- Volume IV: Evaluation of Waste Disposal Capacity Potentially Available to New York City;
- Volume V: Manhattan Transfer Station Siting Study; and
- Volume VI: Waste Vehicle Technology Assessment.

This volume, Volume III: Converted Marine Transfer Stations (MTSs) – Commercial Waste Processing and Analysis of Potential Impacts, reports on: (i) the capacity required by DSNY for DSNY-managed Waste at each of the Converted MTSs; (ii) the quantity of capacity potentiallyavailable for private carters delivering commercial waste; and (iii) the results of the environmental review evaluating whether that capacity can be used without causing potentially unmitigatible adverse environmental impacts. The reports and appendices that provide the analyses and data in support of this Executive Summary are:

"Summary Report on Commercial Waste Processing at Converted MTSs" and its **Appendix**:

Appendix A: MTS Environmental Evaluation

Technical Backup for the MTS Environmental Evaluation is available on request by contacting the office of the DSNY Assistant Commissioner, Harry Szarpanski, P.E., (917) 237-5501.

EXECUTIVE SUMMARY

Scope of Analysis/Approach

LL74 requires the Study to consider whether the City's MTS system could accommodate commercial waste as well. When LL74 was adopted, the concept of developing an MTS Conversion Program for containerizing waste for long-term export was not established as a policy objective of the City. Given this policy objective, addressing the issue of processing commercial waste at the Converted MTSs first required, as a foundation, an environmental review of the potential impacts associated with processing DSNY-managed Waste at the new facilities. That environmental review, using City Environmental Quality Review (CEQR) methodologies, is reported in Volume III, Appendix A, MTS Environmental Evaluation, to this report. It concludes that the DSNY-managed Waste generated in the wastesheds that historically delivered to the MTS system can be containerized for export without causing potentially unmitigatible significant adverse environmental impacts. The next step was to analyze what impacts would result from the potential delivery of commercial putrescible waste to the Converted MTSs.

It is important to emphasize that this assessment focuses solely on environmental considerations. It should not be interpreted as a general conclusion that export of commercial waste through the Converted MTSs is feasible. Some of the additional factors that bear on the issue of feasibility that are not addressed in this report are:

- The economics of export through the MTSs, which will be determined in part by proposals from private vendors for transport and disposal of containerized waste from the Converted MTSs. The City has just received and begun evaluating these proposals. Thus the economics of commercial waste export through the Converted MTSs is not yet known.
- The types of business arrangements that the City would enter into with carters for exporting commercial waste through the MTSs, which are not yet defined.
- Whether further development of the designs for the Converted MTSs will substantiate the operational assumptions or necessitate that the assumed operational capacity be reduced.

- The comparative cost of exporting through the existing private Transfer Stations, which could be more attractive.
- The potential permit limitations that NYSDEC may place on the operation of the Converted MTSs.
- The location of some MTSs in relation to the sources of commercial waste generation, which may not provide the same efficiencies and consequently be as attractive to private carters as delivering to private Transfer Stations.

The evaluation of processing commercial putrescible waste at the Converted MTSs is an incremental analysis, complying with the CEQR procedures, that builds on the foundation of the Volume III, Appendix A, MTS Environmental Evaluation report. The analysis of the potential on-site-related impacts associated with processing DSNY-managed Waste is based on the design capacities of the Converted MTSs and concluded that there were no unmitigatible significant adverse impacts. Since commercial putrescible waste deliveries would not exceed these facility design capacities, the potential processing of some quantities of the City's commercial putrescible waste would not cause any incremental significantly adverse impacts attributable to on-site operations.

The analysis of off-site impacts associated with processing putrescible commercial waste required an incremental environmental review of the potential for on-site air quality and off-site (mobile) air quality and noise impacts attributable to delivery of such commercial waste.

The starting point in evaluating the potential capacity available for commercial putrescible waste was defining a scenario for DSNY's capacity requirements that reserved the block of time from 8:00 a.m. to 8:00 p.m. for processing DSNY-managed Waste and assumed that deliveries of DSNY-managed Waste during the 8:00 p.m. to 8:00 a.m. period would have priority over deliveries of commercial waste. Table ES-1 summarizes:

- The design capacity in tons per day (tpd) that each Converted MTS is capable of processing under a normal operations scenario;
- The capacity reserved for DSNY-managed Waste; and
- The potential available excess capacity at each of the Converted MTSs.

The column showing DSNY-managed Waste reserved capacity reflects the historical average peak day generation in the respective MTS wastesheds. Under conditions of high peak generation, the MTSs can be operated to process DSNY-managed Waste in excess of the tpd quantities shown in the table.

Table ES-1
DSNY-managed Waste Reserved Capacity Scenario

Converted MTS Facility	Converted MTS Design Capacity[(1)] (tpd)	DSNY-managed Waste Reserved Capacity (tpd)	Excess Capacity, 8:00 a.m. to 8:00 p.m. (tons)	Excess Capacity, 8:00 p.m. to 8:00 a.m. (tons)
West 135th Street	4,290	1,180	1,211	1,853
East 91st Street	4,290	880	1,227	2,183
West 59th Street[(2)]	2,145	880	279	956
South Bronx	4,290	2,190	333	1,732
North Shore	4,290	2,370	622	1,000
Greenpoint	4,290	2,360	575	1,145
Hamilton Avenue	4,290	2,170	630	1,337
Southwest Brooklyn	4,290	1,090	1,418	1,725
Totals	32,175	13,120	6,295	11,931

Notes:
(1) Based on operating MTSs under normal operating conditions. Spare operating lines are not used to process waste.
(2) West 59th Street is a lift and load operation, not an open top-loading slot system.

Given the DSNY-managed Waste Reserved Capacity Scenario, a Commercial Waste Capacity Scenario was defined to determine the potential available capacity that could be used by private carters delivering waste from commercial sources. This scenario identified the potential available capacity on an hourly basis at each Converted MTS, and provided the basis for evaluating the potential on-site air quality, off-site air quality and off-site noise impacts associated with the delivery of commercial waste in nighttime hours. The maximum capacity potentially available for processing commercial waste was evaluated with a spreadsheet model that incorporates both Converted MTS design and operating parameters developed by the DSNY's Consultant design team and arrival profiles for DSNY-managed Waste. It is assumed that, between the hours of 8:00 p.m. and 8:00 a.m., both DSNY-managed Waste and commercial waste could be received and processed at the Converted MTSs. Table ES-2 summarizes the results of this evaluation. As shown in the "Potential Available Capacity, 8:00 p.m. to 8:00 a.m." column, the total capacity potentially available for processing commercial waste during this period totals 11,931 tons, allocated among the eight MTSs. This does not take into account any environmental constraints that may limit the potential delivery of commercial waste.

Table ES-2
Available Potential Excess Capacity at Converted MTSs
Based on the Capacity Reserved for DSNY-managed Waste

Converted MTS Facility	Average Day Design Capacity [(1)] (tpd)	Potential Available Capacity, Average Peak Day (tpd)	Average Peak Day			Maximum Number of DSNY Collection Vehicles, 8:00 a.m. to 8:00 p.m. (peak hour)	Potential Range of Maximum Number of Collection Vehicles[(3)] 8:00 p.m. to 8:00 a.m. (peak hour)
			Potential Available Capacity, 8:00 a.m. to 8:00 p.m. (tons)	Potential Available Capacity, 8:00 p.m. to 8:00 a.m. (tons)	Potential Additional Number of Commercial Vehicles, 8:00 p.m. to 8:00 a.m.[(2)] (per day)		
West 135th Street	4,290	3,110	1,211	1,853	175	30	20-22
East 91st Street	4,290	3,410	1,227	2,183	199	28	19-21
West 59th Street [(4)]	2,145	1,265	279	956	91	21	10-12
South Bronx	4,290	2,100	333	1,732	163	64	21-23
North Shore	4,290	1,920	622	1,000	95	39	24-26
Greenpoint	4,290	1,930	575	1,145	109	61	22-24
Hamilton Avenue	4,290	2,120	630	1,337	129	32	23-25
Southwest Brooklyn	4,290	3,200	1,418	1,725	162	27	21-23
Totals	**32,175**	**19,055**	**6,295**	**11,931**	**1,123**		

Notes:

(1) Based on operating the MTSs under normal operating conditions. Spare operating line is not used to process waste.

(2) Assuming commercial collection vehicles deliver an average of 11 tons per truck. (Field data indicates commercial collection vehicles average between 11 and 13 tons per truck.)

(3) DSNY collection vehicles and commercial Waste Hauling Vehicles.

(4) West 59th Street is a lift and load operation - not an open top-loading slot system.

Findings

Processing of Commercial Waste at the Converted MTSs

1. The CEQR analyses in the MTS Environmental Evaluation show there are no potentially significant unmitigatible adverse environmental impacts associated with on-site processing of DSNY-managed Waste. This would also apply to processing of commercial waste at each converted MTS in the quantities shown in Table ES-2. However, further evaluation of potential on-site air quality, off-site noise and off-site air quality impacts from nighttime deliveries of commercial waste was required.

2. The on-site air quality analysis of processing DSNY-managed Waste at some of the Converted MTS sites showed that using the facility average design capacity (including the processing of commercial waste) to estimate pollutants did not cause an exceedance of annual average standards.

3. The off-site air quality analysis of processing DSNY-managed Waste at some of the Converted MTS sites showed that using the conservative assumption that peak hour conditions occur 24 hours per day (a Tier I analysis) resulted in unmitigatible environmental impacts for PM_{10} and $PM_{2.5}$. (See Section 10 of the individual chapters in the MTS Environmental Evaluation for these analyses.) Therefore, a Tier II air quality analysis was also performed for deliveries of commercial waste at intersections near each of the Converted MTS sites. The analysis used data on actual hourly traffic volumes on routes to and from the site and included the higher number of commercial collection vehicles assumed to deliver to each Converted MTS during the 8:00 p.m. to 8:00 a.m. period. No significant adverse unmitigatible environmental off-site air quality impacts were identified.

4. Evaluating the potential for off-site noise impacts required the use of a second-level noise screening analysis. (See Section 3.14.5.2 of Volume III, Appendix A for a detailed explanation.) The results of this analysis indicate that the number of potential commercial Waste Hauling Vehicles that could be routed to the MTSs during various hours within the 8:00 p.m. to 8:00 a.m. period must be limited to less than the available

excess capacity to avoid causing potential impacts at sensitive receptors on the analyzed routes these vehicles might take to the MTSs. The amount of available capacity that can potentially be used to process commercial waste during the hours of 8:00 a.m. to 8:00 p.m. without causing any significant adverse noise impacts is summarized in Table ES-3.

Table ES-3
Converted MTS
Potential Commercial Waste Capacities Summary Table

Location	Converted MTS Design Capacity		DSNY-managed Waste Delivered 8:00 p.m. to 8:00 a.m. (tons)	Potential Converted MTS Capacity with Off-Site Noise Constraints	
	Total Potential Commercial Vehicles (per day)	Potential Commercial Waste Tonnage 8:00 p.m. to 8:00 a.m. (tons)		Total Potential Commercial Vehicles (per day)	Potential Commercial Waste Tonnage 8:00 p.m. to 8:00 a.m. (tons)
West 135th Street	175	1,853	301	95	1,029
East 91st Street(1)	199	2,183	17	71	781
West 59th Street(2)	91	956	114	91	956
South Bronx(1)	163	1,732	433	150	1,611
North Shore(3)	95	1,000	901	95	1,000
Greenpoint(1)	109	1,145	793	109	1,145
Hamilton Avenue(1)	129	1,337	710	124	1,306
Southwest Brooklyn(4)	162	1,725	418	76	828
Total	**1,123**	**11,931**	**3,687**	**811**	**8,656**

Notes:
(1) Need to use different routes for potential commercial Waste Hauling Vehicles to deliver the full amount of excess capacity for commercial waste.
(2) Can take all potential commercial Waste Hauling Vehicles without any noise constraints.
(3) There is a route to the North Shore Converted MTS that does not pass sensitive receptors that must be used from 12:00 a.m. to 6:00 a.m. to deliver the full amount available for commercial capacity. The route should not be used at other times upon request from the City Department of Transportation (NYCDOT) due to congestion that occurs at certain intersections along the route during daytime traffic hours.
(4) Outbound trucks passing 26th Street between Cropsey Avenue and Shore Road limit the number of inbound commercial Waste Hauling Vehicles that can be accommodated at the Southwest Brooklyn Converted MTS.

Since these results are based on a second-level screening for noise impacts, a detailed off-site noise analysis, utilizing the Federal Highway Administration (FHWA) Traffic Noise Model (TNM) Version 2.1, is being performed to determine if noise impacts would actually occur at these sensitive receptor locations and/or if additional potential commercial Waste Hauling Vehicles could be routed to the MTS during the 8:00 p.m. to 8:00 a.m. hour, without causing unmitigatible significant adverse off-site noise impacts, to fully utilize the potentially available capacity of the MTSs. The results of the off-site detailed noise analyses will be available at a later date.

5. This evaluation of potential processing commercial waste at the Converted MTSs was limited to an environmental review that focused on traffic, on-site and off-site air quality and noise, and on-site odor impacts.

Processing of DSNY-Managed Waste at the Converted MTSs

This section summarizes key findings from Volume III, Appendix A, MTS Environmental Evaluation, an environmental review of operations for the Converted MTSs in processing DSNY-managed Waste.

1. Table ES-4 summarizes the facility design capacity assumptions and the assumed tons of DSNY-managed Waste processed during average peak days that were the basis of the MTS Environmental Evaluation. The assumed tons of DSNY-managed Waste in this table vary from the tons shown in the DSNY-managed Waste Reserved Capacity Scenario Table ES-1. This reflects a contingency added to DSNY average peak day deliveries to provide a margin of conservatism in the analysis.

2. Based on the design capacity and operating assumption, described in more detail in Volume III, the MTS Environmental Evaluation found there were no unmitigatible significant adverse environmental impacts associated with processing the average peak day deliveries of DSNY-managed Waste. The environmental evaluation demonstrates the Converted MTSs will enable export of DSNY-managed Waste in an efficient and environmentally sound manner. This summary conclusion is supported by the environmental evaluation that addressed: Land Use, Zoning and Public Policy;

Table ES-4
MTS Environmental Analysis Information

Converted MTS Facility	Total Number of Loading Slots	DSNY-managed Waste Average Peak Day Deliveries, (tons)(1)	Number of DSNY-Managed Vehicles, Average Peak Day	Average Day Design Capacity(2) (tpd)	Peak-Hour Number of DSNY Collection Vehicles
West 135th Street	4	1,416	222	4,290	30
East 91st Street	4	1,093	130	4,290	28
West 59th Street(3)	3	1,068	124	2,145	21
South Bronx	4	2,804	363	4,290	64
North Shore	4	2,672	329	4,290	39
Greenpoint	4	3,387	423	4,290	61
Hamilton Avenue	4	2,248	267	4,290	32
Southwest Brooklyn	4	1,388	166	4,290	27
Totals		**16,076**	**2,024**	**32,175**	

Notes:

(1) All MTSs based on scale data from Fiscal Year 1998 received from the DSNY Bureau of Cleaning and Collection with a 20% contingency allowance, except for the South Bronx MTS. South Bronx MTS data is based on Fiscal Year 1997 with a 20% contingency allowance.

(2) Based on operating the MTS under normal operating conditions. Spare operating line is not used to process waste.

(3) West 59th Street is a lift and load operation - not an open top-loading slot system.

Socioeconomic Conditions; Neighborhood Character; Community Facilities and Services; Open Space and Parklands; Cultural Resources; Traffic and Transportation; Air Quality; Noise; Infrastructure and Energy and Solid Waste; Natural Resources (including Endangered Species and Habitats); Water Quality; Waterfront Revitalization Program; Hazardous Materials; and Urban Design and Visual Quality. For the eight MTSs, the following measures were identified to mitigate estimated adverse impacts for traffic and on-site noise:

- Traffic signal timing adjustments would mitigate estimated traffic impacts identified at five intersections near the South Bronx Converted MTS; three intersections near the Southwest Brooklyn Converted MTS; three intersections near the Greenpoint Converted MTS; two intersections near the Hamilton Avenue Converted MTS; one intersection near the West 135th Street Converted MTS; two intersections near the East 91st Street Converted MTS; and two intersections near the North Shore Converted MTS. No traffic impacts were estimated at traffic study intersections identified near the West 59th Street Converted MTS.

- Construction of a 20-foot-tall (from the ramp surface) noise barrier located on the southern side of the ramp at the South Bronx Converted MTS would mitigate the potential noise impact on a nearby prison barge. A 20-foot-tall (from the ramp surface) noise barrier located on the southeast property line of the Southwest Brooklyn Converted MTS and a restriction on the number of nighttime arrivals of collection vehicles queuing on trucks and ramps would mitigate the potential noise impact on a nearby residential complex.

- Subsurface site investigations at the Southwest Brooklyn, Greenpoint, and Hamilton Avenue Converted MTS sites are underway. Results will be provided at a later date.

These analyses and findings are detailed in the MTS Environmental Evaluation, the appendix to this volume.

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List of Acronyms/Definitions

Acronyms	
CD	community district
CEQR	City Environmental Quality Review
CO	carbon monoxide
DEIS	Draft Environmental Impact Statement
DSNY	New York City Department of Sanitation
FHWA	Federal Highway Administration
LL74	Local Law 74, effective December 19, 2000, enacted by the City Council, requiring a comprehensive assessment of commercial solid waste management in New York City
MTS	marine transfer station
NAAQS	National Ambient Air Quality Standards
NYCDOT	New York City Department of Transportation
NYSDOT	New York State Department of Transportation
PCE	passenger car equivalent
ppm	parts per million
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
STV	screening threshold value
SWMP	Solid Waste Management Plan
TNM	Traffic Noise Model
tpd	tons per day

Acronyms	
$\mu g/m^3$	micrograms per cubic meter

Definitions	
City	New York City
Commercial Waste Capacity Scenario	Scenario which identifies the available capacity on an hourly basis at each Converted MTS, and provides the basis on which potential air quality and noise impacts associated with the delivery of commercial waste in nighttime hours can be evaluated
Converted MTS	One of DSNY's eight marine transfer stations, modified to containerize waste for out-of-City export by barge or rail
DSNY-managed Waste	Solid waste that DSNY collects from all residential households in the City and the institutional waste of City, state and federal agencies that DSNY collects and/or for which DSNY arranges disposal
DSNY-managed Waste Reserved Capacity Scenario	Scenario which determines the Converted MTS capacity that would be required for DSNY-managed Waste to provide for an adequate margin to meet its peak demand requirements under all conditions except declared waste disposal emergencies
Final Study Scope or Final Scope of Work	Commercial Waste Management Study Final Scope of Work issued on July 31, 2003
MTS Conversion Program	The City's initiative to develop, at the sites of the existing marine transfer stations (MTSs), new converted MTSs that will containerize solid waste for long-term export by barge with the potential for additional intermodal transfers to enable delivery of containerized waste to disposal facilities outside of the City

Definitions	
New SWMP	The new comprehensive Solid Waste Management Plan to be developed in 2004 for both DSNY-managed Waste and commercial waste for the planning period 2004 through 2024
New SWMP Planning Period	The 20-year period from 2004 to 2024 addressed by the City's New Solid Waste Management Plan
Study	Commercial Waste Management Study
Transfer Station(s)	Privately owned and operated transfer station in New York City that accepts, transfers and transports some portion of municipal solid waste or construction and demolition (C&D) debris or fill material generated in the private sector for out-of-City disposal
Waste Hauling Vehicles	Collection vehicles/transfer trailers that are used to transport municipal solid waste, C&D debris or fill material to or from the Transfer Stations

1.0 POTENTIAL PROCESSING OF COMMERCIAL WASTE AT THE CONVERTED MARINE TRANSFER STATIONS AND RELATED POTENTIAL IMPACTS

1.1 Introduction

This report evaluates the capacity that would potentially be available at the Converted Marine Transfer Stations (MTSs) to containerize commercial waste delivered by private carters. When Local Law 74 (LL74) was adopted, the concept of developing an MTS Conversion Program for containerizing waste for long-term export was not established as a policy objective of New York City (City). Given this policy objective, addressing the issue of processing commercial waste at the Converted MTSs first required, as a foundation, an environmental review of the potential impacts associated with processing City Department of Sanitation (DSNY)-managed Waste. That environmental review, using City Environmental Quality Review (CEQR) methodologies, is reported in Volume III, Appendix A, MTS Environmental Evaluation. It addressed: Land Use, Zoning and Public Policy; Socioeconomic Conditions; Neighborhood Character; Community Facilities and Services; Open Space and Parklands; Cultural Resources; Traffic and Transportation; Air Quality; Odor; Noise; Infrastructure and Energy and Solid Waste; Natural Resources (including Endangered Species and Habitats); Water Quality; Waterfront Revitalization Program; Hazardous Materials; and Urban Design and Visual Quality. It demonstrates the Converted MTSs will enable export of DSNY-managed Waste in an efficient and environmentally sound manner and provides the basis on which the incremental environmental effects of containerizing and exporting commercial waste from the Converted MTSs are evaluated.

The Converted MTSs, if included in the new Solid Waste Management Plan (New SWMP), would be developed at up to eight of the existing MTS sites with the tons per day (tpd) design capacities indicated below:

- West 135th Street (Manhattan) – 4,290 tpd
- East 91st Street (Manhattan) – 4,290 tpd
- West 59th Street (Manhattan) – 2,145 tpd

- South Bronx (Hunts Point) – 4,290 tpd
- North Shore (Queens) – 4,290 tpd
- Greenpoint (Brooklyn) – 4,290 tpd
- Hamilton Avenue (Brooklyn) – 4,290 tpd
- Southwest Brooklyn– 4,290 tpd

Based on these design capacities and the operating assumption, described in more detail in Appendix A, MTS Environmental Evaluation, there were no unmitigatible significant adverse environmental impacts associated with processing the average peak day deliveries of DSNY-managed Waste. For the eight MTSs, the following measures were identified to mitigate estimated adverse impacts for traffic and on-site noise:

- Traffic signal timing adjustments would mitigate estimated traffic impacts identified at five intersections near the South Bronx Converted MTS; three intersections near the Southwest Brooklyn Converted MTS; three intersections near the Greenpoint Converted MTS; two intersections near the Hamilton Avenue Converted MTS; one intersection near the West 135th Street Converted MTS; two intersections near the East 91st Street Converted MTS; and two intersections near the North Shore Converted MTS. No traffic impacts were estimated at traffic study intersections identified near the West 59th Street Converted MTS.
- Construction of a 20-foot-tall (from the ramp surface) noise barrier located on the southern side of the ramp at the South Bronx Converted MTS would mitigate the potential noise impact on a nearby prison barge. A 20-foot-tall (from the ramp surface) noise barrier located on the southeast property line of the Southwest Brooklyn Converted MTS and a restriction on the number of nighttime arrivals of collection vehicles queuing on trucks and ramps would mitigate the potential noise impact on a nearby residential complex.
- Subsurface site investigations at the Southwest Brooklyn, Greenpoint, and Hamilton Avenue Converted MTS sites are underway. Results will be provided at a later date.

These analyses and findings are detailed in the MTS Environmental Evaluation, the appendix to this volume.

This report evaluates the use of available Converted MTS capacity, after processing all DSNY-managed Waste on a priority basis, to potentially containerize commercial waste without causing potentially significant unmitigatible adverse impacts.

It is important to emphasize that this assessment focuses solely on environmental considerations. It should not be interpreted as a general conclusion that export of commercial waste through the Converted MTSs is feasible. Some of the additional factors that bear on the issue of feasibility that are not addressed in this report are:

- The economics of export through the MTSs, which will be determined in part by proposals from private vendors for transport and disposal of containerized waste from the Converted MTSs. The City has just received and begun evaluating these proposals, thus the economics of commercial waste export through the Converted MTSs are not yet known.
- The types of business arrangements that the City would enter into with carters for exporting commercial waste through the MTSs, which are not yet defined.
- Whether further development of the designs for the Converted MTSs will substantiate the operational assumptions or necessitate that the assumed operational capacity be reduced.
- The comparative cost of exporting through the existing private Transfer Stations, which could be more attractive.
- The potential permit limitations that NYSDEC may place on the operation of the Converted MTSs.
- The location of some MTSs in relation to the sources of commercial waste generation, which may not provide the same efficiencies and consequently be as attractive to private carters as delivering to private Transfer Stations.

1.2 Summary of On-Site Impact Analyses in the MTS Environmental Evaluation

On-site air quality, odor and noise impacts in the MTS Environmental Evaluation were evaluated assuming that the Converted MTSs operated at their design capacities. Appropriate CEQR-based methodologies were applied to evaluate the potential for any significant unmitigatible adverse environmental impacts. As noted in Table 1.2-1, the design capacities are significantly higher than the anticipated quantities of DSNY-managed Waste. The MTS design capacities were based on, among other things, the following considerations:

- Ensuring a facility design with the capacity to containerize DSNY-managed Waste at the peak hourly arrival rates of DSNY collection vehicles;

- Providing redundancy in the system to deal with upset conditions affecting operations at a facility or with weather-related emergencies; and
- Allowing for future growth.

Table 1.2-1
MTS Environmental Analysis Information

Converted MTS Facility	Total Number of Loading Slots	DSNY-managed Waste Average Peak Day Deliveries, (tons)(1)	Number of DSNY-managed Vehicles, Average Peak Day	Average Day Design Capacity(2) (tpd)	Peak-Hour Number of DSNY Collection Vehicles
West 135th Street	4	1,416	222	4,290	30
East 91st Street	4	1,093	130	4,290	28
West 59th Street(3)	3	1,068	124	2,145	21
South Bronx	4	2,804	363	4,290	64
North Shore	4	2,672	329	4,290	39
Greenpoint	4	3,387	423	4,290	61
Hamilton Avenue	4	2,248	267	4,290	32
Southwest Brooklyn	4	1,388	166	4,290	27
Totals		**16,076**	**2,024**	**32,175**	

Notes:
(1) All MTSs based on scale data from Fiscal Year 1998 received from the DSNY Bureau of Cleaning and Collection with a 20% contingency allowance, except for the South Bronx MTS. South Bronx MTS data is based on Fiscal Year 1997 with a 20% contingency allowance.
(2) Based on operating the MTS under normal operating conditions. Spare operating line is not used to process waste.
(3) West 59th Street is a lift and load operation - not an open top-loading slot system.

Although these peak hourly arrival rates are not sustained over a 24-hour period, the MTS Environmental Evaluation of on-site impacts conservatively modeled these peak hour conditions to predict the potential for on-site noise and odor impacts, and air quality impacts for short-term (1-hour, 3-hour, 8-hour and 24-hour) averaging periods. Because the analyses of short-term averaging periods were based on facility operations at the design capacity, no additional evaluation of on-site noise and odor impacts related to the processing of commercial waste was required.

An evaluation of potential on-site air quality impacts for pollutants compared to annual average standards was modeled assuming commercial waste was processed at the Converted MTSs. Based on these analyses, the potential processing of some quantities of the City's commercial putrescible waste would not cause any incremental significantly adverse impacts attributable to on-site operations (see Attachment 4).

Table 1.2-1 also presents the average peak day[1] assumptions for delivery of DSNY-managed Waste used in the environmental analyses performed at each Converted MTS. For the on-site analysis, a 20% contingency factor (i.e., expected peak volumes were increased by 20%) was applied to the average peak day number of DSNY collection vehicles.

[1] The average peak day is the average of historic DSNY-managed Waste delivered to the existing MTSs on the peak day each week for 52 weeks (i.e., the average of 52 Tuesdays).

2.0 DSNY CAPACITY REQUIREMENTS AND POTENTIALLY AVAILABLE COMMERCIAL WASTE CAPACITY

2.1 DSNY-managed Waste Reserved Capacity Scenario

In evaluating the potential quantity of commercial waste that could be processed at the Converted MTSs, DSNY first determined the facility capacity that would be required for DSNY-managed Waste to provide for an adequate margin to meet its peak demand requirements under all conditions except declared waste disposal emergencies. This is referred to as the DSNY-managed Waste Reserved Capacity Scenario. This scenario differs in certain respects from the assumptions made in the MTS Environmental Evaluation. It is based on historical waste delivery patterns for the average peak days, not including a 20% contingency factor, and reserves all capacity between 8:00 a.m. and 8:00 p.m. for DSNY-managed Waste deliveries. Under conditions of high peak generation, the waste processing throughput of the Converted MTSs can be increased over a short period of time with the addition of personnel and extended shift operating time.

DSNY has defined the allocation of the total number of loads and tons of DSNY-managed Waste that would be delivered to each Converted MTS based on each MTS's historical wasteshed. They used a historical annual average of peak day deliveries to the existing MTSs as a basis for reserving sufficient capacity for processing DSNY-managed Waste at each Converted MTS. An hourly distribution of the loads and tons delivered to each MTS was developed based on historical delivery data to the existing MTSs provided by DSNY. For each Converted MTS, a model was set up using this delivery data to simulate the operation of each MTS for processing its allotted DSNY-managed Waste on an hourly basis under normal operating conditions. The following assumptions were made about the normal operations of the Converted MTSs:

- The Converted MTS would process ten containers per hour with three loading slots in operation, except for the West 59th Street MTS;
- The West 59th Street MTS would process five containers per hour using a lift-and-load-type operation and two of the three loading slots;
- The loader level would be kept as clear of waste as possible during processing hours by loading all waste received into containers as soon as possible and keeping stockpiles at a minimum;

- Each container would be loaded with approximately 20 to 22 tons of waste;
- Each barge would be loaded with 48 containers of waste;
- Barge switches would not interrupt waste processing operations; and
- Employees would effectively work six and one-half hours out of an eight-hour shift due to shift changes and break time during the shift.

Based on these assumptions, the Converted MTSs, except for the West 59th Street facility, would containerize a maximum of 220 tons of waste per hour and 4,290 tons of waste per day under normal operating conditions. The West 59th Street Converted MTS would containerize a maximum of 110 tons of waste per hour and 2,145 tons of waste per day.

Waste delivery profiles were established for each Converted MTS and tons and loads were allotted to each Converted MTS on an hourly basis. Facility performance was modeled on an hour-to-hour basis for 24 hours beginning with the first (8:00 a.m. to 4:00 p.m.) of three shifts. The model calculated the difference between the incoming tonnage and the maximum available processing capacity during the same hour. If the incoming tonnage exceeded the processing capacity of the Converted MTS for that hour, the excess tonnage is stockpiled. Stockpiled waste is processed during a subsequent hour, when additional capacity became available. If the total incoming waste plus any waste in the stockpile is less than the processing capacity of the Converted MTS, the model computed the capacity available during that hour to process additional waste.

In addition to calculating the available waste capacity at the Converted MTSs, the model calculated the cumulative tons received, cumulative tons containerized and cumulative number of DSNY collection vehicles that delivered waste to the MTS on an hourly basis. The capacity model also calculated the fluctuation in the stockpile and tonnage in the stockpile by hour and the approximate hour in which barge switches would occur. Table 2.1-1 presents a summary of the reserved capacity for DSNY-managed Waste and available excess capacity at each of the Converted MTSs. The column showing DSNY-managed Waste reserved capacity reflects the historical average peak day generation in the respective MTS wastesheds.

Table 2.1-1
DSNY-managed Waste Reserved Capacity Scenario

Converted MTS Facility	Converted MTS Design Capacity[1] (tpd)	DSNY-managed Waste Reserved Capacity (tpd)	Excess Capacity, 8:00 a.m. to 8:00 p.m. (tons)	Excess Capacity, 8:00 p.m. to 8:00 a.m. (tons)
West 135th Street	4,290	1,180	1,211	1,853
East 91st Street	4,290	880	1,227	2,183
West 59th Street[2]	2,145	880	279	956
South Bronx	4,290	2,190	333	1,732
North Shore	4,290	2,370	622	1,000
Greenpoint	4,290	2,360	575	1,145
Hamilton Avenue	4,290	2,170	630	1,337
Southwest Brooklyn	4,290	1,090	1,418	1,725
Totals	**32,175**	**13,120**	**6,295**	**11,931**

Notes:
(1) Based on operating MTSs under normal operating conditions. Spare operating lines are not used to process waste.
(2) West 59th Street is a lift and load operation, not an open top-loading slot system.
tpd = tons per day

2.2 Commercial Waste Capacity Scenario

Given the DSNY-managed Waste Reserved Capacity Scenario, a Commercial Waste Capacity Scenario was defined to determine the potential available capacity that could be used by private carters delivering waste from commercial sources. This scenario identified the potential available capacity on an hourly basis at each Converted MTS, and provided the basis for evaluating the potential off-site air quality and off-site noise impacts associated with the delivery of commercial waste in nighttime hours. The Commercial Waste Capacity Scenario involved the following steps:

- Quantifying the tons of waste and number of DSNY-managed Waste collection vehicles delivering waste to each Converted MTS on an hourly basis;
- Identifying hours in which additional waste could be delivered to the Converted MTSs;
- Calculating the additional tons of waste that could be delivered to each Converted MTS on an hourly basis;

- Estimating the additional number of collection vehicles it would take to deliver the additional waste;
- Identifying the potential commercial waste vehicle routes by approach direction (north, south, east, or west);
- Identifying the potential commercial wastesheds for each MTS;
- Estimating the number of commercial vehicles along each route based on the location of the waste source; and
- Determining if additional environmental analyses are required at each Converted MTS based on the additional number of collection vehicles that would deliver commercial waste and their assumed routes.

The following assumptions were made about commercial waste deliveries to the Converted MTSs:

- Commercial waste deliveries would occur only during the 8:00 p.m. to 8:00 a.m. period;
- Commercial collection vehicles would deliver an average of 11 tons per vehicle; and
- Commercial waste deliveries would not exceed the hourly waste processing capacity of each Converted MTS, thus commercial waste would not be stockpiled at the Converted MTSs.

It was assumed that all DSNY-managed Waste would be processed before any commercial waste was accepted at the MTS. Thus, the stockpile was reduced to zero tons, and all incoming DSNY-managed Waste containerized during an hour before excess capacity was allotted for commercial waste. Based on the available commercial waste tonnage, the model calculated the additional number of commercial collection vehicles required to deliver the commercial waste totaling the excess capacity. Additionally, the model calculated the total number of DSNY-managed Waste and potential commercial waste collection vehicles that could deliver waste in each hour.

Excess capacity was calculated for every hour of the day. Excess capacity on the first shift and first half of the second shift (8:00 a.m. to 8:00 p.m.) was considered additional contingency for DSNY-managed Waste. Because the hourly distribution is subject to fluctuation and cannot exactly replicate the delivery patterns of DSNY-managed Waste to the Converted MTSs, the total available capacity was summarized as a total tonnage between the hours of 8:00 a.m. to

8:00 p.m. Table 2.2-1 shows the capacity potentially available to commercial carters, based on the capacity assumptions for processing DSNY-managed Waste. The hourly results of the modeling, provided in tables in Attachment 1 to this report, show the hour-by-hour capacity analysis for each Converted MTS.

Table 2.2-1 also presents information on the potential additional number of commercial waste collection vehicles. It assumes that delivery of commercial waste by private carters uses all the remaining available capacity during the 8:00 p.m. to 8:00 a.m. period not required for processing of DSNY-managed Waste, not taking into account any environmental constraints that might limit deliveries of commercial waste. As shown in the "Potential Available Capacity, 8:00 p.m. to 8:00 a.m." column, the total capacity potentially available for processing commercial waste during this period totals 11,931 tons, allocated among the eight MTSs, not taking into account the environmental constraints.

Table 2.2-1
Available Potential Excess Capacity at Converted MTSs
Based on the Capacity Reserved for DSNY-managed Waste

Converted MTS Facility	Average Day Design Capacity (1) (tpd)	Potential Available Capacity, Average Peak Day (tpd)	Average Peak Day: Potential Available Capacity, 8:00 a.m. to 8:00 p.m. (tons)	Average Peak Day: Potential Available Capacity, 8:00 p.m. to 8:00 a.m. (tons)	Average Peak Day: Potential Additional Number of Commercial Vehicles, 8:00 p.m. to 8:00 a.m.(2) (per day)	Maximum Number of DSNY Collection Vehicles, 8:00 a.m. to 8:00 p.m. (peak hour)	Potential Range of Maximum Number of Collection Vehicles(3) 8:00 p.m. to 8:00 a.m. (peak hour)
West 135th Street	4,290	3,110	1,211	1,853	175	30	20-22
East 91st Street	4,290	3,410	1,227	2,183	199	28	19-21
West 59th Street (4)	2,145	1,265	279	956	91	21	10-12
South Bronx	4,290	2,100	333	1,732	163	64	21-23
North Shore	4,290	1,920	622	1,000	95	39	24-26
Greenpoint	4,290	1,930	575	1,145	109	61	22-24
Hamilton Avenue	4,290	2,120	630	1,337	129	32	23-25
Southwest Brooklyn	4,290	3,200	1,418	1,725	162	27	21-23
Totals	**32,175**	**19,055**	**6,295**	**11,931**	**1,123**		

Notes:
(1) Based on operating the MTSs under normal operating conditions. Spare operating line is not used to process waste.
(2) Assuming commercial collection vehicles deliver an average of 11 tons per truck. (Field data indicates commercial collection vehicles average between 11 and 13 tons per truck.)
(3) DSNY collection vehicles and commercial Waste Hauling Vehicles.
(4) West 59th Street is a lift and load operation - not an open top-loading slot system.

3.0 SUMMARY OF OFF-SITE IMPACT ANALYSES

A definitive determination of the quantity of potential commercial waste that can be processed at the Converted MTSs requires an assessment of whether commercial waste deliveries would cause any traffic, off-site air quality or off-site noise impacts. The MTS Environmental Evaluation evaluated the potential for traffic, off-site air quality and off-site noise impacts based on waste delivery profiles for DSNY-managed Waste with a 20% contingency to allow for potential variations in waste deliveries. This section identifies where those analyses were also sufficient for purposes of assessing the impacts associated with the delivery of commercial waste, and where additional analyses were required to determine whether commercial waste deliveries would potentially cause unmitigatible significant adverse environmental impacts.

To perform refined traffic, off-site air quality and noise analyses, it was necessary to identify likely locations where commercial waste might originate and be delivered to each Converted MTS and to develop potential routes for commercial waste vehicles to each Converted MTS. General commercial Waste Hauling Vehicle routes were developed by approach direction (north, south, east, or west). In some cases, more than one route per direction was identified as providing access to a Converted MTS. Waste Hauling Vehicle routes were identified to and from major highways and roadways in the vicinity of each Converted MTS, along local truck routes in the vicinity of each Converted MTS, and following the most direct route along local roads to a Converted MTS from the nearest truck route. As in the MTS Environmental Evaluation, it was assumed that commercial Waste Hauling Vehicles originating in different locations and delivering to the same Converted MTS will converge along routes in close proximity to the Converted MTS where access roads become limited.

To establish the approximate numbers of commercial Waste Hauling Vehicles along routes to each Converted MTS, an assessment was performed of commercial waste-generating establishments by zip code. The information developed in Volume II on commercial waste generation was used to develop commercial waste tonnages for an average peak day by zip code. Zip code boundaries for the City were plotted on a map, and commercial waste from establishments within those zip codes was assigned to each Converted MTS based on the community district (CD) assignment used in the Converted MTS Environmental Evaluation.

Those zip codes that fell within multiple CDs assigned to multiple Converted MTSs were assigned to the Converted MTS in which a greater proportion of the zip code boundary was contained. Once zip codes were assigned to a Converted MTS, the corresponding tonnage associated with that zip code was also assigned to the same Converted MTS. It was assumed that excess commercial tonnage that could not be processed at a Converted MTS would be processed at a private facility.

To analyze the full commercial capacity at each Converted MTS, additional zip codes were added to the wasteshed of a Converted MTS, until enough commercial waste would be delivered to the Converted MTS to fill the excess capacity. The additional zip codes were assigned based on geographic proximity to a Converted MTS and the commercial waste generated within a zip code. It was assumed that zip codes that generate greater volumes of commercial waste would be more likely to make up the difference between the excess capacity and allotted commercial tonnage.

Once sufficient commercial tonnage had been allotted to each Converted MTS, the trucks delivering tonnage from each zip code assigned to the Converted MTS were assigned along an approach to the Converted MTS. After all zip codes and their corresponding tonnages had been assigned, percentages by approach direction were calculated for each Converted MTS. These percentages were used to distribute the commercial waste vehicles along the assumed truck routes for the time period between 8:00 p.m. and 8:00 a.m. Commercial waste vehicles were assigned hourly in this manner as no hourly breakdown of commercial waste deliveries was available. The distribution of commercial waste vehicles by direction was then used for traffic, off-site air and off-site noise analyses.

3.1 Traffic

In the MTS Environmental Evaluation, traffic impacts were analyzed during background peak and facility-generated peak traffic hours using the appropriate CEQR-based methodologies. In evaluating the effect of additional commercial waste deliveries on traffic conditions, the analysis assumed that all remaining available capacity (i.e., the capacity not required to process DSNY-managed Waste) during the 8:00 p.m. to 8:00 a.m. period was used to process commercial waste.

The results of the analysis show that peak hour assumptions for processing of DSNY-managed Waste had higher background traffic volumes, lower (poorer) levels of service and a higher number of collection vehicles than would apply to commercial waste deliveries during the 8:00 p.m. to 8:00 a.m. period. (See Section 9 of the individual MTS chapters in the MTS Environmental Evaluation for these analyses.) Peak hour truck arrival rates during the 8:00 p.m. to 8:00 a.m. period (commercial waste plus DSNY collection vehicles) are lower than the peak hour number of DSNY collection vehicles analyzed during the peak hours at all eight Converted MTSs.

Table 2.2-1 illustrates the number of peak hour DSNY collection vehicles evaluated for the MTS Environmental Evaluation and the potential range of peak hour vehicles during commercial waste delivery hours. The peak hour number of vehicles during commercial delivery hours represents both DSNY collection vehicles and commercial Waste Hauling Vehicles. Since the traffic analysis in the MTS Environmental Evaluation found no significant adverse unmitigatible traffic impacts, there would also be no significant adverse unmitigatible environmental traffic impacts related to processing commercial waste during a peak period between 8:00 p.m. and 8:00 a.m., when there are lower background traffic volumes, higher (better) levels of service and a lower number of collection vehicles.

As noted in Section 1.1, for the eight MTSs, traffic signal timing adjustments would mitigate estimated traffic impacts identified at certain intersections related to delivery of DSNY-managed Waste.

3.2 Air Quality

The off-site air quality analyses during the peak hours for processing DSNY-managed Waste at each Converted MTS were based upon higher background traffic volumes, lower (poorer) levels of service and a higher number of collection vehicles than would be the case for deliveries of commercial waste during the 8:00 p.m. to 8:00 a.m. period. (See Section 10 of the individual chapters in the MTS Environmental Evaluation for these analyses.)

The peak hour conditions over 24 hours per day were conservatively assumed to occur under a Tier I[2] air quality analysis. Under these assumptions, there were no significant adverse unmitigatible environmental impacts. Therefore, there would also be no significant adverse unmitigatible air quality impacts related to processing commercial waste during an 8:00 p.m. to 8:00 a.m. peak period, when there are lower background traffic volumes, higher (better) levels of service and a lower number of collection vehicles.

The off-site air quality analysis of processing DSNY-managed Waste at some of the Converted MTS sites showed that using the conservative assumption that peak hour conditions occur 24 hours per day under a Tier I analysis resulted in unmitigatible environmental impacts for particulate matter less than 10 microns in diameter (PM_{10}) and less than 2.5 microns in diameter ($PM_{2.5}$). (See Section 10 of the individual chapters in the MTS Environmental Evaluation for these analyses.) Therefore, a Tier II air quality analysis was performed at intersections near these Converted MTS sites that utilized actual hourly traffic volumes, including the higher number of collection vehicles used for deliveries of commercial waste to each Converted MTS during the 8:00 p.m. to 8:00 a.m. period, and there were no significant adverse unmitigatible environmental impacts. Tables in Attachment 4 provide more detailed information on the results of the off-site air quality analyses.

3.3 Noise

In the MTS Environmental Evaluation, off-site noise impacts were screened over a 24-hour period at intersections where sensitive receptors exist near convergence points along truck routes to and from the Converted MTSs. If required, based on screening, noise analyses were conducted for the worst hour (the hour when the greatest difference in noise levels was expected) during daytime (7:00 a.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) hours. (See Section 3.14 in the MTS Environmental Evaluation for a detailed description of the off-site screening and analyses.)

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[2] The Tier I air quality analysis conservatively assumed that the peak hour traffic conditions occur 24 hours per day.

The screening analyses identified the potential for DSNY-managed Waste collection vehicles to double passenger car equivalents (PCEs) at two locations for the 91st Street Converted MTS, two locations for the North Shore Converted MTS, one location for the Hamilton Avenue Converted MTS and one location for the Southwest Brooklyn Converted MTS, at various hours during the nighttime. Off-site noise analyses were conducted during the worst daytime and nighttime hours identified through the screening process at these six locations with the potential to double PCEs. The off-site noise analyses results indicate an impact at one access road to the 91st Street Converted MTS, two locations on one access road to the North Shore Converted MTS and one access road to the Hamilton Avenue Converted MTS. Adjustments in the distribution of trucks and truck routes were made at these four locations. The screening, and, if required, the off-site noise analyses, were performed based on the adjusted lower levels of DSNY-managed Waste collection vehicles at these four locations. The results show that processing DSNY-managed Waste at any of the Converted MTSs would not cause any unmitigatible significant adverse off-site noise impacts. Results of the screening analyses and off-site noise analyses are provided in Sections 4.12 through 11.12 of the MTS Environmental Evaluation.

The off-site noise analysis of DSNY-managed Waste deliveries is not sufficient for purposes of assessing any impacts that would be associated with delivery of commercial waste. To determine if an adverse impact would be caused by the delivery of commercial waste, a screening level analysis was performed for each hour where additional truck volumes are estimated to determine if an off-site noise analysis would be required of commercial Waste Hauling Vehicle quantities and routes to and from the Converted MTSs.

3.3.1 Noise Impact Analysis of Commercial Waste Deliveries

A sequence of analyses were performed to determine if an adverse noise impact would be caused by the delivery of commercial waste to the MTSs, utilizing the noise methodology for the off-site screening, monitoring and detailed analysis provided in Section 3.14 of the MTS Environmental Evaluation. Results of the second-level noise screening analyses limit the number of commercial Waste Hauling Vehicles that could be routed to the MTSs during various hours within the 8:00 p.m. to 8:00 a.m. period without causing potentially significant adverse impacts at sensitive receptors. Although a Converted MTS may have available capacity to process commercial waste during the hours of 8:00 a.m. to 8:00 p.m., the potential for off-site noise impacts, based on second-level screening, limits the use of that available processing capacity.

Noise-sensitive receptors were identified along the proposed commercial collection vehicle routes and existing traffic data were gathered for those locations. A first-level screening analysis (based on total traffic volumes and axle factors from the New York State Department of Transportation [NYSDOT]) and a second-level screening analysis (based on actual vehicle classification counts) were performed. The Future Build PCEs -- including DSNY-managed Waste collection vehicles, employee vehicles and commercial collection vehicles -- were compared to the Future No-Build PCEs for each hour during the 8:00 p.m. to 8:00 a.m. period, to determine if the proposed action would double PCEs and therefore cause a possible impact. Table 3.3.1-1 summarizes the results of that analysis.

Since these results are based on a second-level screening for noise impacts, a detailed off-site noise analysis, utilizing the Federal Highway Administration (FHWA) Traffic Noise Model (TNM) Version 2.1, is being performed to determine if noise impacts would actually occur at these sensitive-receptor locations and/or if additional potential commercial Waste Hauling Vehicles could be routed to the MTS during the 8:00 p.m. to 8:00 a.m. hour, without causing unmitigatible significant adverse off-site noise impacts, to fully utilize the potentially available capacity of the MTSs. The results of this off-site detailed noise analyses will be provided in the Solid Waste Management Plan (SWMP) Draft Environmental Impact Statement (DEIS).

Tables in Attachment 5 provide more detailed information on the results of the second-level screening analysis, identifying the estimated range of commercial collection vehicles that can be routed through each of the roadways without causing an unmitigatible significant adverse off-site noise impact. (See Section 3.14.5.2 of the MTS Environmental Evaluation for a detailed description of the second-level screening analysis.)

Table 3.3.1-1
Converted MTS
Potential Commercial Waste Capacities Summary Table

Location	Converted MTS Design Capacity		DSNY-managed Waste Delivered 8:00 p.m. to 8:00 a.m. (tons)	Potential Converted MTS Capacity with Off-Site Noise Constraints	
	Total Potential Commercial Vehicles (per day)	Potential Commercial Waste Tonnage 8:00 p.m. to 8:00 a.m. (tons)		Total Potential Commercial Vehicles (per day)	Potential Commercial Waste Tonnage 8:00 p.m. to 8:00 a.m. (tons)
West 135th Street	175	1,853	301	95	1,029
East 91st Street(1)	199	2,183	17	71	781
West 59th Street(2)	91	956	114	91	956
South Bronx(1)	163	1,732	433	150	1,611
North Shore(3)	95	1,000	901	95	1,000
Greenpoint(1)	109	1,145	793	109	1,145
Hamilton Avenue(1)	129	1,337	710	124	1,306
Southwest Brooklyn(4)	162	1,725	418	76	828
Total	**1,123**	**11,931**	**3,687**	**811**	**8,656**

Notes:

(1) Need to use different routes for potential commercial Waste Hauling Vehicles to deliver the full amount of potential excess capacity for commercial waste.

(2) Can take all potential commercial Waste Hauling Vehicles without any noise constraints.

(3) There is a route to the North Shore Converted MTS that does not pass sensitive receptors that must be used from 12:00 a.m. to 6:00 a.m. to deliver the full amount available for commercial capacity. The route should not be used at other times upon request from the City Department of Transportation (NYCDOT) due to congestion that occurs at certain intersections along the route during daytime traffic hours.

(4) Outbound trucks passing 26th Street between Cropsey Avenue and Shore Road limit the number of inbound commercial Waste Hauling Vehicles that can be accommodated at the Southwest Brooklyn Converted MTS.

ATTACHMENT 1

FULL CAPACITY ANALYSIS FOR EACH CONVERTED MTS
HOURLY RESULTS OF MODELING

West 135th St Historical Average Peak Day Throughput

Hour	Start Time	End Time	Inbound Tonnage	Number of DCV	Tons Containerized in the Hour	Fluctuation in Stock Pile (tons)	Tons in Stock Pile	Cumulative Tons Received	Cumulative Tons Containerized	Hour of the Beginning of a barge switch	Excess Capacity, 8 am - 8 pm (tons)	Excess Capacity, 8 pm - 8 am (tons)	Excess number of Commercial Vehicles, 11 tons per vehicle	Total Number of Trucks, Including Commercial Vehicles
1	8:00	9:00	162.0	15	110.0	52.0	52.0	162.0	110.0		0.0	0.0	0	15
2	9:00	10:00	185.4	17	220.0	-34.6	17.3	347.3	330.0		0.0	0.0	0	17
3	10:00	11:00	156.0	14	173.4	-17.3	0.0	503.4	503.4		46.6	0.0	0	14
4	11:00	12:00	116.4	11	110.0	6.4	6.4	619.8	613.4		0.0	0.0	0	11
5	12:00	13:00	84.6	8	91.0	-6.4	0.0	704.4	704.4		129.0	0.0	0	8
6	13:00	14:00	38.5	4	38.5	0.0	0.0	742.9	742.9		181.5	0.0	0	4
7	14:00	15:00	17.4	2	17.4	0.0	0.0	760.3	760.3		202.6	0.0	0	2
8	15:00	16:00	4.5	1	4.5	0.0	0.0	764.8	764.8		105.5	0.0	0	1
9	16:00	17:00	11.1	1	11.1	0.0	0.0	775.9	775.9		98.9	0.0	0	1
10	17:00	18:00	34.1	3	34.1	0.0	0.0	810.0	810.0		185.9	0.0	0	3
11	18:00	19:00	29.4	3	29.4	0.0	0.0	839.4	839.4		190.6	0.0	0	3
12	19:00	20:00	39.7	4	39.7	0.0	0.0	879.1	879.1		70.3	0.0	0	4
13	20:00	21:00	26.4	2	26.4	0.0	0.0	905.5	905.5		0.0	193.6	18	20
14	21:00	22:00	46.1	4	46.1	0.0	0.0	951.6	951.6		0.0	173.9	16	20
15	22:00	23:00	7.1	1	7.1	0.0	0.0	958.7	958.7		0.0	212.9	20	21
16	23:00	0:00	9.0	1	9.0	0.0	0.0	967.7	967.7		0.0	101.0	10	11
17	0:00	1:00	30.5	3	30.5	0.0	0.0	998.2	998.2		0.0	79.5	8	11
18	1:00	2:00	50.4	5	50.4	0.0	0.0	1048.6	1048.6		0.0	169.6	16	21
19	2:00	3:00	26.3	2	26.3	0.0	0.0	1074.9	1074.9	Barge Switch	0.0	193.7	18	20
20	3:00	4:00	18.4	2	18.4	0.0	0.0	1093.3	1093.3		0.0	91.6	9	11
21	4:00	5:00	6.6	1	0.0	6.6	6.6	1099.9	1093.3		0.0	213.4	20	21
22	5:00	6:00	6.2	1	0.0	6.2	12.8	1106.1	1093.3		0.0	207.2	19	20
23	6:00	7:00	14.1	1	0.0	14.1	26.9	1120.3	1093.3		0.0	193.1	18	19
24	7:00	8:00	59.7	6	0.0	59.7	86.7	1180.0	1093.3		0.0	23.3	3	9
Totals			1,180.0	112	1093.3						1210.9	1852.7	175	287
										Max	202.6	213.4	20	21
										Min	0.0	23.3	0	1
										Average	100.9	154.4	7	12

East 91st St Historical Average Peak Day Throughput

Hour	Start Time	End Time	Inbound Tonnage	Number of DCV	Tons Containerized in the Hour	Fluctuation in Stock Pile (tons)	Tons in Stock Pile	Cumulative Tons Received	Cumulative Tons Containerized	Hour of the Beginning of a barge switch	Excess Capacity, 8 am - 8 pm (tons)	Excess Capacity, 8 pm - 8 am (tons))	Excess number of Commercial Vehicles, 11 tons per vehicle	Total Number of Trucks, Including Commercial Vehicles
1	8:00	9:00	113.4	10	110.0	3.4	3.4	113.4	110.0		0.0	0.0	0	10
2	9:00	10:00	192.9	17	196.3	-3.4	0.0	306.3	306.3		23.7	0.0	0	17
3	10:00	11:00	262.7	23	220.0	42.7	42.7	569.1	526.3		0.0	0.0	0	23
4	11:00	12:00	202.9	18	110.0	92.9	135.6	772.0	636.3		0.0	0.0	0	18
5	12:00	13:00	69.3	6	205.0	-135.6	0.0	841.3	841.3		15.0	0.0	0	6
6	13:00	14:00	19.7	2	19.7	0.0	0.0	861.0	861.0		200.3	0.0	0	2
7	14:00	15:00	1.6	1	1.6	0.0	0.0	862.6	862.6		218.4	0.0	0	1
8	15:00	16:00	0.0	0	0.0	0.0	0.0	862.6	862.6		110.0	0.0	0	0
9	16:00	17:00	0.0	0	0.0	0.0	0.0	862.6	862.6		110.0	0.0	0	0
10	17:00	18:00	0.0	0	0.0	0.0	0.0	862.6	862.6		220.0	0.0	0	0
11	18:00	19:00	0.0	0	0.0	0.0	0.0	862.6	862.6		220.0	0.0	0	0
12	19:00	20:00	0.0	0	0.0	0.0	0.0	862.6	862.6		110.0	0.0	0	0
13	20:00	21:00	0.0	0	0.0	0.0	0.0	862.6	862.6		0.0	220.0	20	20
14	21:00	22:00	0.0	0	0.0	0.0	0.0	862.6	862.6		0.0	220.0	20	20
15	22:00	23:00	0.0	0	0.0	0.0	0.0	862.6	862.6		0.0	220.0	20	20
16	23:00	0:00	0.0	0	0.0	0.0	0.0	862.6	862.6		0.0	110.0	10	10
17	0:00	1:00	0.0	0	0.0	0.0	0.0	862.6	862.6		0.0	110.0	10	10
18	1:00	2:00	0.0	0	0.0	0.0	0.0	862.6	862.6		0.0	220.0	20	20
19	2:00	3:00	0.0	0	0.0	0.0	0.0	862.6	862.6		0.0	220.0	20	20
20	3:00	4:00	0.0	0	0.0	0.0	0.0	862.6	862.6		0.0	110.0	10	10
21	4:00	5:00	0.0	0	0.0	0.0	0.0	862.6	862.6		0.0	220.0	20	20
22	5:00	6:00	0.0	0	0.0	0.0	0.0	862.6	862.6		0.0	220.0	20	20
23	6:00	7:00	0.0	0	0.0	0.0	0.0	862.6	862.6		0.0	220.0	20	20
24	7:00	8:00	17.4	2	0.0	17.4	17.4	880.0	862.6		0.0	92.6	9	11
Totals			880.0	79	862.6						1227.4	2182.6	199	278
										Max	220.0	220.0	20	23
										Min	0.0	92.6	0	0
										Average	102.3	181.9	8	12

West 59th St Historical Average Peak Day Throughput

Hour	Start Time	End Time	Inbound Tonnage	Number of DCV	Tons Containerized in the Hour	Fluctuation in Stock Pile (tons)	Tons in Stock Pile	Cumulative Tons Received	Cumulative Tons Containerized	Hour of the Beginning of a barge switch	Excess Capacity, 8 am - 8 pm (tons)	Excess Capacity, 8 pm - 8 am (tons)	Excess number of Commercial Vehicles, 11 tons per vehicle	Total Number of Trucks, Including Commercial Vehicles
1	8:00	9:00	94.8	9	55.0	39.8	39.8	94.8	55.0		0.0	0.0	0	9
2	9:00	10:00	186.6	18	110.0	76.6	116.4	281.4	165.0		0.0	0.0	0	18
3	10:00	11:00	205.9	20	110.0	95.9	212.3	487.3	275.0		0.0	0.0	0	20
4	11:00	12:00	156.4	15	55.0	101.4	313.7	643.7	330.0		0.0	0.0	0	15
5	12:00	13:00	69.4	7	110.0	-40.6	273.1	713.1	440.0		0.0	0.0	0	7
6	13:00	14:00	25.8	2	110.0	-84.2	188.8	738.8	550.0		0.0	0.0	0	2
7	14:00	15:00	17.2	2	110.0	-92.8	96.0	756.0	660.0		0.0	0.0	0	2
8	15:00	16:00	1.0	1	55.0	-54.0	42.1	757.1	715.0		0.0	0.0	0	1
9	16:00	17:00	0.2	1	42.3	-42.1	0.0	757.3	757.3		12.7	0.0	0	1
10	17:00	18:00	2.9	1	2.9	0.0	0.0	760.2	760.2		107.1	0.0	0	1
11	18:00	19:00	2.7	1	2.7	0.0	0.0	762.9	762.9		107.3	0.0	0	1
12	19:00	20:00	3.3	1	3.3	0.0	0.0	766.2	766.2		51.7	0.0	0	1
13	20:00	21:00	2.7	1	2.7	0.0	0.0	769.0	769.0		0.0	107.3	10	11
14	21:00	22:00	1.5	1	1.5	0.0	0.0	770.5	770.5		0.0	108.5	10	11
15	22:00	23:00	0.5	1	0.5	0.0	0.0	771.0	771.0		0.0	109.5	10	11
16	23:00	0:00	0.0	0	0.0	0.0	0.0	771.0	771.0		0.0	55.0	5	5
17	0:00	1:00	20.0	2	20.0	0.0	0.0	791.1	791.1		0.0	35.0	4	6
18	1:00	2:00	22.1	2	22.1	0.0	0.0	813.1	813.1		0.0	87.9	8	10
19	2:00	3:00	23.4	2	23.4	0.0	0.0	836.5	836.5		0.0	86.6	8	10
20	3:00	4:00	19.1	2	19.1	0.0	0.0	855.5	855.5		0.0	35.9	4	6
21	4:00	5:00	7.1	1	0.0	7.1	7.1	862.6	855.5		0.0	102.9	10	11
22	5:00	6:00	2.9	1	0.0	2.9	10.0	865.5	855.5		0.0	100.0	10	11
23	6:00	7:00	3.0	1	0.0	3.0	13.0	868.6	855.5		0.0	97.0	9	10
24	7:00	8:00	11.4	1	0.0	11.4	24.5	880.0	855.5		0.0	30.5	3	4
Totals			880.0	93	855.5						278.8	956.1	91	184
										Max	107.3	109.5	10	20
										Min	0.0	30.5	0	1
										Average	23.2	79.7	4	8

South Bronx Historical Average Peak Day Throughput

Hour	Start Time	End Time	Inbound Tonnage	Number of DCV	Tons Containerized in the Hour	Fluctuation in Stock Pile (Tons)	Tons in Stock Pile	Cumulative Tons Received	Cumulative Tons Containerized	Hour of the Beginning of a barge switch	Excess Capacity, 8 am - 8 pm (tons)	Excess Capacity, 8 pm - 8 am (tons)	Excess number of Commercial Vehicles, 11 tons per vehicle	Total Number of Trucks, Including Commercial Vehicles
1	8:00	9:00	242.4	27	110.0	132.42	132.42	242.4	110.0		0.0	0.0	0	27
2	9:00	10:00	288.2	32	220.0	68.20	200.63	530.6	330.0		0.0	0.0	0	32
3	10:00	11:00	303.6	34	220.0	83.58	284.20	834.2	550.0		0.0	0.0	0	34
4	11:00	12:00	246.2	27	110.0	136.19	420.39	1,080.4	660.0		0.0	0.0	0	27
5	12:00	13:00	205.9	23	220.0	-14.07	406.32	1,286.3	880.0		0.0	0.0	0	23
6	13:00	14:00	133.3	15	220.0	-86.70	319.62	1,419.6	1,100.0	Barge Switch	0.0	0.0	0	15
7	14:00	15:00	49.5	5	220.0	-170.49	149.13	1,469.1	1,320.0		0.0	0.0	0	5
8	15:00	16:00	15.3	2	110.0	-94.70	54.43	1,484.4	1,430.0		0.0	0.0	0	2
9	16:00	17:00	42.3	5	96.7	-54.43	0.00	1,526.7	1,526.7		13.3	0.0	0	5
10	17:00	18:00	67.9	8	67.9	0.00	0.00	1,594.6	1,594.6		152.1	0.0	0	8
11	18:00	19:00	84.6	9	84.6	0.00	0.00	1,679.2	1,679.2		135.4	0.0	0	9
12	19:00	20:00	77.5	9	77.5	0.00	0.00	1,756.7	1,756.7		32.5	0.0	0	9
13	20:00	21:00	60.2	7	60.2	0.00	0.00	1,816.9	1,816.9		0.0	159.8	15	22
14	21:00	22:00	68.7	8	68.7	0.00	0.00	1,885.6	1,885.6		0.0	151.3	14	22
15	22:00	23:00	29.1	3	29.1	0.00	0.00	1,914.7	1,914.7		0.0	190.9	18	21
16	23:00	0:00	0.8	1	0.8	0.00	0.00	1,915.5	1,915.5		0.0	109.2	10	11
17	0:00	1:00	9.8	1	9.8	0.00	0.00	1,925.3	1,925.3		0.0	100.2	10	11
18	1:00	2:00	22.2	2	22.2	0.00	0.00	1,947.4	1,947.4		0.0	197.8	18	20
19	2:00	3:00	31.9	4	31.9	0.00	0.00	1,979.4	1,979.4		0.0	188.1	18	22
20	3:00	4:00	36.0	4	36.0	0.00	0.00	2,015.3	2,015.3		0.0	74.0	7	11
21	4:00	5:00	17.8	2	0.0	17.80	17.80	2,033.1	2,015.3		0.0	202.2	19	21
22	5:00	6:00	22.0	2	0.0	21.99	39.78	2,055.1	2,015.3		0.0	180.2	17	19
23	6:00	7:00	1.9	1	0.0	1.95	41.73	2,057.1	2,015.3		0.0	178.3	17	18
24	7:00	8:00	132.9	15	0.0	132.93	174.66	2,190.0	2,015.3		0.0	0.0	0	15
Totals			2,190.0	246	2,015.3						333.3	1732.1	163	409
										Max	152.1	202.2	19	34
										Min	0.0	0.0	0	2
										Average	27.8	144.3	7	17

North Shore Historical Average Peak Day Throughput

Hour	Start Time	End Time	Inbound Tonnage	Number of DCV	Tons Containerized in the Hour	Fluctuation in Stock Pile (tons)	Tons in Stock Pile	Cumulative Tons Received	Cumulative Tons Containerized	Hour of the Beginning of a barge switch	Excess Capacity, 8 am - 8 pm (tons)	Excess Capacity, 8 pm - 8 am (tons)	Excess number of Commercial Vehicles, 11 tons per vehicle	Total Number of Trucks, Including Commercial Vehicles
1	8:00	9:00	142.4	17	110.0	32.4	32.4	142.4	110.0		0.0	0.0	0	17
2	9:00	10:00	184.2	22	216.6	-32.4	0.0	326.6	326.6		3.4	0.0	0	22
3	10:00	11:00	176.0	21	176.0	0.0	0.0	502.5	502.5		44.0	0.0	0	21
4	11:00	12:00	181.9	22	110.0	71.9	71.9	684.4	612.5		0.0	0.0	0	22
5	12:00	13:00	150.7	18	220.0	-69.3	2.5	835.1	832.5		0.0	0.0	0	18
6	13:00	14:00	104.1	13	106.7	-2.5	0.0	939.2	939.2		113.3	0.0	0	13
7	14:00	15:00	65.8	8	65.8	0.0	0.0	1005.0	1005.0		154.2	0.0	0	8
8	15:00	16:00	16.7	2	16.7	0.0	0.0	1021.7	1021.7		93.3	0.0	0	2
9	16:00	17:00	97.7	12	97.7	0.0	0.0	1119.4	1119.4	Barge Switch	12.3	0.0	0	12
10	17:00	18:00	116.2	14	116.2	0.0	0.0	1235.6	1235.6		103.8	0.0	0	14
11	18:00	19:00	122.7	15	122.7	0.0	0.0	1358.3	1358.3		97.3	0.0	0	15
12	19:00	20:00	110.7	14	110.0	0.7	0.7	1469.0	1468.3		0.0	0.0	0	14
13	20:00	21:00	80.4	10	81.1	-0.7	0.0	1549.3	1549.3		0.0	138.9	13	23
14	21:00	22:00	114.0	14	114.0	0.0	0.0	1663.4	1663.4		0.0	106.0	10	24
15	22:00	23:00	36.9	5	36.9	0.0	0.0	1700.3	1700.3		0.0	183.1	17	22
16	23:00	0:00	34.7	4	34.7	0.0	0.0	1735.0	1735.0		0.0	75.3	7	11
17	0:00	1:00	82.3	10	82.3	0.0	0.0	1817.2	1817.2		0.0	27.7	3	13
18	1:00	2:00	112.1	14	112.1	0.0	0.0	1929.4	1929.4		0.0	107.9	10	24
19	2:00	3:00	113.3	14	113.3	0.0	0.0	2042.6	2042.6		0.0	106.7	10	24
20	3:00	4:00	105.2	13	105.2	0.0	0.0	2147.9	2147.9	Barge Switch	0.0	4.8	1	14
21	4:00	5:00	80.6	10	0.0	80.6	80.6	2228.5	2147.9		0.0	139.4	13	23
22	5:00	6:00	68.7	8	0.0	68.7	149.4	2297.2	2147.9		0.0	70.6	7	15
23	6:00	7:00	31.2	4	0.0	31.2	180.5	2328.4	2147.9		0.0	39.5	4	8
24	7:00	8:00	41.6	5	0.0	41.6	222.1	2370.0	2147.9		0.0	0.0	0	5
Totals			2,370.0	289	2147.9						621.7	999.9	95	384
										Max	154.2	183.1	17	24
										Min	0.0	0.0	0	2
										Average	51.8	83.3	4	16

Greenpoint Historical Average Peak Day Throughput

Hour	Start Time	End Time	Inbound Tonnage	Number of DCV	Tons Containerized in the Hour	Fluctuation in Stock Pile (tons)	Tons In Stock Pile	Cumulative Tons Received	Cumulative Tons Containerized	Hour of the Beginning of a barge switch	Excess Capacity, 8 am - 8 pm (tons)	Excess Capacity, 8 pm - 8 am (tons)	Excess number of Commercial Vehicles, 11 tons per vehicle	Total Number of Trucks, Including Commercial Vehicles
1	8:00	9:00	99.2	10	99.2	0.0	0.0	99.2	99.2		10.8	0.0	0	10
2	9:00	10:00	180.1	18	180.1	0.0	0.0	279.3	279.3		39.9	0.0	0	18
3	10:00	11:00	197.6	20	197.6	0.0	0.0	476.9	476.9		22.4	0.0	0	20
4	11:00	12:00	184.5	19	110.0	74.5	74.5	661.4	586.9		0.0	0.0	0	19
5	12:00	13:00	178.9	18	220.0	-41.1	33.4	840.3	806.9		0.0	0.0	0	18
6	13:00	14:00	106.9	11	140.3	-33.4	0.0	947.2	947.2		79.7	0.0	0	11
7	14:00	15:00	64.9	7	64.9	0.0	0.0	1012.1	1012.1		155.1	0.0	0	7
8	15:00	16:00	28.5	3	28.5	0.0	0.0	1040.6	1040.6		81.5	0.0	0	3
9	16:00	17:00	86.6	9	86.6	0.0	0.0	1127.2	1127.2	Barge Switch	23.4	0.0	0	9
10	17:00	18:00	135.0	14	135.0	0.0	0.0	1262.2	1262.2		85.0	0.0	0	14
11	18:00	19:00	142.6	15	142.6	0.0	0.0	1404.8	1404.8		77.4	0.0	0	15
12	19:00	20:00	161.7	17	110.0	51.7	51.7	1566.5	1514.8		0.0	0.0	0	17
13	20:00	21:00	95.3	10	147.0	-51.7	0.0	1661.8	1661.8		0.0	73.0	7	17
14	21:00	22:00	101.6	10	101.6	0.0	0.0	1763.5	1763.5		0.0	118.4	11	21
15	22:00	23:00	46.8	5	46.8	0.0	0.0	1810.3	1810.3		0.0	173.2	16	21
16	23:00	0:00	5.1	1	5.1	0.0	0.0	1815.4	1815.4		0.0	104.9	10	11
17	0:00	1:00	54.4	6	54.4	0.0	0.0	1869.8	1869.8		0.0	55.6	6	12
18	1:00	2:00	112.7	12	112.7	0.0	0.0	1982.5	1982.5		0.0	107.3	10	22
19	2:00	3:00	131.8	13	131.8	0.0	0.0	2114.3	2114.3	Barge Switch	0.0	88.2	9	22
20	3:00	4:00	111.4	11	110.0	1.4	1.4	2225.7	2224.3		0.0	0.0	0	11
21	4:00	5:00	46.6	5	0.0	46.6	48.0	2272.3	2224.3		0.0	172.0	16	21
22	5:00	6:00	41.9	4	0.0	41.9	89.8	2314.1	2224.3		0.0	130.2	12	16
23	6:00	7:00	7.5	1	0.0	7.5	97.3	2321.6	2224.3		0.0	122.7	12	13
24	7:00	8:00	38.4	4	0.0	38.4	135.7	2360.0	2224.3		0.0	0.0	0	4
Totals			2,360.0	243	2224.3						575.2	1145.4	109	352
										Max	155.1	173.2	16	22
										Min	0.0	0.0	0	3
										Average	47.9	95.4	5	15

Hamilton Avenue Historical Average Peak Day Throughput

Hour	Start Time	End Time	Inbound Tonnage	Number of DCV	Tons Containerized in the Hour	Fluctuation in Stock Pile (tons)	Tons in Stock Pile	Cumulative Tons Received	Cumulative Tons Containerized	Hour of the Beginning of a barge switch	Excess Capacity, 8 am - 8 pm (tons)	Excess Capacity, 8 pm - 8 am (tons)	Excess number of Commercial Vehicles, 11 tons per vehicle	Total Number of Trucks, Including Commercial Vehicles
1	8:00	9:00	134.2	14	110.0	24.2	24.2	134.2	110.0		0.0	0.0	0	14
2	9:00	10:00	204.8	22	220.0	-15.2	9.0	339.0	330.0		0.0	0.0	0	22
3	10:00	11:00	202.7	22	211.7	-9.0	0.0	541.7	541.7		8.3	0.0	0	22
4	11:00	12:00	187.9	20	110.0	77.9	77.9	729.6	651.7		0.0	0.0	0	20
5	12:00	13:00	156.6	17	220.0	-63.4	14.5	886.3	871.7		0.0	0.0	0	17
6	13:00	14:00	94.9	10	109.5	-14.5	0.0	981.2	981.2		110.5	0.0	0	10
7	14:00	15:00	28.6	3	28.6	0.0	0.0	1009.8	1009.8		191.4	0.0	0	3
8	15:00	16:00	78.0	8	78.0	0.0	0.0	1087.8	1087.8	Barge Switch	32.0	0.0	0	8
9	16:00	17:00	118.5	13	110.0	8.5	8.5	1206.3	1197.8		0.0	0.0	0	13
10	17:00	18:00	81.8	9	90.3	-8.5	0.0	1288.1	1288.1		129.7	0.0	0	9
11	18:00	19:00	86.9	9	86.9	0.0	0.0	1375.0	1375.0		133.1	0.0	0	9
12	19:00	20:00	85.0	9	85.0	0.0	0.0	1460.0	1460.0		25.0	0.0	0	9
13	20:00	21:00	46.9	5	46.9	0.0	0.0	1506.9	1506.9		0.0	173.1	16	21
14	21:00	22:00	84.3	9	84.3	0.0	0.0	1591.1	1591.1		0.0	135.7	13	22
15	22:00	23:00	8.3	1	8.3	0.0	0.0	1599.5	1599.5		0.0	211.7	20	21
16	23:00	0:00	29.2	3	29.2	0.0	0.0	1628.6	1628.6		0.0	80.8	8	11
17	0:00	1:00	100.3	11	100.3	0.0	0.0	1728.9	1728.9		0.0	9.7	1	12
18	1:00	2:00	127.8	14	127.8	0.0	0.0	1856.7	1856.7		0.0	92.2	9	23
19	2:00	3:00	129.9	14	129.9	0.0	0.0	1986.6	1986.6		0.0	90.1	9	23
20	3:00	4:00	98.9	11	98.9	0.0	0.0	2085.5	2085.5		0.0	11.1	2	13
21	4:00	5:00	37.7	4	0.0	37.7	37.7	2123.2	2085.5		0.0	182.3	17	21
22	5:00	6:00	17.1	2	0.0	17.1	54.7	2140.2	2085.5		0.0	165.3	16	18
23	6:00	7:00	6.2	1	0.0	6.2	60.9	2146.5	2085.5		0.0	159.1	15	16
24	7:00	8:00	23.5	3	0.0	23.5	84.5	2170.0	2085.5		0.0	25.5	3	6
Totals			2,170.0	234	2085.5						630.0	1336.7	129	363
										Max	191.4	211.7	20	23
										Min	0.0	9.7	0	3
										Average	52.5	111.4	5	15

Southwest Brooklyn Historical Average Peak Day Throughput

Hour	Start Time	End Time	Inbound Tonnage	Number of DCV	Tons Containerized in the Hour	Fluctuation in Stock Pile (tons)	Tons in Stock Pile	Cumulative Tons Received	Cumulative Tons Containerized	Hour of the Beginning of a barge switch	Excess Capacity, 8 am - 8 pm (tons)	Excess Capacity, 8 pm - 8 am (tons)	Excess number of Commercial Vehicles, 11 tons per vehicle	Total Number of Trucks, Including Commercial Vehicles
1	8:00	9:00	97.2	10	97.2	0.0	0.0	97.2	97.2		12.8	0.0	0	10
2	9:00	10:00	165.8	17	165.8	0.0	0.0	263.0	263.0		54.2	0.0	0	17
3	10:00	11:00	121.6	13	121.6	0.0	0.0	384.5	384.5		98.4	0.0	0	13
4	11:00	12:00	82.1	9	82.1	0.0	0.0	466.6	466.6		27.9	0.0	0	9
5	12:00	13:00	32.0	3	32.0	0.0	0.0	498.6	498.6		188.0	0.0	0	3
6	13:00	14:00	9.5	1	9.5	0.0	0.0	508.1	508.1		210.5	0.0	0	1
7	14:00	15:00	8.9	1	8.9	0.0	0.0	517.0	517.0		211.1	0.0	0	1
8	15:00	16:00	11.1	1	11.1	0.0	0.0	528.1	528.1		98.9	0.0	0	1
9	16:00	17:00	36.2	4	36.2	0.0	0.0	564.2	564.2		73.8	0.0	0	4
10	17:00	18:00	36.4	4	36.4	0.0	0.0	600.6	600.6		183.6	0.0	0	4
11	18:00	19:00	37.3	4	37.3	0.0	0.0	637.9	637.9		182.7	0.0	0	4
12	19:00	20:00	33.9	4	33.9	0.0	0.0	671.9	671.9		76.1	0.0	0	4
13	20:00	21:00	32.2	3	32.2	0.0	0.0	704.1	704.1		0.0	187.8	18	21
14	21:00	22:00	29.5	3	29.5	0.0	0.0	733.6	733.6		0.0	190.5	18	21
15	22:00	23:00	2.2	1	2.2	0.0	0.0	735.8	735.8		0.0	217.8	20	21
16	23:00	0:00	0.0	0	0.0	0.0	0.0	735.8	735.8		0.0	110.0	10	10
17	0:00	1:00	101.4	11	101.4	0.0	0.0	837.2	837.2		0.0	8.6	1	12
18	1:00	2:00	92.9	10	92.9	0.0	0.0	930.2	930.2		0.0	127.1	12	22
19	2:00	3:00	69.1	7	69.1	0.0	0.0	999.3	999.3		0.0	150.9	14	21
20	3:00	4:00	32.4	3	32.4	0.0	0.0	1031.7	1031.7		0.0	77.6	8	11
21	4:00	5:00	14.1	1	0.0	14.1	14.1	1045.8	1031.7		0.0	205.9	19	20
22	5:00	6:00	4.9	1	0.0	4.9	19.0	1050.7	1031.7		0.0	201.0	19	20
23	6:00	7:00	4.9	1	0.0	4.9	23.9	1055.6	1031.7		0.0	196.1	18	19
24	7:00	8:00	34.4	4	0.0	34.4	58.3	1090.0	1031.7		0.0	51.7	5	9
Totals			1,090.0	116	1031.7						1418.1	1724.8	162	278
										Max	211.1	217.8	20	22
										Min	12.8	8.6	0	1
										Average	118.2	143.7	7	12

ATTACHMENT 2

ASSUMED COMMERCIAL WASTE VEHICLE TRUCK ROUTES

Assumed Commercial Waste Vehicle Truck Routes to MTSs

West 135th

From the north
Route 1N
To MTS: Broadway to (West 133rd St OR West 132nd St) to Riverside Drive (12th Ave) to West 135th St
From MTS: Reverse
Route 2N
To MTS: Amsterdam Ave to West 125th St to Riverside Drive (12th Ave) to West 135th St
From MTS: Reverse

From the south
Route 1S
To MTS: Broadway to (West 133rd St OR West 132nd St) to Riverside Drive (12th Ave) to West 135th St
From MTS: Reverse
Route 2S
To MTS: Amsterdam Ave to West 125th St to Riverside Drive (12th Ave) to West 135th St
From MTS: Reverse

From the east
Route 1E
To MTS: 3rd Ave to East 125th St (turns into West 125th St) to Riverside Drive (12th Ave) to West 135th St
From MTS: Reverse

Assumed Commercial Waste Vehicle Truck Routes to MTSs

East 91st

From the north
<u>Route 1N</u>
To MTS: 2nd Ave to (East 90th St OR East 88th St OR East 86th St) to York Ave to East 91st St
From MTS: East 91st St to York Ave to (East 91st St OR East 89th St OR East 87th St OR East 86th St) to (1st Ave OR 3rd Ave)

From the south
<u>Route 1S</u>
To MTS: 1st Ave to (East 90th St OR East 88th St) to York Ave to East 91st St
From MTS: East 91st St to York Ave to East 86th St to 2nd Ave
<u>Route 2S</u>
To MTS: 3rd Ave to East 86th St to York Ave to East 91st St
From MTS: East 91st St to York Ave to East 86th St to 2nd Ave

Assumed Commercial Waste Vehicle Truck Routes to MTSs

West 59th

From the north
Route 1N
To MTS: Columbus Ave to West 59th St
From MTS: West 59th St to Amsterdam Ave

From the south
Route 1S
To MTS: 12th Ave (Joe DiMaggio Hwy) to 12th Ave Service Road (starts at 57th St) to West 59th St
From MTS: Reverse
Route 2S
To MTS: 10th Ave to 57th Ave to 12th Ave Service Road to 59th St
From MTS: West 59th St to 11th Ave

From the east
Route 1E
To MTS: (2nd Ave or 3rd Ave) to East 57th St (turns into West 57th St) to 12th Ave Service Road to 59th St.
From MTS: Reverse

Assumed Commercial Waste Vehicle Truck Routes to MTSs

South Bronx

Route 1
To MTS: Bruckner Blvd to Leggett Ave to Randall Ave to Halleck St to Ryawa Ave
From MTS: Reverse
Route 2
To MTS: Bruckner Blvd to Leggett Ave to (Barry St OR Dupont St OR Truxton St) to Oak Point Ave to Hunt's Point Ave to Halleck St to Ryawa Ave
From MTS: Reverse
Route 3
To MTS: Bruckner Blvd to Longwood Ave to Tiffany St to East Bay Ave to Halleck St to Ryawa Ave
From MTS: Reverse
Route 4
To MTS: Bruckner Blvd to Longwood Ave to Tiffany St to Veile Ave to Halleck St to Ryawa Ave
From MTS: Reverse

Assumed Commercial Waste Vehicle Truck Routes to MTSs

North Shore

From the north
Route 1N
To MTS: 20th Ave to College Point Blvd to 31st Ave
From MTS: Reverse

From the south
Route 1S
To MTS: Van Wick Expressway to Whitestone Expressway to Linden Place to Whitestone Expressway Service Road (Westbound) to College Point Blvd to 31st Ave
From MTS: 31st Ave to College Point Blvd to Whitestone Expressway Service Road (Eastbound) to Linden Place to Whitestone Expressway Service Road (Westbound) to Whitestone Expressway to Van Wick Expressway
Route 2S
To MTS: Van Wick Expressway to College Point Blvd to 31st Ave
From MTS: Reverse

From the east
Route 1E
To MTS: Northern Blvd to Linden Place to Whitestone Expressway Service Road (Eastbound) to College Point Blvd to 31st Ave
From MTS: Reverse
Route 2E
To MTS: Long Island Expressway to College Point Blvd to 31st Ave
From MTS: Reverse

From the west
Route 1W
To MTS: Northern Blvd to Linden Place to Whitestone Expressway Service Road (Eastbound) to College Point Blvd to 31st Ave
From MTS: Reverse
Route 2W
To MTS: Long Island Expressway to College Point Blvd to 31st Ave
From MTS: Reverse
Route 3W
To MTS: Roosevelt Ave to College Point Blvd to 31st Ave
From MTS: Reverse

Assumed Commercial Waste Vehicle Truck Routes to MTSs

Greenpoint

From the north
<u>Route 1N</u>
To MTS: McGuiness Blvd to Greenpoint Ave to Kingsland Ave
From MTS: Reverse
<u>Route 2N</u>
To MTS: Queens Blvd to Greenpoint Ave to Starr Ave to Van Dam St to Greenpoint Ave to Kingsland Ave
From MTS: Kingsland Ave to Greenpoint Ave to Queens Blvd
<u>Route 3N</u>
To MTS: Van Dam St to Greenpoint Ave to Kingsland Ave
From MTS: Reverse

From the south
<u>Route 1S</u>
To MTS: McGuiness Blvd to Greenpoint Ave to Kingsland Ave
From MTS: Reverse
<u>Route 2S</u>
To MTS: Brooklyn-Queens Expressway to Meeker St (eastbound) to Varick St to Bridgewater St to Norman Ave to Kingsland Ave
From MTS: Kingsland Ave to Greenpoint Ave to Henry St to Norman Ave to Bridgewater St to Varick St to Meeker Ave to BQE

From the east
<u>Route 1E</u>
To MTS: Brooklyn-Queens Expressway to Meeker St (eastbound) to Varick St to Bridgewater St to Norman Ave to Kingsland Ave
From MTS: Kingsland Ave to Greenpoint Ave to McGuiness Blvd to Meeker St to BQE
<u>Route 2E</u>
To MTS: Long Island Expressway to Van Dam St to Greenpoint Ave to Kingsland Ave
From MTS: From MTS: Kingsland Ave to Greenpoint Ave to LIE

Assumed Commercial Waste Vehicle Truck Routes to MTSs

Hamilton Ave

From the north
Route 1N
To MTS: BQE to Hamilton Ave (southbound) (Exit 26)
From MTS: Hamilton Ave (southbound) to 20th St to 3rd Ave to Hamilton Ave (northbound) to BQE
Route 2N
To MTS: (3rd Ave OR 4thAve) to 9th Street to Hamilton Ave (southbound)
From MTS: Hamilton Ave (southbound) to 20th St to 3rd Ave to Hamilton Ave (northbound) to 9th Street to 3rd Ave
Route 3N
To MTS: (3rd Ave to 9th Street to Hamilton Ave (northbound) to Hamilton Place to Hamilton Ave (southbound)
From MTS: Hamilton Ave (southbound) to 20th St to 3rd Ave (to 9th St to 4th Ave)

From the south
Route 1S
To MTS: Gowanus Expressway to 4th Ave to Prospect to Hamilton Ave (northbound) to Hamilton Place to Hamilton Ave (southbound)
From MTS: Hamilton Ave (southbound, turns into 3rd Ave) to 65th Street
Route 2S
To MTS: 65th St to 3rd Ave to Hamilton Ave (northbound) to Hamilton Place to Hamilton Ave (southbound)
From MTS: Hamilton Ave (southbound, turns into 3rd Ave) to 65th Street

From the east
Route 1E
To MTS: 39th St to 4th Ave to Prospect Ave to Hamilton Ave (northbound) to Hamilton Place to Hamilton Ave (southbound)
From MTS: Hamilton Ave (southbound, turns into 3rd Ave) to 39th St
Route 2E
To MTS: Prospect Expressway to Prospect Ave to Hamilton Ave (northbound) to Hamilton Place to Hamilton Ave (southbound)
From MTS: Hamilton Ave (southbound) to 20th St to 10th Ave to Prospect Expressway

Assumed Commercial Waste Vehicle Truck Routes to MTSs

Southwest Brooklyn

From the north
Route 1N
To MTS: 86th St to 18th Ave to Cropsey Ave to Bay Parkway to Shore Road (southbound) to 25th Ave
From MTS: 25th Av to Shore Road (southbound) to 26th Ave to Cropsey Ave to 18th Ave to 86th St

From the south
Route 1S
To MTS: Neptune Ave to Cropsey Ave to Bay Parkway to Shore Road (southbound) to 25th Ave
From MTS: 25th Av to Shore Road (southbound) to 26th Ave to Cropsey Ave to Neptune Ave

From the east
Route 1E
To MTS: Kings Highway to Bay Parkway to Shore Road (southbound) to 25th Ave
From MTS: 25th Ave to Shore Road (southbound) to 26th Ave to Cropsey Ave to Bay Parkway to Kings Highway
Route 2E
To MTS: 86th St to 25th Ave to Cropsey Ave to Bay Parkway to Shore Road (southbound) to 25th Ave
From MTS: 25th Ave to Shore Road (southbound) to 26th Ave to Cropsey Ave to 25th Ave to 86th St

ATTACHMENT 3

COMMERCIAL WASTE VEHICLE ALLOCATION BY APPROACH DIRECTION

Commercial Waste Vehicle Allocation by Approach Direction

West 135th St

Time	North	South	East	West	Total Commercial Vehicles
8:00 PM	1	16	1	0	18
9:00 PM	1	14	1	0	16
10:00 PM	1	18	1	0	20
11:00 PM	1	9	1	0	10
12:00 AM	1	7	0	0	8
1:00 AM	1	14	1	0	16
2:00 AM	1	16	1	0	18
3:00 AM	1	8	0	0	9
4:00 AM	1	18	1	0	20
5:00 AM	1	17	1	0	19
6:00 AM	1	16	1	0	18
7:00 AM	0	3	0	0	3

East 91st Street

Time	North	South	East	West	Total Commercial Vehicles
8:00 PM	2	18	0	0	20
9:00 PM	2	18	0	0	20
10:00 PM	2	18	0	0	20
11:00 PM	1	9	0	0	10
12:00 AM	1	9	0	0	10
1:00 AM	2	18	0	0	20
2:00 AM	2	18	0	0	20
3:00 AM	1	9	0	0	10
4:00 AM	2	18	0	0	20
5:00 AM	2	18	0	0	20
6:00 AM	2	18	0	0	20
7:00 AM	1	8	0	0	9

West 59th St

Time	North	South	East	West	Total Commercial Vehicles
8:00 PM	0	9	1	0	10
9:00 PM	0	9	1	0	10
10:00 PM	0	9	1	0	10
11:00 PM	0	4	1	0	5
12:00 AM	0	3	0	0	4
1:00 AM	0	7	1	0	8
2:00 AM	0	7	1	0	8
3:00 AM	0	3	0	0	4
4:00 AM	0	9	1	0	10
5:00 AM	0	9	1	0	10
6:00 AM	0	8	1	0	9
7:00 AM	0	3	0	0	3

Commercial Waste Vehicle Allocation by Approach Direction

South Bronx

Time	North	South	East	West	Total Commercial Vehicles
8:00 PM	6	9	0	0	15
9:00 PM	5	9	0	0	14
10:00 PM	7	11	0	0	18
11:00 PM	4	6	0	0	10
12:00 AM	4	6	0	0	10
1:00 AM	7	11	0	0	18
2:00 AM	7	11	0	0	18
3:00 AM	3	4	0	0	7
4:00 AM	7	12	0	0	19
5:00 AM	7	10	0	0	17
6:00 AM	7	10	0	0	17
7:00 AM	0	0	0	0	0

North Shore

Time	North	South	East	West	Total Commercial Vehicles
8:00 PM	1	8	3	1	13
9:00 PM	1	6	2	1	10
10:00 PM	1	10	4	2	17
11:00 PM	0	4	2	1	7
12:00 AM	0	2	1	0	3
1:00 AM	1	6	2	1	10
2:00 AM	1	6	2	1	10
3:00 AM	0	1	0	0	1
4:00 AM	1	8	3	1	13
5:00 AM	0	4	2	1	7
6:00 AM	0	2	1	0	4
7:00 AM	0	0	0	0	0

Greenpoint

Time	North	South	East	West	Total Commercial Vehicles
8:00 PM	3	3	0	0	7
9:00 PM	5	5	1	0	11
10:00 PM	7	7	1	0	16
11:00 PM	5	5	1	0	10
12:00 AM	3	3	0	0	6
1:00 AM	5	5	1	0	10
2:00 AM	4	4	1	0	9
3:00 AM	0	0	0	0	0
4:00 AM	7	7	1	0	16
5:00 AM	6	6	1	0	12
6:00 AM	6	6	1	0	12
7:00 AM	0	0	0	0	0

Commercial Waste Vehicle Allocation by Approach Direction

Hamilton Ave

Time	North	South	East	West	Total Commercial Vehicles
8:00 PM	9	3	4	0	16
9:00 PM	8	2	3	0	13
10:00 PM	12	3	5	0	20
11:00 PM	5	1	2	0	8
12:00 AM	1	0	0	0	1
1:00 AM	5	1	2	0	9
2:00 AM	5	1	2	0	9
3:00 AM	1	0	1	0	2
4:00 AM	10	3	4	0	17
5:00 AM	9	3	4	0	16
6:00 AM	9	2	4	0	15
7:00 AM	2	0	1	0	3

Southwest Brooklyn

Time	North	South	East	West	Total Commercial Vehicles
8:00 PM	15	1	2	0	18
9:00 PM	15	1	2	0	18
10:00 PM	16	1	2	0	20
11:00 PM	8	1	1	0	10
12:00 AM	1	0	0	0	1
1:00 AM	10	1	1	0	12
2:00 AM	11	1	2	0	14
3:00 AM	7	1	1	0	8
4:00 AM	15	1	2	0	19
5:00 AM	15	1	2	0	19
6:00 AM	15	1	2	0	18
7:00 AM	4	0	1	0	5

ATTACHMENT 4

ON- AND OFF-SITE AIR QUALITY ANALYSIS RESULTS
DSNY-MANAGED WASTE PLUS COMMERCIAL WASTE COLLECTION VEHICLES

Table A.4-1
Highest Estimated Concentrations of the Criteria Pollutants from On-site Emissions
DSNY-managed Waste Plus Commercial Waste
West 135th Street Converted MTS

Pollutant	Averaging Time Period	Maximum Impacts from On-site Emission Sources (1)	Background Pollutant Concentrations (2)	Highest Estimated On-site Pollutant Concentrations	NAAQS(3)	STV(4)
Carbon Monoxide (CO), µg/m³	1-hour(6)	2,091	3,781	5,872	40,000	NA
	8-hour(6)	1,019	2,635	3,654	10,000	NA
Nitrogen Dioxide (NO_2), µg/m³	Annual	5	77	82	100	NA
Particulate Matter (PM_{10}), µg/m³	24-hour(7)	26	88	114	150	NA
	Annual	5	34	39	50	NA
Particulate Matter ($PM_{2.5}$), µg/m³	24-hour	2	-	-	NA	5
	Annual Neighborhood Average	0.036(5)	-	-	NA	0.1
Sulfur Dioxide (SO_2), µg/m³	3-hour(6)	264	265	529	1,300	NA
	24-hour(6)	7	139	146	365	NA
	Annual	1	34	35	80	NA

Notes:

(1) The highest estimated pollutant concentrations found at any of the off-site receptor locations.
(2) Background concentrations were obtained from the NYCDEP on April 18, 2003.
(3) NAAQS = National Ambient Air Quality Standards.
(4) Screening Threshold Value (STV) established by the NYCDEP and NYSDEC.
(5) Average $PM_{2.5}$ concentration over 1 km x 1 km "neighborhood-scale" receptor grid.
(6) The standards for these averaging periods allow one exceedance per year, so the use of the overall maximum concentration in this provides a very conservative comparison with standards.
(7) The 24-hour PM_{10} NAAQS is based on a 99th percentile concentration, which means that the high, 4th high concentration is appropriate for comparison with the standard. Therefore, the use of the overall highest concentration in this comparison is quite conservative.

NA = Not Applicable.

Table A.4-2
Highest Estimated Non-Cancer Hazard Index and Cancer Risk of Toxic Air Pollutant from On-site Emissions
DSNY-managed Waste Plus Commercial Waste
135th Street Converted MTS

No.	Toxic Air Pollutants	Acute Non-Cancer Risk: Highest Estimated Short-Term (1-hr) Pollutant Conc.(1) (µg/m³)	Acute Non-Cancer Risk: Short-Term (1-hr) Guideline Conc. (SGCs) (2) (µg/m³)	Acute Non-Cancer Risk: Acute Non-Cancer Hazard Index(3)	Chronic Non-Cancer Risk: Highest Estimated Long-Term (Annual) Pollutant Conc.(4) (µg/m³)	Chronic Non-Cancer Risk: Long-Term (Annual) Guideline Conc. (AGCs) (5) (µg/m³)	Chronic Non-Cancer Risk: Chronic Non-Cancer Hazard Index (6)	Cancer Risk: Highest Estimated Long-Term (Annual) Pollutant Conc. (4) (µg/m³)	Cancer Risk: Unit Risk Factors (7) (µg/m³)	Cancer Risk: Maximum Cancer Risk (8,9)
Carcinogenic Pollutants										
1	Benzene	9.56E-01	1.30E+03	7.36E-04	5.49E-03	1.30E-01	4.23E-02	5.49E-03	8.30E-06	4.56E-08
2	Formaldehyde	1.21E+00	3.00E+01	4.03E-02	6.95E-03	6.00E-02	1.16E-01	6.95E-03	1.30E-05	9.03E-08
3	1,3 Butadiene	4.01E-02	-	-	2.30E-04	3.60E-03	6.40E-02	2.30E-04	2.80E-04	6.45E-08
4	Acetaldehyde	7.86E-01	4.50E+03	1.75E-04	4.52E-03	4.50E-01	1.00E-02	4.52E-03	2.20E-06	9.94E-09
5	Benzo(a)pyrene	1.93E-04	-	-	1.11E-06	2.00E-03	5.54E-04	1.11E-06	1.70E-03	1.88E-09
6	Propylene	2.64E+00	-	-	1.52E-02	3.00E+03	5.06E-06	1.52E-02	NA	NA
Non-Carcinogenic Pollutants (10)										
7	Acrolein	9.48E-02	1.90E-01	4.99E-01	5.54E-04	2.00E-02	2.72E-02	5.54E-04	NA	NA
8	Toluene	4.19E-01	3.70E+04	1.13E-05	2.41E-03	4.00E+02	6.02E-06	2.41E-03	NA	NA
9	Xylenes	2.92E-01	4.30E+03	6.79E-05	1.68E-03	7.00E+02	2.40E-06	1.68E-03	NA	NA
10	Anthracene	1.92E-03	-	-	1.10E-05	2.00E-02	5.51E-04	1.10E-05	NA	NA
11	Benzo(a)anthracene	1.72E-03	-	-	9.89E-06	2.00E-02	4.95E-04	9.89E-06	NA	NA
12	Chrysene	3.62E-04	-	-	2.08E-06	2.00E-02	1.04E-04	2.08E-06	NA	NA
13	Naphthalene	8.69E-02	7.90E+03	1.10E-05	4.99E-04	3.00E+00	1.66E-04	4.99E-04	NA	NA
14	Pyrene	4.90E-03	-	-	2.81E-05	2.00E-02	1.41E-03	2.81E-05	NA	NA
15	Phenanthrene	3.01E-02	-	-	1.73E-04	2.00E-02	8.66E-03	1.73E-04	NA	NA
16	Dibenz(a,h)anthracene	5.98E-04	-	-	3.43E-06	2.00E-02	1.72E-04	3.43E-06	NA	NA
		Total Estimated Acute Non-Cancer Hazard Index		**2.43E-01**	**Total Estimated Chronic Non-Cancer Hazard Index**		**2.71E-01**	**Total Estimated Combined Cancer Risk**		**2.12E-07**
		Acute Non-Cancer Hazard Index Threshold (11)		**1.0E+00**	**Chronic Non-Cancer Hazard Index Threshold (11)**		**1.0E+00**	**Cancer Risk Threshold (11)**		**1.0E-06**

Notes to Table A.4-2:

(1) Estimated by multiplying the total 1-hr HCs concentration by the ratio of the emission factor for that pollutant to the emission factor of the total hydrocarbons.

(2) Short-term (1-hr) guideline concentrations (SGC) established by NYSDEC.

(3) Estimated by dividing the maximum 1-hr concentrations of each pollutant by the SGC value of that pollutant and summing up the resulting values to obtain hazard index for all of the pollutants combined.

(4) Estimated by multiplying the total annual HCs concentration by ratio of the emission factor for that pollutant to the emission factor of the total hydrocarbons.

(5) Long-term (annual) guideline concentrations (AGC) established by NYSDEC.

(6) Estimated by dividing the maximum annual concentration of each of the individual pollutants by the AGC value of that pollutant and summing up the resulting values to obtain hazard index for all of the pollutants combined.

(7) Unit risk factors established by USEPA and other governmental agencies for the inhalation of carcinogenic air pollutants.

(8) The maximum cancer risk of each of the individual pollutants was estimated by multiplying the estimated annual concentration of each pollutant by its unit risk factor.

(9) The total incremental cancer risk from all of the pollutants combined was estimated by summing the maximum cancer risk of each of the individual pollutants.

(10) Some of the pollutants included in the group of non-carcinogenic pollutants, such as anthracene, benzo(a)anthracene and chrysene, may also have carcinogenic effects. As these pollutants do not have established unit risk factors, they were evaluated using the hazard index approach for non-carcinogens.

(11) Hazard index and cancer risk thresholds based on NYSDEC "Guidelines for the Control of Toxic Ambient Air Contaminants" dated November 12, 1997. Estimated values below these threshold limits are considered to be insignificant impacts.

Table A.4-3
Highest Estimated Concentrations of the Criteria Pollutants from On-site Emissions
DSNY-managed Waste Plus Commercial Waste
East 91st Street Converted MTS

Pollutant	Averaging Time Period	Maximum Impacts from On-site Emission Sources [(1)]	Background Pollutant Concentrations [(2)]	Highest Estimated On-site Pollutant Concentrations	NAAQS[(3)]	STV[(4)]
Carbon Monoxide (CO), µg/m³	1-hour[(6)]	1,158	3,781	4,939	40,000	NA
	8-hour[(6)]	3,38	2,635	3,023	10,000	NA
Nitrogen Dioxide (NO_2), µg/m³	Annual	6	77	83	100	NA
Particulate Matter (PM_{10}), µg/m³	24-hour[(7)]	19	88	107	150	NA
	Annual	4	34	38	50	NA
Particulate Matter ($PM_{2.5}$), µg/m³	24-hour	2	-	-	NA	5
	Annual Neighborhood Average	0.036[(5)]	-	-	NA	0.1
Sulfur Dioxide (SO_2), µg/m³	3-hour[(6)]	56	265	321	1,300	NA
	24-hour[(6)]	9	139	148	365	NA
	Annual	1	34	35	80	NA

Notes:
(1) The highest estimated pollutant concentrations found at any of the off-site receptor locations.
(2) Background concentrations were obtained from the NYCDEP on April 18, 2003.
(3) NAAQS = National Ambient Air Quality Standards.
(4) Screening Threshold Value (STV) established by the NYCDEP and NYSDEC.
(5) Average $PM_{2.5}$ concentration over 1 km x 1 km "neighborhood-scale" receptor grid.
(6) The standards for these averaging periods allow one exceedance per year, so the use of the overall maximum concentration in this provides a very conservative comparison with standards.
(7) The 24-hour PM_{10} NAAQS is based on a 99th percentile concentration, which means that the high, 4th high concentration is appropriate for comparison with the standard. Therefore, the use of the overall highest concentration in this comparison is quite conservative.
NA = Not Applicable.

Table A.4-4
Highest Estimated Non-Cancer Hazard Index and Cancer Risk of Toxic Air Pollutant from On-site Emissions
DSNY-managed Waste Plus Commercial Waste
East 91st Street Converted MTS

No.	Toxic Air Pollutants	Acute Non-Cancer Risk: Highest Estimated Short-Term (1-hr) Pollutant Conc.(1) (µg/m³)	Acute Non-Cancer Risk: Short-Term (1-hr) Guideline Conc. (SGCs) (2) (µg/m³)	Acute Non-Cancer Risk: Acute Non-Cancer Hazard Index(3)	Chronic Non-Cancer Risk: Highest Estimated Long-Term (Annual) Pollutant Conc.(4) (µg/m³)	Chronic Non-Cancer Risk: Long-Term (Annual) Guideline Conc. (AGCs) (5) (µg/m³)	Chronic Non-Cancer Risk: Chronic Non-Cancer Hazard Index (6)	Cancer Risk: Highest Estimated Long-Term (Annual) Pollutant Conc. (4) (µg/m³)	Cancer Risk: Unit Risk Factors (7) (µg/m³)	Cancer Risk: Maximum Cancer Risk (8,9)
Carcinogenic Pollutants										
1	Benzene	3.86E-01	1.30E+03	2.97E-04	7.69E-03	1.30E-01	5.91E-02	7.69E-03	8.30E-06	6.38E-08
2	Formaldehyde	4.88E-01	3.00E+01	1.63E-02	9.72E-03	6.00E-02	1.62E-01	9.72E-03	1.30E-05	1.26E-07
3	1,3 Butadiene	1.62E-02	-	-	3.22E-04	3.60E-03	8.95E-02	3.22E-04	2.80E-04	9.02E-08
4	Acetaldehyde	3.17E-01	4.50E+03	7.04E-05	6.32E-03	4.50E-01	1.40E-02	6.32E-03	2.20E-06	1.39E-08
5	Benzo(a)pyrene	7.77E-05	-	-	1.55E-07	2.00E-03	7.74E-04	1.55E-06	1.70E-03	2.63E-09
6	Propylene	1.07E+00	-	-	2.13E-03	3.00E+03	7.09E-06	2.13E-02	NA	NA
Non-Carcinogenic Pollutants (10)										
7	Acrolein	3.82E-02	1.90E-01	2.01E-01	7.62E-04	2.00E-02	3.81E-02	7.62E-04	NA	NA
8	Toluene	1.69E-01	3.70E+04	4.57E-06	3.37E-03	4.00E+02	8.42E-06	3.37E-03	NA	NA
9	Xylenes	1.18E-01	4.30E+03	2.74E-05	2.35E-04	7.00E+02	3.35E-06	2.35E-03	NA	NA
10	Anthracene	7.73E-04	-	-	1.54E-06	2.00E-02	7.70E-04	1.54E-05	NA	NA
11	Benzo(a)anthracene	6.94E-04	-	-	1.38E-06	2.00E-02	6.92E-04	1.38E-05	NA	NA
12	Chrysene	1.46E-04	-	-	2.91E-07	2.00E-02	1.45E-04	2.91E-06	NA	NA
13	Naphthalene	3.50E-02	7.90E+03	4.44E-06	6.99E-04	3.00E+00	2.33E-04	6.99E-04	NA	NA
14	Pyrene	1.98E-03	-	-	3.94E-05	2.00E-02	1.97E-03	3.94E-05	NA	NA
15	Phenanthrene	1.21E-02	-	-	2.42E-05	2.00E-02	1.21E-02	2.42E-04	NA	NA
16	Dibenz(a,h)anthracene	2.41E-04	-	-	4.80E-06	2.00E-02	2.40E-04	4.80E-05	NA	NA
		Total Estimated Acute Non-Cancer Hazard Index		**2.18E-01**	**Total Estimated Chronic Non-Cancer Hazard Index**		**3.80E-01**	**Total Estimated Combined Cancer Risk**		**2.97E-07**
		Acute Non-Cancer Hazard Index Threshold (11)		**1.0E+00**	**Chronic Non-Cancer Hazard Index Threshold (11)**		**1.0E+00**	**Cancer Risk Threshold (11)**		**1.0E-06**

Notes to Table A.4-4:

(1) Estimated by multiplying the total 1-hr HCs concentration by the ratio of the emission factor for that pollutant to the emission factor of the total hydrocarbons.

(2) Short-term (1-hr) guideline concentrations (SGC) established by NYSDEC.

(3) Estimated by dividing the maximum 1-hr concentrations of each pollutant by the SGC value of that pollutant and summing up the resulting values to obtain hazard index for all of the pollutants combined.

(4) Estimated by multiplying the total annual HCs concentration by ratio of the emission factor for that pollutant to the emission factor of the total hydrocarbons.

(5) Long-term (annual) guideline concentrations (AGC) established by NYSDEC

(6) Estimated by dividing the maximum annual concentration of each of the individual pollutants by the AGC value of that pollutant and summing up the resulting values to obtain hazard index for all of the pollutants combined.

(7) Unit risk factors established by USEPA and other governmental agencies for the inhalation of carcinogenic air pollutants.

(8) The maximum cancer risk of each of the individual pollutants was estimated by multiplying the estimated annual concentration of each pollutant by its unit risk factor.

(9) The total incremental cancer risk from all of the pollutants combined was estimated by summing the maximum cancer risk of each of the individual pollutants.

(10) Some of the pollutants included in the group of non-carcinogenic pollutants, such as anthracene, benzo(a)anthracene and chrysene, may also have carcinogenic effects. As these pollutants do not have established unit risk factors, they were evaluated using the hazard index approach for non-carcinogens.

(11) Hazard index and cancer risk thresholds based on NYSDEC "Guidelines for the Control of Toxic Ambient Air Contaminants" dated November 12, 1997. Estimated values below these threshold limits are considered to be insignificant impacts.

Table A.4-5
Highest Estimated Concentrations of the Criteria Pollutants from On-site Emissions
DSNY-managed Waste Plus Commercial Waste
West 59th Street Converted MTS

Pollutant	Averaging Time Period	Maximum Impacts from On-site Emission Sources [(1)]	Background Pollutant Concentrations [(2)]	Highest Estimated On-site Pollutant Concentrations	NAAQS[(3)]	STV[(4)]
Carbon Monoxide (CO), $\mu g/m^3$	1-hour[(6)]	3,033	4,353	7,386	40,000	NA
	8-hour[(6)]	582	3,322	3,904	10,000	NA
Nitrogen Dioxide (NO_2), $\mu g/m^3$	Annual	4	77	81	100	NA
Particulate Matter (PM_{10}), $\mu g/m^3$	24-hour[(7)]	14	88	102	150	NA
	Annual	1	34	35	50	NA
Particulate Matter ($PM_{2.5}$), $\mu g/m^3$	24-hour	4	-	-	NA	5
	Annual Neighborhood Average	0.033[(5)]	-	-	NA	0.1
Sulfur Dioxide (SO_2), $\mu g/m^3$	3-hour[(6)]	57	265	322	1,300	NA
	24-hour[(6)]	13	139	152	365	NA
	Annual	1	34	35	80	NA

Notes:

(1) The highest estimated pollutant concentrations found at any of the off-site receptor locations.
(2) Background concentrations were obtained from the NYCDEP on April 18, 2003.
(3) NAAQS = National Ambient Air Quality Standards.
(4) Screening Threshold Value (STV) established by the NYCDEP and NYSDEC.
(5) Average $PM_{2.5}$ concentration over 1 km x 1 km "neighborhood-scale" receptor grid.
(6) The standards for these averaging periods allow one exceedance per year, so the use of the overall maximum concentration in this provides a very conservative comparison with standards.
(7) The 24-hour PM_{10} NAAQS is based on a 99th percentile concentration, which means that the high, 4th high concentration is appropriate for comparison with the standard. Therefore, the use of the overall highest concentration in this comparison is quite conservative.

NA = Not Applicable.

Table A.4-6
Highest Estimated Non-Cancer Hazard Index and Cancer Risk of Toxic Air Pollutant from On-site Emissions
DSNY-managed Waste Plus Commercial Waste
West 59th Street Converted MTS

No.	Toxic Air Pollutants	Acute Non-Cancer Risk			Chronic Non-Cancer Risk			Cancer Risk		
		Highest Estimated Short-Term (1-hr) Pollutant Conc.(1) (μg/m³)	Short-Term (1-hr) Guideline Conc. (SGCs) (2) (μg/m³)	Acute Non-Cancer Hazard Index(3)	Highest Estimated Long-Term (Annual) Pollutant Conc.(4) (μg/m³)	Long-Term (Annual) Guideline Conc. (AGCs) (5) (μg/m³)	Chronic Non-Cancer Hazard Index (6)	Highest Estimated Long-Term (Annual) Pollutant Conc. (4) (μg/m³)	Unit Risk Factors (7) (μg/m³)	Maximum Cancer Risk (8,9)
Carcinogenic Pollutants										
1	Benzene	9.85E-01	1.30E+03	7.58E-04	4.06E-03	1.30E-01	3.12E-02	4.06E-03	8.30E-06	3.37E-08
2	Formaldehyde	1.25E+00	3.00E+01	4.15E-02	5.14E-03	6.00E-02	8.56E-02	5.14E-03	1.30E-05	6.68E-08
3	1,3 Butadiene	4.13E-02	-	-	1.70E-04	3.60E-03	4.73E-02	1.70E-04	2.80E-04	4.77E-08
4	Acetaldehyde	8.10E-01	4.50E+03	1.80E-05	3.34E-03	4.50E-01	7.42E-03	3.34E-03	2.20E-06	7.35E-09
5	Benzo(a)pyrene	1.98E-04	-	-	8.19E-07	2.00E-03	4.09E-04	8.19E-07	1.70E-03	1.39E-09
6	Propylene	2.72E+00	-	-	1.12E-02	3.00E+03	3.74E-06	1.12E-02	NA	NA
Non-Carcinogenic Pollutants (10)										
7	Acrolein	9.77E-02	1.90E-01	5.14E-01	4.03E-04	2.00E-02	2.01E-02	4.03E-04	NA	NA
8	Toluene	4.32E-01	3.70E+04	1.17E-05	1.78E-03	4.00E+02	4.45E-06	1.78E-03	NA	NA
9	Xylenes	3.01E-01	4.30E+03	7.00E-05	1.24E-03	7.00E+02	1.77E-06	1.24E-03	NA	NA
10	Anthracene	1.97E-03	-	-	8.14E-06	2.00E-02	4.07E-04	8.14E-06	NA	NA
11	Benzo(a)anthracene	1.77E-03	-	-	7.31E-06	2.00E-02	3.66E-04	7.31E-06	NA	NA
12	Chrysene	3.73E-04	-	-	1.54E-06	2.00E-02	7.68E-05	1.54E-06	NA	NA
13	Naphthalene	8.95E-02	7.90E+03	1.13E-05	3.69E-04	3.00E+00	1.23E-04	3.69E-04	NA	NA
14	Pyrene	5.05E-03	-	-	2.08E-05	2.00E-02	1.04E-03	2.08E-05	NA	NA
15	Phenanthrene	3.10E-02	-	-	1.28E-04	2.00E-02	6.40E-03	1.28E-04	NA	NA
16	Dibenz(a,h)anthracene	6.16E-04	-	-	2.54E-06	2.00E-02	1.27E-04	2.54E-06	NA	NA
		Total Estimated Acute Non-Cancer Hazard Index		**5.57E-01**	**Total Estimated Chronic Non-Cancer Hazard Index**		**2.01E-01**	**Total Estimated Combined Cancer Risk**		**1.57E-07**
		Acute Non-Cancer Hazard Index Threshold (11)		**1.0E+00**	**Chronic Non-Cancer Hazard Index Threshold (11)**		**1.0E+00**	**Cancer Risk Threshold (11)**		**1.0E-06**

Notes to Table A.4-6:

(1) Estimated by multiplying the total 1-hr HCs concentration by the ratio of the emission factor for that pollutant to the emission factor of the total hydrocarbons.

(2) Short-term (1-hr) guideline concentrations (SGC) established by NYSDEC.

(3) Estimated by dividing the maximum 1-hr concentrations of each pollutant by the SGC value of that pollutant and summing up the resulting values to obtain hazard index for all of the pollutants combined.

(4) Estimated by multiplying the total annual HCs concentration by ratio of the emission factor for that pollutant to the emission factor of the total hydrocarbons.

(5) Long-term (annual) guideline concentrations (AGC) established by NYSDEC.

(6) Estimated by dividing the maximum annual concentration of each of the individual pollutants by the AGC value of that pollutant and summing up the resulting values to obtain hazard index for all of the pollutants combined.

(7) Unit risk factors established by USEPA and other governmental agencies for the inhalation of carcinogenic air pollutants.

(8) The maximum cancer risk of each of the individual pollutants was estimated by multiplying the estimated annual concentration of each pollutant by its unit risk factor.

(9) The total incremental cancer risk from all of the pollutants combined was estimated by summing the maximum cancer risk of each of the individual pollutants.

(10) Some of the pollutants included in the group of non-carcinogenic pollutants, such as anthracene, benzo(a)anthracene and chrysene, may also have carcinogenic effects. As these pollutants do not have established unit risk factors, they were evaluated using the hazard index approach for non-carcinogens.

(11) Hazard index and cancer risk thresholds based on NYSDEC "Guidelines for the Control of Toxic Ambient Air Contaminants" dated November 12, 1997. Estimated values below these threshold limits are considered to be insignificant impacts.

Table A.4-7
Highest Estimated Concentrations of the Criteria Pollutants from On-site Emissions
DSNY-managed Waste Plus Commercial Waste
South Bronx Converted MTS

Pollutant	Averaging Time Period	Maximum Impacts from On-site Emission Sources (1)	Background Pollutant Concentrations (2)	Highest Estimated On-site Pollutant Concentrations	NAAQS(3)	STV(4)
Carbon Monoxide (CO), µg/m³	1-hour(6)	947	3,781	4,728	40,000	NA
	8-hour(6)	182	2,635	2,817	10,000	NA
Nitrogen Dioxide (NO_2), µg/m³	Annual	3	68	71	100	NA
Particulate Matter (PM_{10}), µg/m³	24-hour(7)	18	73	91	150	NA
	Annual	5	25	30	50	NA
Particulate Matter ($PM_{2.5}$), µg/m³	24-hour	1	-	-	NA	5
	Annual Neighborhood Average	0.027(5)	-	-	NA	0.1
Sulfur Dioxide (SO_2), µg/m³	3-hour(6)	35	325	360	1,300	NA
	24-hour(6)	3	144	147	365	NA
	Annual	0.7	31	32	80	NA

Notes:

(1) The highest estimated pollutant concentrations found at any of the off-site receptor locations.
(2) Background concentrations were obtained from the NYCDEP on April 18, 2003.
(3) NAAQS = National Ambient Air Quality Standards.
(4) Screening Threshold Value (STV) established by the NYCDEP and NYSDEC.
(5) Average $PM_{2.5}$ concentration over 1 km x 1 km "neighborhood-scale" receptor grid.
(6) The standards for these averaging periods allow one exceedance per year, so the use of the overall maximum concentration in this provides a very conservative comparison with standards.
(7) The 24-hour PM_{10} NAAQS is based on a 99th percentile concentration, which means that the high, 4th high concentration is appropriate for comparison with the standard. Therefore, the use of the overall highest concentration in this comparison is quite conservative.

NA = Not Applicable.

Table A.4-8
Highest Estimated Non-Cancer Hazard Index and Cancer Risk of Toxic Air Pollutant from On-site Emissions
DSNY-managed Waste Plus Commercial Waste
South Bronx Converted MTS

No.	Toxic Air Pollutants	Acute Non-Cancer Risk			Chronic Non-Cancer Risk			Cancer Risk		
		Highest Estimated Short-Term (1-hr) Pollutant Conc.(1) (μg/m³)	Short-Term (1-hr) Guideline Conc. (SGCs) (2) (μg/m³)	Acute Non-Cancer Hazard Index(3)	Highest Estimated Long-Term (Annual) Pollutant Conc.(4) (μg/m³)	Long-Term (Annual) Guideline Conc. (AGCs) (5) (μg/m³)	Chronic Non-Cancer Hazard Index (6)	Highest Estimated Long-Term (Annual) Pollutant Conc. (4) (μg/m³)	Unit Risk Factors (7) (μg/m³)	Maximum Cancer Risk (8,9)
Carcinogenic Pollutants										
1	Benzene	3.08E-01	1.30E+03	2.37E-04	4.23E-03	1.30E-01	3.25E-02	4.23E-03	8.30E-06	3.51E-08
2	Formaldehyde	3.98E-01	3.00E+01	1.30E-02	5.35E-03	6.00E-02	8.91E-02	5.35E-03	1.30E-05	6.95E-08
3	1,3 Butadiene	1.29E-02	-	-	1.77E-04	3.60E-03	4.92E-02	1.77E-04	2.80E-04	4.96E-08
4	Acetaldehyde	2.53E-01	4.50E+03	5.62E-05	3.48E-03	4.50E-01	7.73E-03	3.48E-03	2.20E-06	7.65E-09
5	Benzo(a)pyrene	6.20E-05	-	-	8.52E-07	2.00E-03	4.26E-04	8.52E-07	1.70E-03	1.45E-09
6	Propylene	8.51E-01	-	-	1.17E-02	3.00E+03	3.90E-06	1.17E-02	NA	NA
Non-Carcinogenic Pollutants (10)										
7	Acrolein	3.05E-02	1.90E-01	1.61E-01	4.19E-04	2.00E-02	2.10E-02	4.19E-04	NA	NA
8	Toluene	1.35E-01	3.70E+04	3.65E-06	1.85E-03	4.00E+02	4.63E-06	1.85E-03	NA	NA
9	Xylenes	9.40E-02	4.30E+03	2.19E-05	1.29E-03	7.00E+02	1.85E-06	1.29E-03	NA	NA
10	Anthracene	6.17E-04	-	-	8.48E-06	2.00E-02	4.24E-04	8.48E-06	NA	NA
11	Benzo(a)anthracene	5.54E-04	-	-	7.61E-06	2.00E-02	3.81E-04	7.61E-06	NA	NA
12	Chrysene	1.16E-04	-	-	1.60E-06	2.00E-02	8.00E-05	1.60E-06	NA	NA
13	Naphthalene	2.80E-02	7.90E+03	3.54E-06	3.84E-04	3.00E+00	1.28E-04	3.84E-04	NA	NA
14	Pyrene	1.58E-03	-	-	2.17E-05	2.00E-02	1.08E-03	2.17E-05	NA	NA
15	Phenanthrene	9.70E-03	-	-	1.33E-04	2.00E-02	6.66E-03	1.33E-04	NA	NA
16	Dibenz(a,h)anthracene	1.92E-04	-	-	2.64E-06	2.00E-02	1.32E-04	2.64E-06	NA	NA
		Total Estimated Acute Non-Cancer Hazard Index		**1.74E-01**	**Total Estimated Chronic Non-Cancer Hazard Index**		**2.09E-01**	**Total Estimated Combined Cancer Risk**		**1.63E-07**
		Acute Non-Cancer Hazard Index Threshold (11)		**1.0E+00**	**Chronic Non-Cancer Hazard Index Threshold (11)**		**1.0E+00**	**Cancer Risk Threshold (11)**		**1.0E-06**

Notes to Table A.4-8:

(1) Estimated by multiplying the total 1-hr HCs concentration by the ratio of the emission factor for that pollutant to the emission factor of the total hydrocarbons.

(2) Short-term (1-hr) guideline concentrations (SGC) established by NYSDEC.

(3) Estimated by dividing the maximum 1-hr concentrations of each pollutant by the SGC value of that pollutant and summing up the resulting values to obtain hazard index for all of the pollutants combined.

(4) Estimated by multiplying the total annual HCs concentration by ratio of the emission factor for that pollutant to the emission factor of the total hydrocarbons.

(5) Long-term (annual) guideline concentrations (AGC) established by NYSDEC.

(6) Estimated by dividing the maximum annual concentration of each of the individual pollutants by the AGC value of that pollutant and summing up the resulting values to obtain hazard index for all of the pollutants combined.

(7) Unit risk factors established by USEPA and other governmental agencies for the inhalation of carcinogenic air pollutants.

(8) The maximum cancer risk of each of the individual pollutants was estimated by multiplying the estimated annual concentration of each pollutant by its unit risk factor.

(9) The total incremental cancer risk from all of the pollutants combined was estimated by summing the maximum cancer risk of each of the individual pollutants.

(10) Some of the pollutants included in the group of non-carcinogenic pollutants, such as anthracene, benzo(a)anthracene and chrysene, may also have carcinogenic effects. As these pollutants do not have established unit risk factors, they were evaluated using the hazard index approach for non-carcinogens.

(11) Hazard index and cancer risk thresholds based on NYSDEC "Guidelines for the Control of Toxic Ambient Air Contaminants" dated November 12, 1997. Estimated values below these threshold limits are considered to be insignificant impacts.

Table A.4-9
Highest Estimated Concentrations of the Criteria Pollutants from On-site Emissions
DSNY-managed Waste Plus Commercial Waste
North Shore Converted MTS

Pollutant	Averaging Time Period	Maximum Impacts from On-site Emission Sources [1]	Background Pollutant Concentrations [2]	Highest Estimated On-site Pollutant Concentrations	NAAQS[3]	STV[4]
Carbon Monoxide (CO), $\mu g/m^3$	1-hour[6]	1,261	3,781	5,042	40,000	NA
	8-hour[6]	194	2,635	3,767	10,000	NA
Nitrogen Dioxide (NO_2), $\mu g/m^3$	Annual	4	56	60	100	NA
Particulate Matter (PM_{10}), $\mu g/m^3$	24-hour[7]	17	57	74	150	NA
	Annual	4	23	27	50	NA
Particulate Matter ($PM_{2.5}$), $\mu g/m^3$	24-hour	1	-	-	NA	5
	Annual Neighborhood Average	0.036[5]	-	-	NA	0.1
Sulfur Dioxide (SO_2), $\mu g/m^3$	3-hour[6]	49	186	235	1,300	NA
	24-hour[6]	5	107	112	365	NA
	Annual	1	18.3	19	80	NA

Notes:
(1) The highest estimated pollutant concentrations found at any of the off-site receptor locations.
(2) Background concentrations were obtained from the NYCDEP on April 18, 2003.
(3) NAAQS = National Ambient Air Quality Standards.
(4) Screening Threshold Value (STV) established by the NYCDEP and NYSDEC.
(5) Average $PM_{2.5}$ concentration over 1 km x 1 km "neighborhood-scale" receptor grid.
(6) The standards for these averaging periods allow one exceedance per year, so the use of the overall maximum concentration in this provides a very conservative comparison with standards.
(7) The 24-hour PM_{10} NAAQS is based on a 99th percentile concentration, which means that the high, 4th high concentration is appropriate for comparison with the standard. Therefore, the use of the overall highest concentration in this comparison is quite conservative.
NA = Not Applicable.

Table A.4-10
Highest Estimated Non-Cancer Hazard Index and Cancer Risk of Toxic Air Pollutant from On-site Emissions
DSNY-managed Waste Plus Commercial Waste
North Shore Converted MTS

		Acute Non-Cancer Risk			Chronic Non-Cancer Risk			Cancer Risk		
No.	Toxic Air Pollutants	Highest Estimated Short-Term (1-hr) Pollutant Conc.[1] ($\mu g/m^3$)	Short-Term (1-hr) Guideline Conc. (SGCs)[2] ($\mu g/m^3$)	Acute Non-Cancer Hazard Index[3]	Highest Estimated Long-Term (Annual) Pollutant Conc.[4] ($\mu g/m^3$)	Long-Term (Annual) Guideline Conc. (AGCs)[5] ($\mu g/m^3$)	Chronic Non-Cancer Hazard Index[6]	Highest Estimated Long-Term (Annual) Pollutant Conc.[4] ($\mu g/m^3$)	Unit Risk Factors[7] ($\mu g/m^3$)	Maximum Cancer Risk[8,9]
Carcinogenic Pollutants										
1	Benzene	4.06E-01	1.30E+03	3.12E-04	4.63E-03	1.30E-01	3.56E-02	4.63E-03	8.30E-06	3.84E-08
2	Formaldehyde	5.13E-01	3.00E+01	1.71E-02	5.85E-03	6.00E-02	9.75E-02	5.85E-03	1.30E-05	7.60E-08
3	1,3 Butadiene	1.70E-02	-	-	1.94E-04	3.60E-03	5.38E-02	1.94E-04	2.80E-04	5.43E-08
4	Acetaldehyde	3.33E-01	4.50E+03	7.41E-05	3.80E-03	4.50E-01	8.45E-03	3.80E-03	2.20E-06	8.36E-09
5	Benzo(a)pyrene	8.17E-05	-	-	9.32E-07	2.00E-03	4.66E-04	9.32E-07	1.70E-03	1.58E-10
6	Propylene	1.12E+00	-	-	1.28E-02	3.00E+03	4.26E-06	1.28E-02	NA	NA
Non-Carcinogenic Pollutants[10]										
7	Acrolein	4.02E-02	1.90E-01	2.12E-01	4.59E-04	2.00E-02	2.29E-02	4.59E-04	NA	NA
8	Toluene	1.78E-01	3.70E+04	4.81E-06	2.03E-03	4.00E+02	5.07E-06	2.03E-03	NA	NA
9	Xylenes	1.24E-01	4.30E+03	2.88E-05	1.41E-03	7.00E+02	2.02E-06	1.41E-03	NA	NA
10	Anthracene	8.13E-04	-	-	9.27E-06	2.00E-02	4.63E-04	9.27E-06	NA	NA
11	Benzo(a)anthracene	7.30E-04	-	-	8.33E-06	2.00E-02	4.16E-04	8.33E-06	NA	NA
12	Chrysene	1.53E-04	-	-	1.75E-06	2.00E-02	8.75E-05	1.75E-06	NA	NA
13	Naphthalene	3.69E-02	7.90E+03	4.67E-06	4.20E-04	3.00E+00	1.40E-04	4.20E-04	NA	NA
14	Pyrene	2.08E-03	-	-	2.37E-05	2.00E-02	1.18E-03	2.37E-05	NA	NA
15	Phenanthrene	1.28E-02	-	-	1.46E-04	2.00E-02	7.29E-03	1.46E-04	NA	NA
16	Dibenz(a,h)anthracene	2.54E-04	-	-	2.89E-06	2.00E-02	1.45E-04	2.89E-06	NA	NA
		Total Estimated Acute Non-Cancer Hazard Index		2.29E-01	Total Estimated Chronic Non-Cancer Hazard Index		2.28E-01	Total Estimated Combined Cancer Risk		1.79E-07
		Acute Non-Cancer Hazard Index Threshold[11]		1.0E+00	Chronic Non-Cancer Hazard Index Threshold[11]		1.0E+00	Cancer Risk Threshold[11]		1.0E-06

Notes to Table A.4-10:

(1) Estimated by multiplying the total 1-hr HCs concentration by the ratio of the emission factor for that pollutant to the emission factor of the total hydrocarbons.

(2) Short-term (1-hr) guideline concentrations (SGC) established by NYSDEC.

(3) Estimated by dividing the maximum 1-hr concentrations of each pollutant by the SGC value of that pollutant and summing up the resulting values to obtain hazard index for all of the pollutants combined.

(4) Estimated by multiplying the total annual HCs concentration by ratio of the emission factor for that pollutant to the emission factor of the total hydrocarbons.

(5) Long-term (annual) guideline concentrations (AGC) established by NYSDEC.

(6) Estimated by dividing the maximum annual concentration of each of the individual pollutants by the AGC value of that pollutant and summing up the resulting values to obtain hazard index for all of the pollutants combined.

(7) Unit risk factors established by USEPA and other governmental agencies for the inhalation of carcinogenic air pollutants.

(8) The maximum cancer risk of each of the individual pollutants was estimated by multiplying the estimated annual concentration of each pollutant by its unit risk factor.

(9) The total incremental cancer risk from all of the pollutants combined was estimated by summing the maximum cancer risk of each of the individual pollutants.

(10) Some of the pollutants included in the group of non-carcinogenic pollutants, such as anthracene, benzo(a)anthracene and chrysene, may also have carcinogenic effects. As these pollutants do not have established unit risk factors, they were evaluated using the hazard index approach for non-carcinogens.

(11) Hazard index and cancer risk thresholds based on NYSDEC "Guidelines for the Control of Toxic Ambient Air Contaminants" dated November 12, 1997. Estimated values below these threshold limits are considered to be insignificant impacts.

Table A.4-11
Highest Estimated Concentrations of the Criteria Pollutants from On-site Emissions
DSNY-managed Waste Plus Commercial Waste
Greenpoint Converted MTS

Pollutant	Averaging Time Period	Maximum Impacts from On-site Emission Sources (1)	Background Pollutant Concentrations (2)	Highest Estimated On-site Pollutant Concentrations	NAAQS(3)	STV(4)
Carbon Monoxide (CO), µg/m^3	1-hour(6)	1,335	3,321	4,656	40,000	NA
	8-hour(6)	445	2,635	3,080	10,000	NA
Nitrogen Dioxide (NO_2), µg/m^3	Annual	2	56	58	100	NA
Particulate Matter (PM_{10}), µg/m^3	24-hour(7)	25	57	82	150	NA
	Annual	4	23	27	50	NA
Particulate Matter ($PM_{2.5}$), µg/m^3	24-hour	2	-	-	NA	5
	Annual Neighborhood Average	0.024(5)	-	-	NA	0.1
Sulfur Dioxide (SO_2), µg/m^3	3-hour(6)	51	189	240	1,300	NA
	24-hour(6)	6	87	93	365	NA
	Annual	0.5	21	22	80	NA

Notes:

(1) The highest estimated pollutant concentrations found at any of the off-site receptor locations.

(2) Background concentrations were obtained from the NYCDEP on April 18, 2003.

(3) NAAQS = National Ambient Air Quality Standards.

(4) Screening Threshold Value (STV) established by the NYCDEP and NYSDEC.

(5) Average $PM_{2.5}$ concentration over 1 km x 1 km "neighborhood-scale" receptor grid.

(6) The standards for these averaging periods allow one exceedance per year, so the use of the overall maximum concentration in this provides a very conservative comparison with standards.

(7) The 24-hour PM_{10} NAAQS is based on a 99th percentile concentration, which means that the high, 4th high concentration is appropriate for comparison with the standard. Therefore, the use of the overall highest concentration in this comparison is quite conservative.

NA = Not Applicable.

Table A.4-12
Highest Estimated Non-Cancer Hazard Index and Cancer Risk of Toxic Air Pollutant from On-site Emissions
DSNY-managed Waste Plus Commercial Waste
Greenpoint Converted MTS

		Acute Non-Cancer Risk			Chronic Non-Cancer Risk			Cancer Risk		
No.	Toxic Air Pollutants	Highest Estimated Short-Term (1-hr) Pollutant Conc.[1] (μg/m³)	Short-Term (1-hr) Guideline Conc. (SGCs)[2] (μg/m³)	Acute Non-Cancer Hazard Index[3]	Highest Estimated Long-Term (Annual) Pollutant Conc.[4] (μg/m³)	Long-Term (Annual) Guideline Conc. (AGCs)[5] (μg/m³)	Chronic Non-Cancer Hazard Index[6]	Highest Estimated Long-Term (Annual) Pollutant Conc.[4] (μg/m³)	Unit Risk Factors[7] (μg/m³)	Maximum Cancer Risk[8,9]
Carcinogenic Pollutants										
1	Benzene	4.31E-01	1.30E+03	3.31E-04	3.00E-03	1.30E-01	2.31E-02	3.00E-03	8.30E-06	2.49E-08
2	Formaldehyde	5.45E-01	3.00E+01	1.82E-02	3.80E-03	6.00E-02	6.33E-02	3.80E-03	1.30E-05	4.94E-08
3	1,3 Butadiene	1.81E-02	-	-	1.26E-04	3.60E-03	3.50E-02	1.26E-04	2.80E-04	3.53E-08
4	Acetaldehyde	3.54E-01	4.50E+03	7.87E-05	2.47E-03	4.50E-01	5.49E-03	2.47E-03	2.20E-06	5.43E-09
5	Benzo(a)pyrene	8.68E-05	-	-	6.05E-07	2.00E-03	3.03E-04	6.05E-07	1.70E-03	1.03E-09
6	Propylene	1.19E+00	-	-	8.31E-03	3.00E+03	2.77E-06	8.31E-03	NA	NA
Non-Carcinogenic Pollutants[10]										
7	Acrolein	4.27E-02	1.90E-01	2.25E-01	2.98E-04	2.00E-02	1.49E-02	2.98E-04	NA	NA
8	Toluene	1.89E-01	3.70E+04	5.10E-06	1.32E-03	4.00E+02	3.29E-06	1.32E-03	NA	NA
9	Xylenes	1.32E-01	4.30E+03	3.06E-05	9.18E-04	7.00E+02	1.31E-06	9.18E-04	NA	NA
10	Anthracene	8.63E-04	-	-	6.02E-06	2.00E-02	3.01E-04	6.02E-06	NA	NA
11	Benzo(a)anthracene	7.76E-04	-	-	5.41E-06	2.00E-02	2.70E-04	5.41E-06	NA	NA
12	Chrysene	1.63E-04	-	-	1.14E-06	2.00E-02	5.68E-05	1.14E-06	NA	NA
13	Naphthalene	3.92E-02	7.90E+03	4.96E-06	2.73E-04	3.00E+00	9.10E-05	2.73E-04	NA	NA
14	Pyrene	2.21E-03	-	-	1.54E-05	2.00E-02	7.70E-04	1.54E-05	NA	NA
15	Phenanthrene	1.36E-02	-	-	9.47E-05	2.00E-02	4.73E-03	9.47E-05	NA	NA
16	Dibenz(a,h)anthracene	2.69E-04	-	-	1.88E-06	2.00E-02	9.39E-05	1.88E-06	NA	NA
		Total Estimated Acute Non-Cancer Hazard Index		2.43E-01	Total Estimated Chronic Non-Cancer Hazard Index		1.48E-01	Total Estimated Combined Cancer Risk		1.16E-07
		Acute Non-Cancer Hazard Index Threshold[11]		1.0E+00	Chronic Non-Cancer Hazard Index Threshold[11]		1.0E+00	Cancer Risk Threshold[11]		1.0E-06

Notes to Table A.4-12:

(1) Estimated by multiplying the total 1-hr HCs concentration by the ratio of the emission factor for that pollutant to the emission factor of the total hydrocarbons.

(2) Short-term (1-hr) guideline concentrations (SGC) established by NYSDEC.

(3) Estimated by dividing the maximum 1-hr concentrations of each pollutant by the SGC value of that pollutant and summing up the resulting values to obtain hazard index for all of the pollutants combined.

(4) Estimated by multiplying the total annual HCs concentration by ratio of the emission factor for that pollutant to the emission factor of the total hydrocarbons.

(5) Long-term (annual) guideline concentrations (AGC) established by NYSDEC.

(6) Estimated by dividing the maximum annual concentration of each of the individual pollutants by the AGC value of that pollutant and summing up the resulting values to obtain hazard index for all of the pollutants combined.

(7) Unit risk factors established by USEPA and other governmental agencies for the inhalation of carcinogenic air pollutants.

(8) The maximum cancer risk of each of the individual pollutants was estimated by multiplying the estimated annual concentration of each pollutant by its unit risk factor.

(9) The total incremental cancer risk from all of the pollutants combined was estimated by summing the maximum cancer risk of each of the individual pollutants.

(10) Some of the pollutants included in the group of non-carcinogenic pollutants, such as anthracene, benzo(a)anthracene and chrysene, may also have carcinogenic effects. As these pollutants do not have established unit risk factors, they were evaluated using the hazard index approach for non-carcinogens.

(11) Hazard index and cancer risk thresholds based on NYSDEC "Guidelines for the Control of Toxic Ambient Air Contaminants" dated November 12, 1997. Estimated values below these threshold limits are considered to be insignificant impacts.

Table A.4-13
Highest Estimated Concentrations of the Criteria Pollutants from On-site Emissions
DSNY-managed Waste Plus Commercial Waste
Hamilton Avenue Converted MTS

Pollutant	Averaging Time Period	Maximum Impacts from On-site Emission Sources [(1)]	Background Pollutant Concentrations [(2)]	Highest Estimated On-site Pollutant Concentrations	NAAQS[(3)]	STV[(4)]
Carbon Monoxide (CO), $\mu g/m^3$	1-hour[(6)]	1,334	3,321	4,655	40,000	NA
	8-hour[(6)]	393	2,636	3,029	10,000	NA
Nitrogen Dioxide (NO_2), $\mu g/m^3$	Annual	4	56	60	100	NA
Particulate Matter (PM_{10}), $\mu g/m^3$	24-hour[(7)]	21	82	103	150	NA
	Annual	5	22	27	50	NA
Particulate Matter ($PM_{2.5}$), $\mu g/m^3$	24-hour	2	-	-	NA	5
	Annual Neighborhood Average	0.029[(5)]	-	-	NA	0.1
Sulfur Dioxide (SO_2), $\mu g/m^3$	3-hour[(6)]	45	152	197	1,300	NA
	24-hour[(6)]	9	94	103	365	NA
	Annual	1	24	25	80	NA

Notes:
(1) The highest estimated pollutant concentrations found at any of the off-site receptor locations.
(2) Background concentrations were obtained from the NYCDEP on April 18, 2003.
(3) NAAQS = National Ambient Air Quality Standards.
(4) Screening Threshold Value (STV) established by the NYCDEP and NYSDEC.
(5) Average $PM_{2.5}$ concentration over 1 km x 1 km "neighborhood-scale" receptor grid.
(6) The standards for these averaging periods allow one exceedance per year, so the use of the overall maximum concentration in this provides a very conservative comparison with standards.
(7) The 24-hour PM_{10} NAAQS is based on a 99th percentile concentration, which means that the high, 4th high concentration is appropriate for comparison with the standard. Therefore, the use of the overall highest concentration in this comparison is quite conservative.
NA = Not Applicable.

Table A.4-14
Highest Estimated Non-Cancer Hazard Index and Cancer Risk of Toxic Air Pollutant from On-site Emissions
DSNY-managed Waste Plus Commercial Waste
Hamilton Avenue Converted MTS

No.	Toxic Air Pollutants	Acute Non-Cancer Risk			Chronic Non-Cancer Risk			Cancer Risk		
		Highest Estimated Short-Term (1-hr) Pollutant Conc.(1) (μg/m³)	Short-Term (1-hr) Guideline Conc. (SGCs) (2) (μg/m³)	Acute Non-Cancer Hazard Index(3)	Highest Estimated Long-Term (Annual) Pollutant Conc.(4) (μg/m³)	Long-Term (Annual) Guideline Conc. (AGCs) (5) (μg/m³)	Chronic Non-Cancer Hazard Index (6)	Highest Estimated Long-Term (Annual) Pollutant Conc. (4) (μg/m³)	Unit Risk Factors (7) (μg/m³)	Maximum Cancer Risk (8,9)
Carcinogenic Pollutants										
1	Benzene	4.75E-01	1.30E+03	3.65E-04	6.22E-03	1.30E-01	4.79E-02	6.22E-03	8.30E-06	5.17E-08
2	Formaldehyde	6.01E-01	3.00E+01	2.00E-02	7.87E-03	6.00E-02	1.31E-02	7.87E-03	1.30E-05	1.02E-07
3	1,3 Butadiene	1.99E-02	-	-	2.61E-04	3.60E-03	7.24E-02	2.61E-04	2.80E-04	7.30E-08
4	Acetaldehyde	3.90E-01	4.50E+03	8.67E-05	5.12E-03	4.50E-01	1.14E-03	5.12E-03	2.20E-06	1.13E-08
5	Benzo(a)pyrene	9.57E-05	-	-	1.25E-06	2.00E-03	6.27E-04	1.25E-06	1.70E-03	2.13E-09
6	Propylene	1.31E+00	-	-	1.72E-02	3.00E+03	5.74E-06	1.72E-02	NA	NA
Non-Carcinogenic Pollutants (10)										
7	Acrolein	4.71E-02	1.90E-01	2.48E-01	6.17E-04	2.00E-02	3.09E-02	6.17E-04	NA	NA
8	Toluene	2.08E-01	3.70E+04	5.63E-06	2.73E-03	4.00E+02	6.82E-06	2.73E-03	NA	NA
9	Xylenes	1.45E-01	4.30E+03	3.37E-05	1.90E-03	7.00E+02	2.72E-06	1.90E-03	NA	NA
10	Anthracene	9.52E-04	-	-	1.25E-05	2.00E-02	6.24E-04	1.25E-05	NA	NA
11	Benzo(a)anthracene	8.55E-04	-	-	1.12E-05	2.00E-02	5.60E-04	1.12E-05	NA	NA
12	Chrysene	1.80E-04	-	-	2.35E-06	2.00E-02	1.18E-05	2.35E-06	NA	NA
13	Naphthalene	4.32E-02	7.90E+03	5.46E-06	5.66E-04	3.00E+00	1.89E-05	5.66E-04	NA	NA
14	Pyrene	2.43E-03	-	-	3.19E-05	2.00E-02	1.59E-04	3.19E-05	NA	NA
15	Phenanthrene	1.50E-02	-	-	1.96E-04	2.00E-02	9.81E-03	1.96E-04	NA	NA
16	Dibenz(a,h)anthracene	2.97E-04	-	-	1.49E-06	2.00E-02	3.89E-05	1.49E-06	NA	NA
		Total Estimated Acute Non-Cancer Hazard Index		**2.68E-01**	**Total Estimated Chronic Non-Cancer Hazard Index**		**3.07E-01**	**Total Estimated Combined Cancer Risk**		**2.40E-07**
		Acute Non-Cancer Hazard Index Threshold (11)		**1.0E+00**	**Chronic Non-Cancer Hazard Index Threshold (11)**		**1.0E+00**	**Cancer Risk Threshold (11)**		**1.0E-06**

Notes to Table A.4-14:

(1) Estimated by multiplying the total 1-hr HCs concentration by the ratio of the emission factor for that pollutant to the emission factor of the total hydrocarbons.

(2) Short-term (1-hr) guideline concentrations (SGC) established by NYSDEC.

(3) Estimated by dividing the maximum 1-hr concentrations of each pollutant by the SGC value of that pollutant and summing up the resulting values to obtain hazard index for all of the pollutants combined.

(4) Estimated by multiplying the total annual HCs concentration by ratio of the emission factor for that pollutant to the emission factor of the total hydrocarbons.

(5) Long-term (annual) guideline concentrations (AGC) established by NYSDEC.

(6) Estimated by dividing the maximum annual concentration of each of the individual pollutants by the AGC value of that pollutant and summing up the resulting values to obtain hazard index for all of the pollutants combined.

(7) Unit risk factors established by USEPA and other governmental agencies for the inhalation of carcinogenic air pollutants.

(8) The maximum cancer risk of each of the individual pollutants was estimated by multiplying the estimated annual concentration of each pollutant by its unit risk factor.

(9) The total incremental cancer risk from all of the pollutants combined was estimated by summing the maximum cancer risk of each of the individual pollutants.

(10) Some of the pollutants included in the group of non-carcinogenic pollutants, such as anthracene, benzo(a)anthracene and chrysene, may also have carcinogenic effects. As these pollutants do not have established unit risk factors, they were evaluated using the hazard index approach for non-carcinogens.

(11) Hazard index and cancer risk thresholds based on NYSDEC "Guidelines for the Control of Toxic Ambient Air Contaminants" dated November 12, 1997. Estimated values below these threshold limits are considered to be insignificant impacts.

Table A.4-15
Highest Estimated Concentrations of the Criteria Pollutants from On-site Emissions
DSNY-managed Waste Plus Commercial Waste
Southwest Brooklyn Converted MTS

Pollutant	Averaging Time Period	Maximum Impacts from On-site Emission Sources [(1)]	Background Pollutant Concentrations [(2)]	Highest Estimated On-site Pollutant Concentrations	NAAQS[(3)]	STV[(4)]
Carbon Monoxide (CO), $\mu g/m^3$	1-hour[(6)]	1,391	3,781	5,172	40,000	NA
	8-hour[(6)]	419	2,635	3,054	10,000	NA
Nitrogen Dioxide (NO_2), $\mu g/m^3$	Annual	4	56	60	100	NA
Particulate Matter (PM_{10}), $\mu g/m^3$	24-hour[(7)]	22	91	113	150	NA
	Annual	4	27	31	50	NA
Particulate Matter ($PM_{2.5}$), $\mu g/m^3$	24-hour	2	-	-	NA	5
	Annual Neighborhood Average	0.028[(5)]	-	-	NA	0.1
Sulfur Dioxide (SO_2), $\mu g/m^3$	3-hour[(6)]	47	152	199	1,300	NA
	24-hour[(6)]	8	94	102	365	NA
	Annual	0.7	24	25	80	NA

Notes:
(1) The highest estimated pollutant concentrations found at any of the off-site receptor locations.
(2) Background concentrations were obtained from the NYCDEP on April 18, 2003.
(3) NAAQS = National Ambient Air Quality Standards.
(4) Screening Threshold Value (STV) established by the NYCDEP and NYSDEC.
(5) Average $PM_{2.5}$ concentration over 1 km x 1 km "neighborhood-scale" receptor grid.
(6) The standards for these averaging periods allow one exceedance per year, so the use of the overall maximum concentration in this provides a very conservative comparison with standards.
(7) The 24-hour PM_{10} NAAQS is based on a 99^{th} percentile concentration, which means that the high, 4^{th} high concentration is appropriate for comparison with the standard. Therefore, the use of the overall highest concentration in this comparison is quite conservative.
NA = Not Applicable.

Table A.4-16
Highest Estimated Non-Cancer Hazard Index and Cancer Risk of Toxic Air Pollutant from On-site Emissions
DSNY-managed Waste Plus Commercial Waste
Southwest Brooklyn Converted MTS

No.	Toxic Air Pollutants	Acute Non-Cancer Risk: Highest Estimated Short-Term (1-hr) Pollutant Conc.(1) (μg/m³)	Acute Non-Cancer Risk: Short-Term (1-hr) Guideline Conc. (SGCs) (2) (μg/m³)	Acute Non-Cancer Risk: Acute Non-Cancer Hazard Index(3)	Chronic Non-Cancer Risk: Highest Estimated Long-Term (Annual) Pollutant Conc.(4) (μg/m³)	Chronic Non-Cancer Risk: Long-Term (Annual) Guideline Conc. (AGCs) (5) (μg/m³)	Chronic Non-Cancer Risk: Chronic Non-Cancer Hazard Index (6)	Cancer Risk: Highest Estimated Long-Term (Annual) Pollutant Conc. (4) (μg/m³)	Cancer Risk: Unit Risk Factors (7) (μg/m³)	Cancer Risk: Maximum Cancer Risk (8,9)
Carcinogenic Pollutants										
1	Benzene	7.42E-01	1.30E+03	5.71E-04	4.28E-03	1.30E-01	3.29E-02	4.28E-03	8.30E-06	3.56E-08
2	Formaldehyde	9.39E-01	3.00E+01	3.13E-02	5.42E-03	6.00E-02	9.03E-02	5.42E-03	1.30E-05	7.04E-08
3	1,3 Butadiene	3.11E-02	-	-	1.80E-04	3.60E-03	4.99E-02	1.80E-04	2.80E-04	5.03E-08
4	Acetaldehyde	6.10E-01	4.50E+03	1.36E-04	3.52E-03	4.50E-01	7.83E-03	3.52E-03	2.20E-06	7.75E-09
5	Benzo(a)pyrene	1.50E-04	-	-	8.63E-07	2.00E-03	4.32E-04	8.63E-07	1.70E-03	1.47E-09
6	Propylene	2.05E+00	-	-	1.18E-02	3.00E+03	3.95E-06	1.18E-02	NA	NA
Non-Carcinogenic Pollutants (10)										
7	Acrolein	7.36E-02	1.90E-01	3.87E-01	4.25E-04	2.00E-02	2.12E-02	4.25E-04	NA	NA
8	Toluene	3.25E-01	3.70E+04	8.80E-06	1.88E-03	4.00E+02	4.69E-06	1.88E-03	NA	NA
9	Xylenes	2.27E-01	4.30E+03	5.27E-05	1.31E-03	7.00E+02	1.87E-06	1.31E-03	NA	NA
10	Anthracene	1.49E-03	-	-	8.59E-06	2.00E-02	4.29E-04	8.59E-06	NA	NA
11	Benzo(a)anthracene	1.34E-03	-	-	7.71E-06	2.00E-02	3.86E-04	7.71E-06	NA	NA
12	Chrysene	2.81E-04	-	-	1.62E-06	2.00E-02	8.10E-05	1.62E-06	NA	NA
13	Naphthalene	6.75E-02	7.90E+03	8.54E-06	3.89E-04	3.00E+00	1.30E-04	3.89E-04	NA	NA
14	Pyrene	3.80E-03	-	-	2.19E-05	2.00E-02	1.10E-03	2.19E-05	NA	NA
15	Phenanthrene	2.34E-02	-	-	1.35E-04	2.00E-02	6.75E-03	1.35E-04	NA	NA
16	Dibenz(a,h)anthracene	4.64E-04	-	-	2.68E-06	2.00E-02	1.34E-04	2.68E-06	NA	NA
		Total Estimated Acute Non-Cancer Hazard Index		**4.20E-01**	**Total Estimated Chronic Non-Cancer Hazard Index**		**2.12E-01**	**Total Estimated Combined Cancer Risk**		**1.65E-07**
		Acute Non-Cancer Hazard Index Threshold (11)		**1.0E+00**	**Chronic Non-Cancer Hazard Index Threshold (11)**		**1.0E+00**	**Cancer Risk Threshold (11)**		**1.0E-06**

Notes to Table A.4-16:

(1) Estimated by multiplying the total 1-hr HCs concentration by the ratio of the emission factor for that pollutant to the emission factor of the total hydrocarbons.

(2) Short-term (1-hr) guideline concentrations (SGC) established by NYSDEC.

(3) Estimated by dividing the maximum 1-hr concentrations of each pollutant by the SGC value of that pollutant and summing up the resulting values to obtain hazard index for all of the pollutants combined.

(4) Estimated by multiplying the total annual HCs concentration by ratio of the emission factor for that pollutant to the emission factor of the total hydrocarbons.

(5) Long-term (annual) guideline concentrations (AGC) established by NYSDEC.

(6) Estimated by dividing the maximum annual concentration of each of the individual pollutants by the AGC value of that pollutant and summing up the resulting values to obtain hazard index for all of the pollutants combined.

(7) Unit risk factors established by USEPA and other governmental agencies for the inhalation of carcinogenic air pollutants.

(8) The maximum cancer risk of each of the individual pollutants was estimated by multiplying the estimated annual concentration of each pollutant by its unit risk factor.

(9) The total incremental cancer risk from all of the pollutants combined was estimated by summing the maximum cancer risk of each of the individual pollutants.

(10) Some of the pollutants included in the group of non-carcinogenic pollutants, such as anthracene, benzo(a)anthracene and chrysene, may also have carcinogenic effects. As these pollutants do not have established unit risk factors, they were evaluated using the hazard index approach for non-carcinogens.

(11) Hazard index and cancer risk thresholds based on NYSDEC "Guidelines for the Control of Toxic Ambient Air Contaminants" dated November 12, 1997. Estimated values below these threshold limits are considered to be insignificant impacts.

Table A.4-17
Maximum Estimated Potential Pollutant Concentrations Near Selected Roadway Intersection
DSNY-managed Waste Plus Commercial Waste Hauling Vehicles
West 135th Street Converted MTS

Air Quality Receptor Site	CO	PM_{10}		24-hr $PM_{2.5}$ Impacts			Annual Neighborhood $PM_{2.5}$ Impacts		
	8-hr CO Conc.(1) ppm (NAAQS: 9 ppm)	24-hr PM_{10} Conc.(1) μg/m³ (NAAQS: 150 μg/m³)	Annual PM_{10} Conc.(1) μg/m³ (NAAQS: 50 μg/m³)	Impacts from On-Site Emission Sources(2) μg/m³ (STV: 5 μg/m³)	Impacts from Off-Site Emission Sources(3) μg/m³ (STV: 5 μg/m³)	Total Combined Impacts from On and Off-Site Emission Sources μg/m³ (STV: 5 μg/m³)	Impacts from On-Site Emission Sources(2) μg/m³ (STV: 0.1 μg/m³)	Impacts from Off-Site Emission Sources(4) μg/m³ (STV: 0.1 μg/m³)	Total Combined Impacts from On and Off-Site Emission Sources μg/m³ (STV: 0.1 μg/m³)
12th Ave. & 133rd St.									
Existing Conditions	NA (5)	77 (6)	34 (6)						
Future No-Build Conditions	NA (5)	77 (6)	34 (6)						
Future Build Conditions	NA (5)	77 (6)	34 (6)						
Future Build Incremental				0.4	0.27 (6)	0.67	0.02	0.06 (6)	0.08
Broadway & 133rd St.									
Existing Conditions	NA (5)	77 (6)	33 (6)						
Future No-Build Conditions	NA (5)	77 (6)	33 (6)						
Future Build Conditions	NA (5)	78 (6)	34 (6)						
Future Build Incremental				0.4	0.21 (6)	0.61	0.02	0.06 (6)	0.04

Notes:

(1) PM_{10} concentrations are the maximum concentrations estimated using the AM, Facility AM, and PM peak traffic conditions plus background concentration (24-hr PM_{10} = 46 μg/m³; Annual PM_{10} = 21μg/m³).

(2) The maximum estimated concentrations of on-site emissions near the intersection considered.

(3) The $PM_{2.5}$ concentrations are the maximum modeled incremental $PM_{2.5}$ impacts (due to project-induced [or future build] traffic only) estimated by taking the difference between the maximum $PM_{2.5}$ concentrations for the Future No-Build and Future Build scenarios at any receptor 3 meters from the edge of the roadways using AM, midday or PM peak traffic conditions .

(4) The $PM_{2.5}$ concentrations are the maximum modeled incremental $PM_{2.5}$ impacts (due to project-induced [or future build] traffic only) estimated by taking the difference between the maximum $PM_{2.5}$ concentrations for the Future No-Build and Future Build scenarios at any receptor 15 meters from the edge of the roadways using AM, midday or PM peak traffic conditions.

(5) Incremental 1-hour vehicular trips were below CEQR CO air quality screening thresholds.

ppm = parts per million.

μg/m³ = micrograms per cubic meter.

Table A.4-18
Maximum Estimated Potential Pollutant Concentrations Near Selected Roadway Intersection
DSNY-managed Waste Plus Commercial Waste Hauling Vehicles
East 91st Street Converted MTS

Air Quality Receptor Site	CO	PM_{10}		24-hr $PM_{2.5}$ Impacts			Annual Neighborhood $PM_{2.5}$ Impacts		
	8-hr CO Conc.(1) ppm (NAAQS: 9 ppm)	24-hr PM_{10} Conc.(1) µg/m³ (NAAQS: 150 µg/m³)	Annual PM_{10} Conc.(1) µg/m³ (NAAQS: 50 µg/m³)	Impacts from On-Site Emission Sources(2) µg/m³ (STV: 5 µg/m³)	Impacts from Off-Site Emission Sources(3) µg/m³ (STV: 5 µg/m³)	Total Combined Impacts from On and Off-Site Emission Sources µg/m³ (STV: 5 µg/m³)	Impacts from On-Site Emission Sources(2) µg/m³ (STV: 0.1 µg/m³)	Impacts from Off-Site Emission Sources(4) µg/m³ (STV: 0.1 µg/m³)	Total Combined Impacts from On and Off-Site Emission Sources µg/m³ (STV: 0.1 µg/m³)
York Ave. & 86th St.									
Existing Conditions	NA (5)	76	32 (6)						
Future No-Build Conditions	NA (5)	77	32 (6)						
Future Build Conditions	NA (5)	77	32 (6)						
Future Build Incremental				0.31	0.3 (6)	0.68	0.04	0.09 (6)	0.1
York Ave. & 91st St.									
Existing Conditions	4	86	35 (6)						
Future No-Build Conditions	4	87	35 (6)						
Future Build Conditions	4	89	36 (6)						
Future Build Incremental				0.88	1.36 (6)	2.17	0.04	0.1 (6)	0.1

Notes:
(1) PM_{10} concentrations are the maximum concentrations estimated using the AM, Facility AM, and PM peak traffic conditions plus background concentration (24-hr PM_{10} = 46 µg/m³; Annual PM_{10} = 21µg/m³).
(2) The maximum estimated concentrations of on-site emissions near the intersection considered.
(3) The $PM_{2.5}$ concentrations are the maximum modeled incremental $PM_{2.5}$ impacts (due to project-induced [or future build] traffic only) estimated by taking the difference between the maximum $PM_{2.5}$ concentrations for the Future No-Build and Future Build scenarios at any receptor 3 meters from the edge of the roadways using AM, midday or PM peak traffic conditions .
(4) The $PM_{2.5}$ concentrations are the maximum modeled incremental $PM_{2.5}$ impacts (due to project-induced [or future build] traffic only) estimated by taking the difference between the maximum $PM_{2.5}$ concentrations for the Future No-Build and Future Build scenarios at any receptor 15 meters from the edge of the roadways using AM, midday or PM peak traffic conditions.
(5) Incremental 1-hour vehicular trips were below CEQR CO air quality screening thresholds.
ppm = parts per million.
µg/m³ = micrograms per cubic meter.

Table A.4-19
Maximum Estimated Potential Pollutant Concentrations Near Selected Roadway Intersection
DSNY-managed Waste Plus Commercial Waste Hauling Vehicles
West 59th Street Converted MTS

Air Quality Receptor Site	CO	PM$_{10}$		24-hr PM$_{2.5}$ Impacts			Annual Neighborhood PM$_{2.5}$ Impacts		
	8-hr CO Conc.(1) ppm (NAAQS: 9 ppm)	24-hr PM$_{10}$ Conc.(1) μg/m^3 (NAAQS: 150 μg/m^3)	Annual PM$_{10}$ Conc.(1) μg/m^3 (NAAQS: 50 μg/m^3)	Impacts from On-Site Emission Sources(2) μg/m^3 (STV: 5 μg/m^3)	Impacts from Off-Site Emission Sources(3) μg/m^3 (STV: 5 μg/m^3)	Total Combined Impacts from On and Off-Site Emission Sources μg/m^3 (STV: 5 μg/m^3)	Impacts from On-Site Emission Sources(2) μg/m^3 (STV: 0.1 μg/m^3)	Impacts from Off-Site Emission Sources(4) μg/m^3 (STV: 0.1 μg/m^3)	Total Combined Impacts from On and Off-Site Emission Sources μg/m^3 (STV: 0.1 μg/m^3)
59th St. and 12th Avenue									
Existing Conditions	NA (5)	86	36						
Future No-Build Conditions	NA (5)	92	40						
Future Build Conditions	NA (5)	93	41						
Future Build Incremental				1.57	0.77 (6)	2.36	0.03	0.04 (6)	0.06
Route 9A & 57th									
Existing Conditions	NA (5)	105	44						
Future No-Build Conditions	NA (5)	109	44						
Future Build Conditions	NA (5)	109	44						
Future Build Incremental				0.64	0.2 (6)	0.87	0.03	0.03 (6)	0.05

Notes:

(1) PM$_{10}$ concentrations are the maximum concentrations estimated using the AM, Facility AM, and PM peak traffic conditions plus background concentration (24-hr PM$_{10}$ = 46 μg/m^3; Annual PM$_{10}$ = 21μg/m^3).

(2) The maximum estimated concentrations of on-site emissions near the intersection considered.

(3) The PM$_{2.5}$ concentrations are the maximum modeled incremental PM$_{2.5}$ impacts (due to project-induced [or future build] traffic only) estimated by taking the difference between the maximum PM$_{2.5}$ concentrations for the Future No-Build and Future Build scenarios at any receptor 3 meters from the edge of the roadways using AM, midday or PM peak traffic conditions .

(4) The PM$_{2.5}$ concentrations are the maximum modeled incremental PM$_{2.5}$ impacts (due to project-induced [or future build] traffic only) estimated by taking the difference between the maximum PM$_{2.5}$ concentrations for the Future No-Build and Future Build scenarios at any receptor 15 meters from the edge of the roadways using AM, midday or PM peak traffic conditions.

(5) Incremental 1-hour vehicular trips were below CEQR CO air quality screening thresholds.

ppm = parts per million.

μg/m^3 = micrograms per cubic meter.

Table A.4-20
Maximum Estimated Potential Pollutant Concentrations Near Selected Roadway Intersection
DSNY-managed Waste Plus Commercial Waste Hauling Vehicles
South Bronx Converted MTS

	CO	PM$_{10}$		24-hr PM$_{2.5}$ Impacts			Annual Neighborhood PM$_{2.5}$ Impacts		
Air Quality Receptor Site	8-hr CO Conc.[1] ppm (NAAQS: 9 ppm)	24-hr PM$_{10}$ Conc.[1] µg/m^3 (NAAQS: 150 µg/m^3)	Annual PM$_{10}$ Conc.[1] µg/m^3 (NAAQS: 50 µg/m^3)	Impacts from On-Site Emission Sources[2] µg/m^3 (STV: 5 µg/m^3)	Impacts from Off-Site Emission Sources[3] µg/m^3 (STV: 5 µg/m^3)	Total Combined Impacts from On and Off-Site Emission Sources µg/m^3 (STV: 5 µg/m^3)	Impacts from On-Site Emission Sources[2] µg/m^3 (STV: 0.1 µg/m^3)	Impacts from Off-Site Emission Sources[4] µg/m^3 (STV: 0.1 µg/m^3)	Total Combined Impacts from On and Off-Site Emission Sources µg/m^3 (STV: 0.1 µg/m^3)
Bruckner & Leggett									
Existing Conditions	6	121	42						
Future No-Build Conditions	5	117	41						
Future Build Conditions	5	118	41						
Future Build Incremental				0.02	0.31	0.33	0.0003	0.09	0.09
Bruckner & Longwood									
Existing Conditions	NA [5]	132	42						
Future No-Build Conditions	NA [5]	129	41						
Future Build Conditions	NA [5]	129	43						
Future Build Incremental				0.02	0.36	0.39	0.0004	0.08	0.08
Tiffany & Randall									
Existing Conditions	3	93	32						
Future No-Build Conditions	3	88	34						
Future Build Conditions	3	99	34						
Future Build Incremental				0.03	0.28	0.31	0.0006	0.06	0.06

Table A.4-20 (Continued)
Maximum Estimated Potential Pollutant Concentrations Near Selected Roadway Intersection
DSNY-managed Waste Plus Commercial Waste Hauling Vehicles
South Bronx Converted MTS

	CO	PM_{10}		24-hr $PM_{2.5}$ Impacts			Annual Neighborhood $PM_{2.5}$ Impacts		
Air Quality Receptor Site	8-hr CO Conc.(1) ppm (NAAQS: 9 ppm)	24-hr PM_{10} Conc.(1) $\mu g/m^3$ (NAAQS: 150 $\mu g/m^3$)	Annual PM_{10} Conc.(1) $\mu g/m^3$ (NAAQS: 50 $\mu g/m^3$)	Impacts from On-Site Emission Sources(2) $\mu g/m^3$ (STV: 5 $\mu g/m^3$)	Impacts from Off-Site Emission Sources(3) $\mu g/m^3$ (STV: 5 $\mu g/m^3$)	Total Combined Impacts from On and Off-Site Emission Sources $\mu g/m^3$ (STV: 5 $\mu g/m^3$)	Impacts from On-Site Emission Sources(2) $\mu g/m^3$ (STV: 0.1 $\mu g/m^3$)	Impacts from Off-Site Emission Sources(4) $\mu g/m^3$ (STV: 0.1 $\mu g/m^3$)	Total Combined Impacts from On and Off-Site Emission Sources $\mu g/m^3$ (STV: 0.1 $\mu g/m^3$)
Halleck & Ryawa									
Existing Conditions	NA (5)	84	28						
Future No-Build Conditions	NA (5)	95	32						
Future Build Conditions	NA (5)	98	33						
Future Build Incremental				0.10	0.54	0.65	0.03	0.07	0.09
Halleck & East Bay/Hunts Point									
Existing Conditions	4	111	44						
Future No-Build Conditions	4	110	43						
Future Build Conditions	4	113	44						
Future Build Incremental				0.07	0.34	0.45	0.002	0.05	0.05

Notes:

(1) PM_{10} concentrations are the maximum concentrations estimated using the AM, Facility AM, and PM peak traffic conditions plus background concentration (24-hr PM_{10} = 46 $\mu g/m^3$; Annual PM_{10} = 21$\mu g/m^3$).

(2) The maximum estimated concentrations of on-site emissions near the intersection considered.

(3) The $PM_{2.5}$ concentrations are the maximum modeled incremental $PM_{2.5}$ impacts (due to project-induced [or future build] traffic only) estimated by taking the difference between the maximum $PM_{2.5}$ concentrations for the Future No-Build and Future Build scenarios at any receptor 3 meters from the edge of the roadways using AM, midday or PM peak traffic conditions .

(4) The $PM_{2.5}$ concentrations are the maximum modeled incremental $PM_{2.5}$ impacts (due to project-induced [or future build] traffic only) estimated by taking the difference between the maximum $PM_{2.5}$ concentrations for the Future No-Build and Future Build scenarios at any receptor 15 meters from the edge of the roadways using AM, midday or PM peak traffic conditions.

(5) Incremental 1-hour vehicular trips were below CEQR CO air quality screening thresholds.

ppm = parts per million.

$\mu g/m^3$ = micrograms per cubic meter.

Table A.4-21
Maximum Estimated Potential Pollutant Concentrations Near Selected Roadway Intersection
DSNY-managed Waste Plus Commercial Waste Hauling Vehicles
North Shore Converted MTS

	CO	PM_{10}		24-hr $PM_{2.5}$ Impacts			Annual Neighborhood $PM_{2.5}$ Impacts		
Air Quality Receptor Site	8-hr CO Conc.(1) ppm (NAAQS: 9 ppm)	24-hr PM_{10} Conc.(1) $\mu g/m^3$ (NAAQS: 150 $\mu g/m^3$)	Annual PM_{10} Conc.(1) $\mu g/m^3$ (NAAQS: 50 $\mu g/m^3$)	Impacts from On-Site Emission Sources(2) $\mu g/m^3$ (STV: 5 $\mu g/m^3$)	Impacts from Off-Site Emission Sources(3) $\mu g/m^3$ (STV: 5 $\mu g/m^3$)	Total Combined Impacts from On and Off-Site Emission Sources $\mu g/m^3$ (STV: 5 $\mu g/m^3$)	Impacts from On-Site Emission Sources(2) $\mu g/m^3$ (STV: 0.1 $\mu g/m^3$)	Impacts from Off-Site Emission Sources(4) $\mu g/m^3$ (STV: 0.1 $\mu g/m^3$)	Total Combined Impacts from On and Off-Site Emission Sources $\mu g/m^3$ (STV: 0.1 $\mu g/m^3$)
College Point Blvd. & 31st Ave.									
Existing Conditions	4.4	87	35						
Future No-Build Conditions	4.8	88	35						
Future Build Conditions	4.3	91	36						
Future Build Incremental				0.12	0.41 (5)	0.71	0.01	0.1 (5)	0.1
College Point Blvd. & Booth Memorial Ave.									
Existing Conditions	5.1	100	41						
Future No-Build Conditions	4.5	102	42						
Future Build Conditions	4.9	102	42						
Future Build Incremental				0.02	0.30	0.35	0.002	0.1	0.1
College Point Blvd., 32nd Ave. & WSE Service Rd.									
Existing Conditions	5.0	96	39						
Future No-Build Conditions	4.9	97	39						
Future Build Conditions	4.9	98	40						
Future Build Incremental				0.06	0.38	0.56	0.01	0.1	0.1

Notes for Table A.4-21:

(1) PM_{10} concentrations are the maximum concentrations estimated using the AM, Facility AM, and PM peak traffic conditions plus background concentration (24-hr PM_{10} = 46 $\mu g/m^3$; Annual PM_{10} = 21 $\mu g/m^3$).

(2) The maximum estimated concentrations of on-site emissions near the intersection considered.

(3) The $PM_{2.5}$ concentrations are the maximum modeled incremental $PM_{2.5}$ impacts (due to project-induced [or future build] traffic only) estimated by taking the difference between the maximum $PM_{2.5}$ concentrations for the Future No-Build and Future Build scenarios at any receptor 3 meters from the edge of the roadways using AM, midday or PM peak traffic conditions .

(4) The $PM_{2.5}$ concentrations are the maximum modeled incremental $PM_{2.5}$ impacts (due to project-induced [or future build] traffic only) estimated by taking the difference between the maximum $PM_{2.5}$ concentrations for the Future No-Build and Future Build scenarios at any receptor 15 meters from the edge of the roadways using AM, midday or PM peak traffic conditions.

(5) Incremental 1-hour vehicular trips were below CEQR CO air quality screening thresholds.

ppm = parts per million.

$\mu g/m^3$ = micrograms per cubic meter.

Table A.4-22
Maximum Estimated Potential Pollutant Concentrations Near Selected Roadway Intersection
DSNY-managed Waste Plus Commercial Waste Hauling Vehicles
Greenpoint Converted MTS

	CO	PM_{10}		24-hr $PM_{2.5}$ Impacts			Annual Neighborhood $PM_{2.5}$ Impacts		
Air Quality Receptor Site	8-hr CO Conc.(1) ppm (NAAQS: 9 ppm)	24-hr PM_{10} Conc.(1) $\mu g/m^3$ (NAAQS: 150 $\mu g/m^3$)	Annual PM_{10} Conc.(1) $\mu g/m^3$ (NAAQS: 50 $\mu g/m^3$)	Impacts from On-Site Emission Sources(2) $\mu g/m^3$ (STV: 5 $\mu g/m^3$)	Impacts from Off-Site Emission Sources(3) $\mu g/m^3$ (STV: 5 $\mu g/m^3$)	Total Combined Impacts from On and Off-Site Emission Sources $\mu g/m^3$ (STV: 5 $\mu g/m^3$)	Impacts from On-Site Emission Sources(2) $\mu g/m^3$ (STV: 0.1 $\mu g/m^3$)	Impacts from Off-Site Emission Sources(4) $\mu g/m^3$ (STV: 0.1 $\mu g/m^3$)	Total Combined Impacts from On and Off-Site Emission Sources $\mu g/m^3$ (STV: 0.1 $\mu g/m^3$)
Kingsland Ave., Greenpoint Ave. & Norman Ave.									
Existing Conditions	5.2	104	43						
Future No-Build Conditions	4.8	105	43						
Future Build Conditions	4.9	105	43						
Future Build Incremental				0.061	0.7	0.76	0.02	0.1	0.1
Greenpoint Ave., Review Ave. & VanDam St.									
Existing Conditions	NA (5)	118	49						
Future No-Build Conditions	NA (5)	102	40						
Future Build Conditions	NA (5)	103	40						
Future Build Incremental				0.037	0.3	0.34	0.01	0.1	0.1
Greenpoint Ave., McGuiness Blvd. & Provost									
Existing Conditions	NA (5)	104	40						
Future No-Build Conditions	NA (5)	105	40						
Future Build Conditions	NA (5)	106	41						
Future Build Incremental				0.037	0.5	0.54	0.006	0.1	0.1

Notes for Table A.4-22:

(1) PM_{10} concentrations are the maximum concentrations estimated using the AM, Facility AM, and PM peak traffic conditions plus background concentration (24-hr PM_{10} = 46 μg/m³; Annual PM_{10} = 21μg/m³).

(2) The maximum estimated concentrations of on-site emissions near the intersection considered.

(3) The $PM_{2.5}$ concentrations are the maximum modeled incremental $PM_{2.5}$ impacts (due to project-induced [or future build] traffic only) estimated by taking the difference between the maximum $PM_{2.5}$ concentrations for the Future No-Build and Future Build scenarios at any receptor 3 meters from the edge of the roadways using AM, midday or PM peak traffic conditions .

(4) The $PM_{2.5}$ concentrations are the maximum modeled incremental $PM_{2.5}$ impacts (due to project-induced [or future build] traffic only) estimated by taking the difference between the maximum $PM_{2.5}$ concentrations for the Future No-Build and Future Build scenarios at any receptor 15 meters from the edge of the roadways using AM, midday or PM peak traffic conditions.

(5) Incremental 1-hour vehicular trips were below CEQR CO air quality screening thresholds.

ppm = parts per million.

μg/m³ = micrograms per cubic meter.

Table A.4-23
Maximum Estimated Potential Pollutant Concentrations Near Selected Roadway Intersection
DSNY-managed Waste Plus Commercial Waste Hauling Vehicles
Hamilton Avenue Converted MTS

Air Quality Receptor Site	CO	PM_{10}		24-hr $PM_{2.5}$ Impacts			Annual Neighborhood $PM_{2.5}$ Impacts		
	8-hr CO Conc.(1) ppm (NAAQS: 9 ppm)	24-hr PM_{10} Conc.(1) $\mu g/m^3$ (NAAQS: 150 $\mu g/m^3$)	Annual PM_{10} Conc.(1) $\mu g/m^3$ (NAAQS: 50 $\mu g/m^3$)	Impacts from On-Site Emission Sources(2) $\mu g/m^3$ (STV: 5 $\mu g/m^3$)	Impacts from Off-Site Emission Sources(3) $\mu g/m^3$ (STV: 5 $\mu g/m^3$)	Total Combined Impacts from On and Off-Site Emission Sources $\mu g/m^3$ (STV: 5 $\mu g/m^3$)	Impacts from On-Site Emission Sources(2) $\mu g/m^3$ (STV: 0.1 $\mu g/m^3$)	Impacts from Off-Site Emission Sources(4) $\mu g/m^3$ (STV: 0.1 $\mu g/m^3$)	Total Combined Impacts from On and Off-Site Emission Sources $\mu g/m^3$ (STV: 0.1 $\mu g/m^3$)
20th St., 3rd Ave. & 4th Ave.									
Existing Conditions	NA (5)	128 (6)	37 (6)						
Future No-Build Conditions	NA (5)	127 (6)	38 (6)						
Future Build Conditions	NA (5)	131 (6)	38 (6)						
Future Build Incremental				0.075	0.5	0.58	0.006	0.10	0.1
Hamilton Ave., Hamilton Pl. & 14th St.									
Existing Conditions	NA (5)	137 (6)	43 (6)						
Future No-Build Conditions	NA (5)	141 (6)	45 (6)						
Future Build Conditions	NA (5)	142 (6)	45 (6)						
Future Build Incremental				0.46	0.3	0.76	0.03	0.05	0.08

Notes:

(1) PM_{10} concentrations are the maximum concentrations estimated using the AM, Facility AM, and PM peak traffic conditions plus background concentration (24-hr PM_{10} = 46 $\mu g/m^3$; Annual PM_{10} = 21$\mu g/m^3$).

(2) The maximum estimated concentrations of on-site emissions near the intersection considered.

(3) The $PM_{2.5}$ concentrations are the maximum modeled incremental $PM_{2.5}$ impacts (due to project-induced [or future build] traffic only) estimated by taking the difference between the maximum $PM_{2.5}$ concentrations for the Future No-Build and Future Build scenarios at any receptor 3 meters from the edge of the roadways using AM, midday or PM peak traffic conditions .

(4) The $PM_{2.5}$ concentrations are the maximum modeled incremental $PM_{2.5}$ impacts (due to project-induced [or future build] traffic only) estimated by taking the difference between the maximum $PM_{2.5}$ concentrations for the Future No-Build and Future Build scenarios at any receptor 15 meters from the edge of the roadways using AM, midday or PM peak traffic conditions.

(5) Incremental 1-hour vehicular trips were below CEQR CO air quality screening thresholds.

ppm = parts per million.

$\mu g/m^3$ = micrograms per cubic meter.

Table A.4-24
Maximum Estimated Potential Pollutant Concentrations Near Selected Roadway Intersection
DSNY-managed Waste Plus Commercial Waste Hauling Vehicles
Southwest Brooklyn Converted MTS

	CO	PM_{10}		24-hr $PM_{2.5}$ Impacts			Annual Neighborhood $PM_{2.5}$ Impacts		
Air Quality Receptor Site	8-hr CO Conc.(1) ppm (NAAQS: 9 ppm)	24-hr PM_{10} Conc.(1) $\mu g/m^3$ (NAAQS: 150 $\mu g/m^3$)	Annual PM_{10} Conc.(1) $\mu g/m^3$ (NAAQS: 50 $\mu g/m^3$)	Impacts from On-Site Emission Sources(2) $\mu g/m^3$ (STV: 5 $\mu g/m^3$)	Impacts from Off-Site Emission Sources(3) $\mu g/m^3$ (STV: 5 $\mu g/m^3$)	Total Combined Impacts from On and Off-Site Emission Sources $\mu g/m^3$ (STV: 5 $\mu g/m^3$)	Impacts from On-Site Emission Sources(2) $\mu g/m^3$ (STV: 0.1 $\mu g/m^3$)	Impacts from Off-Site Emission Sources(4) $\mu g/m^3$ (STV: 0.1 $\mu g/m^3$)	Total Combined Impacts from On and Off-Site Emission Sources $\mu g/m^3$ (STV: 0.1 $\mu g/m^3$)
26th Ave., Cropsey Ave & Shore Parkway									
Existing Conditions	NA (5)	137	47						
Future No-Build Conditions	NA (5)	136	46						
Future Build Conditions	NA (5)	136	46						
Future Build Incremental				0.25	0.4	0.65	0.03	0.06	0.09
Bay Parkway, Cropsey Ave. & Shore Parkway									
Existing Conditions	NA (5)	147 (3)	54 (3)						
Future No-Build Conditions	NA (5)	149 (3)	55 (3)						
Future Build Conditions	NA (5)	150 (3)	55 (3)						
Future Build Incremental				0.10	0.3	0.40	0.006	0.1	0.1

Notes:
(1) PM_{10} concentrations are the maximum concentrations estimated using the AM, Facility AM, and PM peak traffic conditions plus background concentration (24-hr PM_{10} = 46 $\mu g/m^3$; Annual PM_{10} = 21$\mu g/m^3$).
(2) The maximum estimated concentrations of on-site emissions near the intersection considered.
(3) The $PM_{2.5}$ concentrations are the maximum modeled incremental $PM_{2.5}$ impacts (due to project-induced [or future build] traffic only) estimated by taking the difference between the maximum $PM_{2.5}$ concentrations for the Future No-Build and Future Build scenarios at any receptor 3 meters from the edge of the roadways using AM, midday or PM peak traffic conditions .
(4) The $PM_{2.5}$ concentrations are the maximum modeled incremental $PM_{2.5}$ impacts (due to project-induced [or future build] traffic only) estimated by taking the difference between the maximum $PM_{2.5}$ concentrations for the Future No-Build and Future Build scenarios at any receptor 15 meters from the edge of the roadways using AM, midday or PM peak traffic conditions.
(5) Incremental 1-hour vehicular trips were below CEQR CO air quality screening thresholds.
ppm = parts per million.
$\mu g/m^3$ = micrograms per cubic meter.

ATTACHMENT 5

COMMERCIAL WASTE TRUCKS ALLOWED BASED ON SECOND-LEVEL NOISE SCREENING

Summary of Commercial Waste Trucks Allowed for the 8:00 p.m. to 8:00 a.m. Period Based on Second-Level Noise Screening and the DSNY-managed Waste Reserved Capacity

Routes Screened [1]	Commercial Waste Trucks Based on Second-Level Noise Screening		Range of Commercial Waste Trucks Allowed during 8:00 p.m. to 8:00 a.m. Period Based on DSNY Managed Waste Reserved Capacity at MTS
	Hours Where Commercial Waste Trucks are Allowed	Range of Commercial Waste Trucks Allowed during these Hours	
135th Street Converted MTS			
From the north			
Route 1N A To MTS: Broadway to West 133rd St to Riverside Drive (12th Ave) to West 135th St From MTS: Reverse	8 p.m. - 12 a.m., 6 a.m. - 8 a.m. [2]	2-7	3 - 18
Route 1N B To MTS: Broadway to West 132m St to Riverside Drive (12th Ave) to West 135th St From MTS: Reverse	8 p.m. - 12 a.m., 6 a.m. - 8 a.m. [2]	1-5	3 - 18
Route 2N To MTS: Amsterdam Ave to West 125th St to Riverside Drive (12th Ave) to West 135th St From MTS: Reverse	8 p.m. – 1 a.m., 4 a.m. – 8 a.m. [2]	2-16	3 - 20
From the south			
Route 1S A To MTS: Broadway to West 133rd St to Riverside Drive (12th Ave) to West 135th St From MTS: Reverse	8 p.m. - 12 a.m., 6 a.m. - 8 a.m. [2]	3-7	3 - 18
Route 1S B To MTS: Broadway to West 132nd St to Riverside Drive (12th Ave) to West 135th St From MTS: Reverse	8 p.m. - 12 a.m., 6 a.m. - 8 a.m. [2]	1-5	3 - 18
Route 2S To MTS: Amsterdam Ave to West 125th St to Riverside Drive (12th Ave) to West 135th St From MTS: Reverse	8 p.m. – 1 a.m., 4 a.m. – 8 a.m. [2]	2-16	3 - 20
From the east			
Route 1E To MTS: 3rd Ave to East 125th St (turns into West 125th St) to Riverside Drive (12th Ave) to West 135th St From MTS: Reverse	8 p.m. – 1 a.m., 4 a.m. – 8 a.m. [2]	2-16	3 - 20
91st Street Converted MTS			
From the north			
Route 1N A To MTS: 2nd Ave to East 90th St to York Ave to East 91st St From MTS: East 91st St to York Ave to East 91st St to (1st Ave OR 3rd Ave)	8 p.m. - 2 a.m., 5 a.m. - 8 a.m. [2]	1-2	1-2
Route 1N B To MTS: 2nd Ave to East 88th St to York Ave to East 91st St From MTS: East 91st St to York Ave to East 89th to (1st Ave OR 3rd Ave)	8 p.m. - 2 a.m., 6 a.m. - 7 a.m. [2]	1-2	1-2
Route 1N C To MTS: 2nd Ave East 86th St to York Ave to East 91st St From MTS: East 91st St to York Ave to East 87th St to (1st Ave OR 3rd Ave)	8 p.m. – 11 p.m., 6 a.m. - 7 a.m. [2]	1-2	1-2
From the south			
Route 1S A To MTS: 1st Ave to East 90th St to York Ave to East 91st St From MTS: East 91st St to York Ave to East 86th St to 2nd Ave	8 p.m. - 2 a.m., 4 a.m. - 7 a.m. [2]	3-4	9-20

Summary of Commercial Waste Trucks Allowed for the 8:00 p.m. to 8:00 a.m. Period Based on Second-Level Noise Screening and the DSNY-managed Waste Reserved Capacity (Continued)

Routes Screened (1)	Commercial Waste Trucks Based on Second-Level Noise Screening		Range of Commercial Waste Trucks Allowed during 8:00 p.m. to 8:00 a.m. Period Based on DSNY Managed Waste Reserved Capacity at MTS
	Hours Where Commercial Waste Trucks are Allowed	Range of Commercial Waste Trucks Allowed during these Hours	
Route 1S B To MTS: 1st Ave to East 88th St to York Ave to East 91st St From MTS: East 91st St to York Ave to East 86th St to 2nd Ave	8 p.m. - 2 a.m., 5 a.m. - 7 a.m. (2)	1-6	9-20
Route 2S To MTS: 3rd Ave to East 86th St to York Ave to East 91st St From MTS: East 91st St to York Ave to East 86th St to 2nd Ave	8 p.m. - 2 a.m., 5 a.m. - 7 a.m. (2)	1 - 12	9-20
59th Street Converted MTS(2)			
From the north			
Route 1N To MTS: Columbus Ave to West 59th St From MTS: West 59th St to Amsterdam Ave	8 p.m. - 3 a.m., 4 a.m. - 8 a.m. (2)	0-1	0-1
From the south			
Route 1S To MTS: 12th Ave (Joe DiMaggio Hwy) to 12th Ave Service Road (starts at 57th St) to West 59th St From MTS: Reverse	8 p.m. – 8 a.m.	3-9	3-9
Route 2S To MTS: 10th Ave to 57th Ave to 12th Ave Service Road to 59th St From MTS: West 59th St to 11th Ave	8 p.m. – 8 a.m.	3-9	3-9
From the east			
Route 1E To MTS: (2nd Ave or 3rd Ave) to East 57th St (turns into West 57th St) to 12th Ave Service Road to 59th St. From MTS: Reverse	8 p.m. – 8 a.m.	3-10	3-10
South Bronx Converted MTS			
Route 1 To MTS: Bruckner Blvd to Leggett Ave to Randall Ave to Halleck St to Ryawa Ave From MTS: Reverse	8 p.m. - 8 a.m.	0-7	0-7
Route 2 To MTS: Bruckner Blvd to Leggett Ave to (Barry St OR Dupont St OR Truxton St) to Oak Point Ave to Hunt's Point Ave to Halleck St to Ryawa Ave From MTS: Reverse	8 p.m. - 8 a.m.	0-7	0-7
Route 3 To MTS: Bruckner Blvd to Longwood Ave to Tiffany St to East Bay Ave to Halleck St to Ryawa Ave From MTS: Reverse	8 p.m. - 1 a.m., 2 a.m. – 8 a.m. (2)	0-7	0-7
Route 4 To MTS: Bruckner Blvd to Longwood Ave to Tiffany St to Viele Ave to Halleck St to Ryawa Ave From MTS: Reverse	8 p.m. - 1 a.m., 2 a.m. – 8 a.m. (2)	0-7	0-7
North Shore Converted MTS			
From the north			
Route 1N To MTS: 20th Ave to College Point Blvd to 31st Ave From MTS: Reverse	8 p.m. - 8 a.m.	0-1	0-1

Summary of Commercial Waste Trucks Allowed for the 8:00 p.m. to 8:00 a.m. Period Based on Second-Level Noise Screening and the DSNY-managed Waste Reserved Capacity (Continued)

Routes Screened [1]	Commercial Waste Trucks Based on Second-Level Noise Screening		Range of Commercial Waste Trucks Allowed during 8:00 p.m. to 8:00 a.m. Period Based on DSNY Managed Waste Reserved Capacity at MTS
	Hours Where Commercial Waste Trucks are Allowed	Range of Commercial Waste Trucks Allowed during these Hours	
Route 1S B To MTS: 1st Ave to East 88th St to York Ave to East 91st St From MTS: East 91st St to York Ave to East 86th St to 2nd Ave	8 p.m. - 2 a.m., 5 a.m. - 7 a.m. [2]	1-6	9-20
From the south			
Route 1S To MTS: Van Wick Expressway to Whitestone Expressway to Linden Place to Whitestone Expressway Service Road (Westbound) to College Point Blvd to 31st Ave From MTS: 31st Ave to College Point Blvd to Whitestone Expressway Service Road (Eastbound) to Linden Place to Whitestone Expressway Service Road (Westbound) to Whitestone Expressway to Van Wick Expressway	8 p.m. - 8 a.m.	0 -16	0 -16
Route 2S To MTS: Van Wick Expressway to College Point Blvd to 31st Ave From MTS: Reverse	8 p.m. – 12 a.m., 6 a.m. – 8 a.m. [2]	0 – 11	0-14
From the east			
Route 1E To MTS: Northern Blvd to Linden Place to Whitestone Expressway Service Road (Eastbound) to College Point Blvd to 31st Ave From MTS: Reverse	8 p.m. – 1 a.m., 3 a.m. – 4 a.m., 5 a.m. – 8 a.m. [2]	0 – 5	0 - 5
Route 2E To MTS: Long Island Expressway to College Point Blvd to 31st Ave From MTS: Reverse	8 p.m. – 12 a.m., 6 a.m. – 8 a.m. [2]	0 – 11	0 - 14
From the west			
Route 1W To MTS: Northern Blvd to Linden Place to Whitestone Expressway Service Road (Eastbound) to College Point Blvd to 31st Ave From MTS: Reverse	8 p.m. – 1 a.m., 3 a.m. – 4 a.m., 5 a.m. – 8 a.m. [2]	0 – 2	0 - 2
Route 2W To MTS: Long Island Expressway to College Point Blvd to 31st Ave From MTS: Reverse	8 p.m. – 12 a.m., 6 a.m. – 8 a.m. [2]	0 – 11	0 - 14
Route 3W To MTS: Roosevelt Ave to College Point Blvd to 31st Ave From MTS: Reverse	8 p.m. – 1 a.m., 3 a.m. – 4 a.m., 6 a.m. – 8 a.m. [2]	0 – 2	0 - 2
Greenpoint Avenue Converted MTS			
From the north			
Route 1N To MTS: McGuiness Blvd to Greenpoint Ave to Kingsland Ave From MTS: Reverse	8 p.m. - 2 a.m., 3 a.m. - 8 a.m. [2]	0 – 8	0 – 8
Route 2N To MTS: Queens Blvd to Greenpoint Ave to Starr Ave to Van Dam St to Greenpoint Ave to Kingsland Ave From MTS: Kingsland Ave to Greenpoint Ave to Queens Blvd	8 p.m. - 8 a.m.	1 –6	0 – 7

Summary of Commercial Waste Trucks Allowed for the 8:00 p.m. to 8:00 a.m. Period Based on Second-Level Noise Screening and the DSNY-managed Waste Reserved Capacity (Continued)

Routes Screened [1]	Commercial Waste Trucks Based on Second-Level Noise Screening		Range of Commercial Waste Trucks Allowed during 8:00 p.m. to 8:00 a.m. Period Based on DSNY Managed Waste Reserved Capacity at MTS
	Hours Where Commercial Waste Trucks are Allowed	Range of Commercial Waste Trucks Allowed during these Hours	
Route 1S B To MTS: 1st Ave to East 88th St to York Ave to East 91st St From MTS: East 91st St to York Ave to East 86th St to 2nd Ave	8 p.m. - 2 a.m., 5 a.m. - 7 a.m. [2]	1-6	9-20
Route 3N To MTS: Van Dam St to Greenpoint Ave to Kingsland Ave From MTS: Reverse	8 p.m. - 8 a.m.	0 – 7	0 – 7
From the south			
Route 1S To MTS: McGuiness Blvd to Greenpoint Ave to Kingsland Ave From MTS: Reverse	8 p.m. - 2 a.m., 3 a.m. - 8 a.m. [2]	0 – 8	0 - 8
Route 2S To MTS: Brooklyn-Queens Expressway to Meeker St (eastbound) to Varick St to Bridgewater St to Norman Ave to Kingsland Ave From MTS: Kingsland Ave to Greenpoint Ave to Henry St to Norman Ave to Bridgewater St to Varick St to Meeker Ave to BQE	8 p.m. - 8 a.m.	0 – 6	0 - 9
From the east			
Route 1E To MTS: Brooklyn-Queens Expressway to Meeker St (eastbound) to Varick St to Bridgewater St to Norman Ave to Kingsland Ave From MTS: Kingsland Ave to Greenpoint Ave to McGuiness Blvd to Meeker St to BQE	8 p.m. - 2 a.m., 3 a.m. - 8 a.m. [2]	0 – 8	0 – 8
Route 2E To MTS: Long Island Expressway to Van Dam St to Greenpoint Ave to Kingsland Ave From MTS: From MTS: Kingsland Ave to Greenpoint Ave to LIE	8 p.m. - 8 a.m.	0 – 7	0 – 7
Hamilton Avenue Converted MTS			
From the north			
Route 1N To MTS: BQE to Hamilton Ave (southbound) (Exit 26) From MTS: Hamilton Ave (southbound) to 20th St to 3rd Ave to Hamilton Ave (northbound) to BQE	8 p.m. - 8 a.m.	1 – 12	1 - 12
Route 2NA To MTS: 3rd Ave to 9th Street to Hamilton Ave (southbound) From MTS: Hamilton Ave (southbound) to 20th St to 3rd Ave to Hamilton Ave (northbound) to 9th Street to 3rd Ave	8 p.m. - 8 a.m.	1 – 9	1 - 12
Route 2NB To MTS: 4th Ave to 9th Street to Hamilton Ave (southbound) From MTS: Hamilton Ave (southbound) to 20th St to 3rd Ave to Hamilton Ave (northbound) to 9th Street to 3rd Ave	8 p.m. - 8 a.m.	1 – 9	1 - 12
Route 3N To MTS: 3rd Ave to 9th Street to Hamilton Ave (northbound) to Hamilton Place to Hamilton Ave (southbound) From MTS: Hamilton Ave (southbound) to 20th St to 3rd Ave (to 9th St to 4th Ave)	8 p.m. - 8 a.m.	1 – 9	1 - 12
From the south			

Summary of Commercial Waste Trucks Allowed for the 8:00 p.m. to 8:00 a.m. Period Based on Second-Level Noise Screening and the DSNY-managed Waste Reserved Capacity (Continued)

Routes Screened [1]	Commercial Waste Trucks Based on Second-Level Noise Screening: Hours Where Commercial Waste Trucks are Allowed	Commercial Waste Trucks Based on Second-Level Noise Screening: Range of Commercial Waste Trucks Allowed during these Hours	Range of Commercial Waste Trucks Allowed during 8:00 p.m. to 8:00 a.m. Period Based on DSNY Managed Waste Reserved Capacity at MTS
Route 1S B To MTS: 1st Ave to East 88th St to York Ave to East 91st St From MTS: East 91st St to York Ave to East 86th St to 2nd Ave	8 p.m. - 2 a.m., 5 a.m. - 7 a.m. [2]	1-6	9-20
Route 1S To MTS: Gowanus Expressway to 4th Ave to Prospect to Hamilton Ave (northbound) to Hamilton Place to Hamilton Ave (southbound) From MTS: Hamilton Ave (southbound, turns into 3rd Ave) to 65th Street	8 p.m. -2 a.m., 3 a.m. – 8 a.m. [2]	0 – 3	0 – 3
Route 2S To MTS: 65th St to 3rd Ave to Hamilton Ave (northbound) to Hamilton Place to Hamilton Ave (southbound) From MTS: Hamilton Ave (southbound, turns into 3rd Ave) to 65th Street	8 p.m. - 8 a.m.	0 – 3	0 – 3
From the east			
Route 1E To MTS: 39th St WB to 4th Ave NB to Prospect Ave to Hamilton Ave (northbound) to Hamilton Place to Hamilton Ave (southbound) From MTS: Hamilton Ave (southbound, turns into 3rd Ave) to 39th St	8 p.m. - 2 a.m., 4 a.m. – 8 a.m. [2]	0-5	0-5
Route 2E To MTS: Prospect Expressway to Prospect Ave to Hamilton Ave (northbound) to Hamilton Place to Hamilton Ave (southbound) From MTS: Hamilton Ave (southbound) to 20th St to 10th Ave to Prospect Expressway	8 p.m. -2 a.m., 4 a.m. – 8 a.m. [2]	0-4	0-5
Southwest Brooklyn Converted MTS			
From the north			
Route 1N To MTS: 86th St to 18th Ave to Cropsey Ave to Bay Parkway to Shore Road (southbound) to 25th Ave From MTS: 25th Av to Shore Road (southbound) to 26th Ave to Cropsey Ave to 18th Ave to 86th St	8 p.m. - 2 a.m., 4 a.m. - 8 a.m. [2]	1 - 12	1 - 16
From the south			
Route 1S To MTS: Neptune Ave to Cropsey Ave to Bay Parkway to Shore Road (southbound) to 25th Ave From MTS: 25th Av to Shore Road (southbound) to 26th Ave to Cropsey Ave to Neptune Ave	8 p.m. - 2 a.m., 4 a.m. - 8 a.m. [2]	0-1	0-1
From the east			
Route 1E To MTS: Kings Highway to Bay Parkway to Shore Road (southbound) to 25th Ave From MTS: 25th Ave to Shore Road (southbound) to 26th Ave to Cropsey Ave to Bay Parkway to Kings Highway	8 p.m. - 2 a.m., 4 a.m. - 8 a.m. [2]	0 – 2	0 – 2

Summary of Commercial Waste Trucks Allowed for the 8:00 p.m. to 8:00 a.m. Period Based on Second-Level Noise Screening and the DSNY-managed Waste Reserved Capacity (Continued)

Routes Screened (1)	Commercial Waste Trucks Based on Second-Level Noise Screening		Range of Commercial Waste Trucks Allowed during 8:00 p.m. to 8:00 a.m. Period Based on DSNY Managed Waste Reserved Capacity at MTS
	Hours Where Commercial Waste Trucks are Allowed	Range of Commercial Waste Trucks Allowed during these Hours	
Route 1S B To MTS: 1st Ave to East 88th St to York Ave to East 91st St From MTS: East 91st St to York Ave to East 86th St to 2nd Ave	8 p.m. - 2 a.m., 5 a.m. - 7 a.m. (2)	1-6	9-20
Route 2E To MTS: 86th St to 25th Ave to Cropsey Ave to Bay Parkway to Shore Road (southbound) to 25th Ave From MTS: 25th Ave to Shore Road (southbound) to 26th Ave to Cropsey Ave to 25th Ave to 86th St	8 p.m. - 2 a.m., 5 a.m. - 8 a.m. (2)	0 – 2	0 – 2

Notes:

(1) It is assumed that one route will be chosen for multiple routes originating from the same direction.

(2) Hours not listed cannot accept any commercial waste trucks based on second-level noise screening analysis.

West 135th Street Converted MTS
Hourly Summary of Potential Commercial Waste Hauling Vehicles for the 8:00 p.m. to 8:00 a.m. Period
Based on Second Level Noise Screening and the DSNY-managed Waste Reserved Capacity

Traffic Route Number	Traffic Route Description	Hour	Weighted Average: Potential Commercial Waste Hauling Vehicles	Weighted Average: Potentially Allowed Commercial Waste Hauling Vehicles
1-N (A)[1]	To MTS: Broadway to West 133rd St to Riverside Drive (12th Ave) to West 135th St From MTS: Reverse	8 - 9 pm	16	7
		9 - 10 pm	14	6
		10 - 11 pm	18	5
		11 pm - 12 am	9	4
		12 - 1 am	7	0
		1 - 2 am	14	0
		2 - 3 am	16	0
		3 - 4 am	8	0
		4 - 5 am	18	0
		5 - 6 am	17	0
		6 - 7 am	16	6
		7 - 8 am	3	2
1-N (B)	To MTS: Broadway to West 132nd St to Riverside Drive (12th Ave) to West 135th St From MTS: Reverse	8 - 9 pm	16	5
		9 - 10 pm	14	3
		10 - 11 pm	18	3
		11 pm - 12 am	9	2
		12 - 1 am	7	0
		1 - 2 am	14	0
		2 - 3 am	16	0
		3 - 4 am	8	0
		4 - 5 am	18	0
		5 - 6 am	17	0
		6 - 7 am	16	1
		7 - 8 am	3	3

Notes:

[1] This route is predominantly for trucks leaving the MTS. One truck per hour for the hours of 8 p.m. to 6 a.m. is assigned to deliver waste to the MTS using this route. The proposed and allowed Commercial Waste Truck numbers shown above for this route are trucks leaving the MTS.

1-S (A)[1]	To MTS: Broadway to West 133rd St to Riverside Drive (12th Ave) to West 135th St From MTS: Reverse	8 - 9 pm	16	7
		9 - 10 pm	14	6
		10 - 11 pm	18	5
		11 pm - 12 am	9	4
		12 - 1 am	7	0
		1 - 2 am	14	0
		2 - 3 am	16	0
		3 - 4 am	8	0
		4 - 5 am	18	0
		5 - 6 am	17	0
		6 - 7 am	16	6
		7 - 8 am	3	3

Notes:

[1] This route is predominantly for trucks leaving the MTS. One truck per hour for the hours of 8 p.m. to 6 a.m. is assigned to deliver waste to the MTS using this route. The proposed and allowed Commercial Waste Truck numbers shown above for this route are trucks leaving the MTS.

West 135th Street Converted MTS
Hourly Summary of Potential Commercial Waste Hauling Vehicles for the 8:00 p.m. to 8:00 a.m. Period
Based on Second Level Noise Screening and the DSNY-managed Waste Reserved Capacity

Traffic Route Number	Traffic Route Description	Hour	Weighted Average: Potential Commercial Waste Hauling Vehicles	Weighted Average: Potentially Allowed Commercial Waste Hauling Vehicles
1-S (B)	**To MTS:** Broadway to West 132nd St) to Riverside Drive (12th Ave) to West 135th St **From MTS:** Reverse	8 - 9 pm	16	5
		9 - 10 pm	14	3
		10 - 11 pm	18	3
		11 pm - 12 am	9	2
		12 - 1 am	7	0
		1 - 2 am	14	0
		2 - 3 am	16	0
		3 - 4 am	8	0
		4 - 5 am	18	0
		5 - 6 am	17	0
		6 - 7 am	16	1
		7 - 8 am	3	3
2-N & 2-S	**To MTS:** Amsterdam Ave to West 125th St to Riverside Drive (12th Ave) to West 135th St **From MTS:** Reverse	8 - 9 pm	18	15
		9 - 10 pm	16	15
		10 - 11 pm	20	12
		11 pm - 12 am	10	10
		12 - 1 am	8	8
		1 - 2 am	16	0
		2 - 3 am	18	0
		3 - 4 am	9	0
		4 - 5 am	20	2
		5 - 6 am	19	10
		6 - 7 am	18	16
		7 - 8 am	3	3
1-E	**To MTS:** 3rd Ave to East 125th St (turns into West 125th St) to Riverside Drive (12th Ave) to West 135th St **From MTS:** Reverse	8 - 9 pm	18	15
		9 - 10 pm	16	15
		10 - 11 pm	20	12
		11 pm - 12 am	10	10
		12 - 1 am	8	8
		1 - 2 am	16	0
		2 - 3 am	18	0
		3 - 4 am	9	0
		4 - 5 am	20	2
		5 - 6 am	19	10
		6 - 7 am	18	16
		7 - 8 am	3	3

East 91st Street Converted MTS
Hourly Summary of Potential Commercial Waste Hauling Vehicles Allowed for the 8:00 a.m. to 8:00 p.m. Period
Based on Second Level Noise Screening and the DSNY-managed Waste Reserved Capacity

Traffic Route Number	Traffic Route Description	Hour	Weighted Average	
			Potential Commercial Waste Hauling Vehicles	Potentially Allowed Commercial Waste Hauling Vehicles
1-N (A)	**To MTS:** 2nd Ave to East 90th St to York Ave to East 91st St **From MTS:** East 91st St to York Ave to East 91st St to 1st Ave or 3rd ave	8 - 9 pm	2	2
		9 - 10 pm	2	2
		10 - 11 pm	2	2
		11 pm - 12 am	1	1
		12 - 1 am	1	1
		1 - 2 am	2	2
		2 - 3 am	2	0
		3 - 4 am	1	0
		4 - 5 am	2	0
		5 - 6 am	2	1
		6 - 7 am	2	2
		7 - 8 am	1	0
1-N (B)	**To MTS:** 2nd Ave to East 88th St to York Ave to East 91st St **From MTS:** East 91st St to York Ave to East 89th St to 1st Ave OR 3rd Ave	8 - 9 pm	2	2
		9 - 10 pm	2	2
		10 - 11 pm	2	2
		11 pm - 12 am	1	1
		12 - 1 am	1	1
		1 - 2 am	2	1
		2 - 3 am	2	0
		3 - 4 am	1	0
		4 - 5 am	2	0
		5 - 6 am	2	0
		6 - 7 am	2	2
		7 - 8 am	1	0
1-N (C)	**To MTS:** 2nd Ave to East 86th St to York Ave to East 91st St **From MTS:** East 91st St to York Ave to East 87th St to 1st Ave OR 3rd Ave	8 - 9 pm	2	1
		9 - 10 pm	2	2
		10 - 11 pm	2	1
		11 pm - 12 am	1	0
		12 - 1 am	1	0
		1 - 2 am	2	0
		2 - 3 am	2	0
		3 - 4 am	1	0
		4 - 5 am	2	0
		5 - 6 am	2	0
		6 - 7 am	2	2
		7 - 8 am	1	0
1-SA	**To MTS:** 1st Ave to East 90th St to York Ave to East 91st St **From MTS:** East 91st St to York Ave to East 86th St to 2nd Ave	8 - 9 pm	20	4
		9 - 10 pm	20	4
		10 - 11 pm	20	4
		11 pm - 12 am	10	4
		12 - 1 am	10	4
		1 - 2 am	20	4
		2 - 3 am	20	0
		3 - 4 am	10	0
		4 - 5 am	20	4
		5 - 6 am	20	4
		6 - 7 am	20	3
		7 - 8 am	9	0

East 91st Street Converted MTS
Hourly Summary of Potential Commercial Waste Hauling Vehicles Allowed for the 8:00 a.m. to 8:00 p.m. Period
Based on Second Level Noise Screening and the DSNY-managed Waste Reserved Capacity

Traffic Route Number	Traffic Route Description	Hour	Weighted Average: Potential Commercial Waste Hauling Vehicles	Weighted Average: Potentially Allowed Commercial Waste Hauling Vehicles
1-SB	**To MTS:** 1st Ave to East 88 th St to York Ave to East 91st St **From MTS:** East 91st St to York Ave to East 86th St to 2nd Ave	8 - 9 pm	20	4
		9 - 10 pm	20	3
		10 - 11 pm	20	2
		11 pm - 12 am	10	4
		12 - 1 am	10	2
		1 - 2 am	20	1
		2 - 3 am	20	0
		3 - 4 am	10	0
		4 - 5 am	20	0
		5 - 6 am	20	1
		6 - 7 am	20	6
		7 - 8 am	9	0
2-S	**To MTS:** 3rd Ave to East 86th St to York Ave to East 91st St **From MTS:** East 91st St to York Ave to East 86th St to 2nd Ave	8 - 9 pm	20	9
		9 - 10 pm	20	8
		10 - 11 pm	20	6
		11 pm - 12 am	10	5
		12 - 1 am	10	3
		1 - 2 am	20	2
		2 - 3 am	20	0
		3 - 4 am	10	0
		4 - 5 am	20	1
		5 - 6 am	20	5
		6 - 7 am	20	12
		7 - 8 am	9	0

West 59th Street Converted MTS
Hourly Summary of Potential Commercial Waste Hauling Vehicles Allowed for the 8:00 a.m. to 8:00 p.m. Period
Based on Second Level Noise Screening and the DSNY-managed Waste Reserved Capacity

Traffic Route Number	Traffic Route Description	Hour	Weighted Average	
			Potential Commercial Waste Hauling Vehicles	Potentially Allowed Commercial Waste Hauling Vehicles
1-N	**To MTS:** Columbus Ave to West 59th St **From MTS:** West 59th St to Amsterdam Ave	8 - 9 pm	1	1
		9 - 10 pm	1	1
		10 - 11 pm	1	1
		11 pm - 12 am	1	1
		12 - 1 am	1	1
		1 - 2 am	1	1
		2 - 3 am	1	1
		3 - 4 am	1	0
		4 - 5 am	1	1
		5 - 6 am	1	1
		6 - 7 am	1	1
		7 - 8 am	0	0
1-S	**To MTS:** 12th Ave (Joe DiMaggio Hwy) to 12th Ave Service Road (starts at 57th St) to West 59th St **From MTS:** Reverse	8 - 9 pm	9	9
		9 - 10 pm	9	9
		10 - 11 pm	9	9
		11 pm - 12 am	4	4
		12 - 1 am	3	3
		1 - 2 am	7	7
		2 - 3 am	7	7
		3 - 4 am	3	3
		4 - 5 am	9	9
		5 - 6 am	9	9
		6 - 7 am	8	8
		7 - 8 am	3	3
2-S	**To MTS:** 10th Ave to 57th Ave to 12th Ave Service Road to 59th St **From MTS:** West 59th St to 11th Ave	8 - 9 pm	9	9
		9 - 10 pm	9	9
		10 - 11 pm	9	9
		11 pm - 12 am	4	4
		12 - 1 am	3	3
		1 - 2 am	7	7
		2 - 3 am	7	7
		3 - 4 am	3	3
		4 - 5 am	9	9
		5 - 6 am	9	9
		6 - 7 am	8	8
		7 - 8 am	3	3
1-E	**To MTS:** (2nd Ave or 3rd Ave) to East 57th St (turns into West 57th St) to 12th Ave Service Road to 59th St. **From MTS:** Reverse	8 - 9 pm	10	10
		9 - 10 pm	10	10
		10 - 11 pm	10	10
		11 pm - 12 am	5	5
		12 - 1 am	4	4
		1 - 2 am	8	8
		2 - 3 am	8	8
		3 - 4 am	4	4
		4 - 5 am	10	10
		5 - 6 am	10	10
		6 - 7 am	9	9
		7 - 8 am	3	3

South Bronx Converted MTS
Hourly Summary of Potential Commercial Waste Hauling Vehicles Allowed for the 8:00 p.m. to 8:00 a.m. Period
Based on Second Level Noise Screening and the DSNY-managed Waste Reserved Capacity

Traffic Route Number	Traffic Route Description	Hour	Weighted Average: Potential Commercial Waste Hauling Vehicles	Weighted Average: Potentially Allowed Commercial Waste Hauling Vehicles
1	**To MTS:** Bruckner Blvd to Leggett Ave to Randall Ave to Halleck St to Ryawa Ave **From MTS:** Reverse	8 - 9 pm	6	6
		9 - 10 pm	5	5
		10 - 11 pm	7	7
		11 pm - 12 am	4	4
		12 - 1 am	4	4
		1 - 2 am	7	7
		2 - 3 am	7	7
		3 - 4 am	3	3
		4 - 5 am	7	7
		5 - 6 am	7	7
		6 - 7 am	7	7
		7 - 8 am	0	0
2	**To MTS:** Bruckner Blvd to Leggett Ave to (Barry St OR Dupont St OR Truxton St) to Oak Point Ave to Hunt's Point Ave to Halleck St to Ryawa Ave **From MTS:** Reverse	8 - 9 pm	6	6
		9 - 10 pm	5	5
		10 - 11 pm	7	7
		11 pm - 12 am	4	4
		12 - 1 am	4	4
		1 - 2 am	7	7
		2 - 3 am	7	7
		3 - 4 am	3	3
		4 - 5 am	7	7
		5 - 6 am	7	7
		6 - 7 am	7	7
		7 - 8 am	0	0
3 & 4	**Truck Route 3** **To MTS:** Bruckner Blvd to Longwood Ave to Tiffany St to East Bay Ave to Halleck St to Ryawa Ave **From MTS:** Reverse **Truck Route 4** **To MTS:** Bruckner Blvd to Longwood Ave to Tiffany St to Viele Ave to Halleck St to Ryawa Ave **From MTS:** Reverse	8 - 9 pm	6	4
		9 - 10 pm	5	5
		10 - 11 pm	7	6
		11 pm - 12 am	4	4
		12 - 1 am	4	4
		1 - 2 am	7	0
		2 - 3 am	7	4
		3 - 4 am	3	3
		4 - 5 am	7	7
		5 - 6 am	7	7
		6 - 7 am	7	7
		7 - 8 am	0	0

North Shore Converted MTS
Hourly Summary of Potential Commercial Waste Hauling Vehicles Allowed for the 8:00 p.m. to 8:00 a.m. Period
Based on Second Level Noise Screening and DSNY-managed Waste Reserved Capacity

Traffic Route Number	Traffic Route Description	Hour	Weighted Average: Potential Commercial Waste Hauling Vehicles	Weighted Average: Potentially Allowed Commercial Waste Hauling Vehicles
1-N	**To MTS:** 20th Avenue WB to College Point Blvd SB to 31st Ave WB **From MTS:** (reverse)	8 - 9 pm	1	1
		9 - 10 pm	1	1
		10 - 11 pm	1	1
		11 pm - 12 am	0	0
		12 - 1 am	0	0
		1 - 2 am	1	1
		2 - 3 am	1	1
		3 - 4 am	0	0
		4 - 5 am	1	1
		5 - 6 am	0	0
		6 - 7 am	0	0
		7 - 8 am	0	0
1-S	**To MTS:** Van Wick Expwy NB to Whitestone Expwy NB to Linden Place NB to Whitestone Expwy Service Rd WB to College Point Blvd NB to 31st Ave WB **From MTS:** 31st Ave EB to College Point Blvd SB to Whitestone Expwy Service Rd WB to Whitestone Expwy SB to Van Wick Expwy SB	8 - 9 pm	12	12
		9 - 10 pm	9	9
		10 - 11 pm	16	16
		11 pm - 12 am	7	7
		12 - 1 am	3	3
		1 - 2 am	9	9
		2 - 3 am	9	9
		3 - 4 am	1	1
		4 - 5 am	12	12
		5 - 6 am	7	7
		6 - 7 am	4	4
		7 - 8 am	0	0
2-S & 2-E & 2-W	**2-S** **To MTS:** Van Wick Expwy NB to College Point Blvd NB to 31st Ave WB **From MTS:** (reverse) **2-E** **To MTS:** LIE WB to College Point Blvd NB to 31st Ave WB **From MTS:** (reverse) **2-W** **To MTS:** LIE EB to College Point Blvd NB to 31st Ave WB **From MTS:** (reverse)	8 - 9 pm	11	11
		9 - 10 pm	8	8
		10 - 11 pm	14	8
		11 pm - 12 am	6	6
		12 - 1 am	3	0
		1 - 2 am	8	0
		2 - 3 am	8	0
		3 - 4 am	1	0
		4 - 5 am	11	0
		5 - 6 am	6	0
		6 - 7 am	3	1
		7 - 8 am	0	0
1-E	**To MTS:** Northern Blvd WB to Linden Place NB to Whitestone Expwy Service Rd WB to College Point Blvd NB to 31st Ave WB **From MTS:** (reverse)	8 - 9 pm	4	4
		9 - 10 pm	3	3
		10 - 11 pm	5	5
		11 pm - 12 am	2	2
		12 - 1 am	1	1
		1 - 2 am	3	0
		2 - 3 am	3	0
		3 - 4 am	0	0
		4 - 5 am	4	0
		5 - 6 am	2	2
		6 - 7 am	1	1
		7 - 8 am	0	0

North Shore Converted MTS
Hourly Summary of Potential Commercial Waste Hauling Vehicles Allowed for the 8:00 p.m. to 8:00 a.m. Period
Based on Second Level Noise Screening and DSNY-managed Waste Reserved Capacity

Traffic Route Number	Traffic Route Description	Hour	Weighted Average: Potential Commercial Waste Hauling Vehicles	Weighted Average: Potentially Allowed Commercial Waste Hauling Vehicles
1-W	**To MTS:** Northern Blvd EB to Linden Place NB to Whitestone Expressway Service Road WB to College Point Blvd NB to 31st Ave WB **From MTS:** (reverse)	8 - 9 pm	1	1
		9 - 10 pm	1	1
		10 - 11 pm	2	2
		11 pm - 12 am	1	1
		12 - 1 am	0	0
		1 - 2 am	1	0
		2 - 3 am	1	0
		3 - 4 am	0	0
		4 - 5 am	1	0
		5 - 6 am	1	1
		6 - 7 am	0	0
		7 - 8 am	0	0
3-W	**To MTS:** Roosevelt Ave EB to College Point Blvd NB to 31st Ave WB **From MTS:** (reverse)	8 - 9 pm	1	1
		9 - 10 pm	1	1
		10 - 11 pm	2	2
		11 pm - 12 am	1	1
		12 - 1 am	0	0
		1 - 2 am	1	0
		2 - 3 am	1	0
		3 - 4 am	0	0
		4 - 5 am	1	0
		5 - 6 am	1	0
		6 - 7 am	1	1
		7 - 8 am	0	0

Greenpoint Converted MTS
Hourly Summary of Potential Commercial Waste Hauling Vehicles Allowed for the 8:00 p.m. to 8:00 a.m. Period
Based on Second Level Noise Screening and the DSNY-managed Waste Reserved Capacity

Traffic Route Number	Traffic Route Description	Hour	Weighted Average	
			Potential Commercial Waste Hauling Vehicles	Potentially Allowed Commercial Waste Hauling Vehicles
1-N	**To MTS:** McGuinness Blvd SB to Greenpoint Ave EB to Kingsland Ave NB **From MTS:** (reverse)	8 - 9 pm	3	3
		9 - 10 pm	5	5
		10 - 11 pm	8	8
		11 pm - 12 am	5	5
		12 - 1 am	3	3
		1 - 2 am	5	4
		2 - 3 am	4	0
		3 - 4 am	0	0
		4 - 5 am	8	8
		5 - 6 am	6	6
		6 - 7 am	6	6
		7 - 8 am	0	0
2-N	**To MTS:** Queens Blvd WB to Greepoint Ave WB to Starr Ave NB to Van Dam WB to Greenpoint WB to Kingsland Ave NB **From MTS:** Kingsland Ave SB to Greenpoint Ave EB to Queens Blvd EB	8 - 9 pm	3	3
		9 - 10 pm	5	5
		10 - 11 pm	7	6
		11 pm - 12 am	5	5
		12 - 1 am	3	3
		1 - 2 am	5	2
		2 - 3 am	4	2
		3 - 4 am	0	0
		4 - 5 am	7	2
		5 - 6 am	6	6
		6 - 7 am	6	6
		7 - 8 am	0	0
3-N	**To MTS:** LIE WB to Van Dam St WB to Greenpoint Ave WB to Kingsland Ave NB **From MTS:** Kingsland Ave SB to Greenpoint Ave EB to LI	8 - 9 pm	3	3
		9 - 10 pm	5	5
		10 - 11 pm	7	6
		11 pm - 12 am	5	5
		12 - 1 am	3	3
		1 - 2 am	5	5
		2 - 3 am	4	3
		3 - 4 am	0	0
		4 - 5 am	7	7
		5 - 6 am	6	6
		6 - 7 am	6	6
		7 - 8 am	0	0
1-S	**To MTS:** McGuinness Blvd NB to Greenpoint Ave EB to Kingsland Ave NB **From MTS:** (reverse)	8 - 9 pm	3	3
		9 - 10 pm	5	5
		10 - 11 pm	8	8
		11 pm - 12 am	5	5
		12 - 1 am	3	3
		1 - 2 am	5	4
		2 - 3 am	4	0
		3 - 4 am	0	0
		4 - 5 am	8	8
		5 - 6 am	6	6
		6 - 7 am	6	6
		7 - 8 am	0	0

Greenpoint Converted MTS
Hourly Summary of Potential Commercial Waste Hauling Vehicles Allowed for the 8:00 p.m. to 8:00 a.m. Period
Based on Second Level Noise Screening and the DSNY-managed Waste Reserved Capacity

Traffic Route Number	Traffic Route Description	Hour	Weighted Average: Potential Commercial Waste Hauling Vehicles	Weighted Average: Potentially Allowed Commercial Waste Hauling Vehicles
2-S	**To MTS:** BQE EB to Meeker St EB to Varick St NB to Bridgewater St WB to Norman Ave WB to Kingsland Ave NB **From MTS:** Kingsland Ave SB to Greenpoint Ave WB to Henry St SB to Norman Ave EB to Bri	8 - 9 pm	4	3
		9 - 10 pm	6	6
		10 - 11 pm	9	6
		11 pm - 12 am	5	3
		12 - 1 am	3	3
		1 - 2 am	5	4
		2 - 3 am	5	2
		3 - 4 am	0	0
		4 - 5 am	9	8
		5 - 6 am	6	6
		6 - 7 am	6	6
		7 - 8 am	0	0
1-E	**To MTS:** BQE WB to Meeker St EB to Varick St NB to Bridgewater St WB to Norman Ave WB to Kingsland Ave NB **From MTS:** Kingsland Ave SB to Greenpoint Ave WB to McGuinness Blvd SB to Meeker St EB	8 - 9 pm	3	3
		9 - 10 pm	5	5
		10 - 11 pm	8	6
		11 pm - 12 am	5	3
		12 - 1 am	3	3
		1 - 2 am	5	4
		2 - 3 am	4	0
		3 - 4 am	0	0
		4 - 5 am	8	8
		5 - 6 am	6	6
		6 - 7 am	6	6
		7 - 8 am	0	0
2-E	**To MTS:** LIE WB to Van Dam St WB to Greenpoint Ave WB to Kingsland Ave NB **From MTS:** Kingsland Ave SB to Greenpoint Ave EB to LI	8 - 9 pm	3	3
		9 - 10 pm	5	5
		10 - 11 pm	7	6
		11 pm - 12 am	5	5
		12 - 1 am	3	3
		1 - 2 am	5	5
		2 - 3 am	4	3
		3 - 4 am	0	0
		4 - 5 am	7	7
		5 - 6 am	6	6
		6 - 7 am	6	6
		7 - 8 am	0	0

Hamilton Avenue Converted MTS
Hourly Summary of Potential Commercial Waste Hauling Vehicles Allowed for the 8:00 p.m. to 8:00 a.m. Period
Based on Second-Level Screening and the DSNY-managed Waste Reserve Capacity

Traffic Route Number	Traffic Route Description	Hour	Weighted Average	
			Potential Commercial Waste Hauling Vehicles	Potentially Allowed Commercial Waste Hauling Vehicles
1-N	**To MTS:** BQE WB to Hamilton Ave SB/Exit 26 **From MTS:** Hamilton Ave SB To 20th St EB to Hamilton Ave NB to BQE EB	8 - 9 pm	9	9
		9 - 10 pm	8	8
		10 - 11 pm	12	12
		11 pm - 12 am	5	5
		12 - 1 am	1	1
		1 - 2 am	5	5
		2 - 3 am	5	5
		3 - 4 am	1	1
		4 - 5 am	10	10
		5 - 6 am	9	9
		6 - 7 am	9	9
		7 - 8 am	2	2
2-N (A)	**To MTS:** 3rd SB to 9th St WB to Hamilton Ave SB **From MTS:** Hamilton Ave SB to 20th St EB to 3rd Ave NB	8 - 9 pm	9	9
		9 - 10 pm	8	8
		10 - 11 pm	12	7
		11 pm - 12 am	5	5
		12 - 1 am	1	1
		1 - 2 am	5	1
		2 - 3 am	5	2
		3 - 4 am	1	1
		4 - 5 am	10	4
		5 - 6 am	9	9
		6 - 7 am	9	9
		7 - 8 am	2	2
2-N (B)	**To MTS:** 4th Ave SB to 9th St WB to Hamilton Ave SB **From MTS:** Hamilton Ave SB to 20th St EB to 3rd Ave NB	8 - 9 pm	9	9
		9 - 10 pm	8	8
		10 - 11 pm	12	7
		11 pm - 12 am	5	5
		12 - 1 am	1	1
		1 - 2 am	5	1
		2 - 3 am	5	2
		3 - 4 am	1	1
		4 - 5 am	10	4
		5 - 6 am	9	9
		6 - 7 am	9	9
		7 - 8 am	2	2
3-N	**To MTS:** 3rd Ave SB to 9th St WB to Hamilton Ave SB **From MTS:** Hamilton Ave SB to 20th St EB to 3rd Ave NB to 9th St to 4th Ave	8 - 9 pm	9	9
		9 - 10 pm	8	8
		10 - 11 pm	12	7
		11 pm - 12 am	5	5
		12 - 1 am	1	1
		1 - 2 am	5	1
		2 - 3 am	5	2
		3 - 4 am	1	1
		4 - 5 am	10	4
		5 - 6 am	9	9
		6 - 7 am	9	9
		7 - 8 am	2	2

Hamilton Avenue Converted MTS
Hourly Summary of Potential Commercial Waste Hauling Vehicles Allowed for the 8:00 p.m. to 8:00 a.m. Period
Based on Second-Level Screening and the DSNY-managed Waste Reserve Capacity

Traffic Route Number	Traffic Route Description	Hour	Weighted Average: Potential Commercial Waste Hauling Vehicles	Weighted Average: Potentially Allowed Commercial Waste Hauling Vehicles
1-S	**To MTS:** Gowanus Expwy NB to 4th Avenue NB to Prospect Avenue WB to Hamilton Ave NB to Hamilton Place WB to Hamilton Ave SB **From MTS:** Hamilton Ave (southbound, turns into 3rd Ave) to 65th St	8 - 9 pm	3	3
		9 - 10 pm	2	2
		10 - 11 pm	3	3
		11 pm - 12 am	1	1
		12 - 1 am	0	0
		1 - 2 am	1	1
		2 - 3 am	1	0
		3 - 4 am	0	0
		4 - 5 am	3	1
		5 - 6 am	3	3
		6 - 7 am	2	2
		7 - 8 am	0	0
2-S	**To MTS:** 65th St WB to Hamilton Ave NB to Hamilton Place WB to Hamilton Ave SB **From MTS:** Hamilton Ave SB to 65th St EB	8 - 9 pm	3	3
		9 - 10 pm	2	2
		10 - 11 pm	3	3
		11 pm - 12 am	1	1
		12 - 1 am	0	0
		1 - 2 am	1	1
		2 - 3 am	1	1
		3 - 4 am	0	0
		4 - 5 am	3	3
		5 - 6 am	3	3
		6 - 7 am	2	2
		7 - 8 am	0	0
1-E	**To MTS:** 39th St WB to 4th Ave NB to Prospect Ave WB to Hamilton Ave NB to Hamilton Pl WB to Hamilton Ave SB **From MTS:** Hamilton Ave SB to 39th St EB	8 - 9 pm	4	4
		9 - 10 pm	3	3
		10 - 11 pm	5	5
		11 pm - 12 am	2	2
		12 - 1 am	0	0
		1 - 2 am	2	2
		2 - 3 am	2	0
		3 - 4 am	1	0
		4 - 5 am	4	2
		5 - 6 am	4	4
		6 - 7 am	4	4
		7 - 8 am	1	1
2-E	**To MTS:** Prospect Expwy WB to Prospect Ave WB to Hamilton Ave NB to Hamilton Pl WB to Hamilton Ave SB **From MTS:** Hamilton Av SB to 20th St EB to 10th Ave NB to Prospect Expwy EB	8 - 9 pm	4	4
		9 - 10 pm	3	3
		10 - 11 pm	5	2
		11 pm - 12 am	2	2
		12 - 1 am	0	0
		1 - 2 am	2	2
		2 - 3 am	2	0
		3 - 4 am	1	0
		4 - 5 am	4	2
		5 - 6 am	4	2
		6 - 7 am	4	4
		7 - 8 am	1	1

Southwest Brooklyn Converted MTS
Hourly Summary of Potential Commercial Waste Hauling Vehicles Allowed for the 8:00 p.m. to 8:00 a.m. Period
Based on Second Level Noise Screening and the DSNY-managed Waste Reserved Capacity

Traffic Route Number	Traffic Route Description	Hour	Weighted Average: Potential Commercial Waste Hauling Vehicles	Weighted Average: Potentially Allowed Commercial Waste Hauling Vehicles
1-N	**To MTS:** 86th St SB to 18th Ave WB to Cropsey Ave SB to Bay Pkwy WB to Shore Road SB to 25th Ave WB **From MTS:** 25th Ave EB to Shore Road SB to 26th Ave EB to Cropsey Ave NB to 18th Ave EB to 86th St NB	8 - 9 pm	15	11
		9 - 10 pm	15	9
		10 - 11 pm	16	5
		11 pm - 12 am	8	4
		12 - 1 am	1	1
		1 - 2 am	10	2
		2 - 3 am	11	0
		3 - 4 am	7	0
		4 - 5 am	15	2
		5 - 6 am	15	3
		6 - 7 am	15	12
		7 - 8 am	4	4
1-S	**To MTS:** Neptune Ave WB to Cropsey Ave NB to Bay Pkwy WB to Shore Road SB to 25th Ave WB **From MTS:** 25th Ave EB to Shore Road SB to 26th Ave EB to Cropsey Ave SB to Neptune EB	8 - 9 pm	1	1
		9 - 10 pm	1	1
		10 - 11 pm	1	1
		11 pm - 12 am	1	1
		12 - 1 am	0	0
		1 - 2 am	1	1
		2 - 3 am	1	0
		3 - 4 am	1	0
		4 - 5 am	1	1
		5 - 6 am	1	1
		6 - 7 am	1	1
		7 - 8 am	0	0
1-E	**To MTS:** Kings Hwy WB to Bay Pkwy WB to Shore Road SB to 25th Ave WB **From MTS:** 25th Ave EB to Shore Road SB to 26th Ave EB to Cropsey Ave NB to Bay Pkwy EB to Kings Hwy EB	8 - 9 pm	2	2
		9 - 10 pm	2	2
		10 - 11 pm	2	2
		11 pm - 12 am	1	1
		12 - 1 am	0	0
		1 - 2 am	1	1
		2 - 3 am	2	0
		3 - 4 am	1	0
		4 - 5 am	2	2
		5 - 6 am	2	2
		6 - 7 am	2	2
		7 - 8 am	1	1
2-E	**To MTS:** 86th St NB to 25th Ave WB to Cropsey Ave NB to Bay Pkwy WB to Shore Road SB to 25th Ave WB **From MTS:** 25th Ave EB to Shore Road SB to 26th Ave EB to Cropsey Ave NB to 25th Ave EB to 86th St SB	8 - 9 pm	2	2
		9 - 10 pm	2	2
		10 - 11 pm	2	2
		11 pm - 12 am	1	1
		12 - 1 am	0	0
		1 - 2 am	1	1
		2 - 3 am	2	0
		3 - 4 am	1	0
		4 - 5 am	2	0
		5 - 6 am	2	2
		6 - 7 am	2	2
		7 - 8 am	1	1

COMMERCIAL WASTE MANAGEMENT STUDY

VOLUME IV

EVALUATION OF WASTE DISPOSAL CAPACITY POTENTIALLY AVAILABLE TO NEW YORK CITY

March 2004

Prepared for:

New York City Department of Sanitation
for submission to the New York City Council

Prepared by:

Henningson, Durham & Richardson
Architecture and Engineering, P.C.

This report was prepared by

HDR

Henningson, Durham & Richardson
Architecture and Engineering, P.C.

TABLE OF CONTENTS

ATTACHMENTS

LIST OF TABLES

List of Acronyms/Definitions

Acronyms	
C&D	construction and demolition
DSNY	New York City Department of Sanitation
LL74	Local Law 74, effective December 19, 2000, enacted by the City Council, requiring a comprehensive assessment of commercial solid waste management in New York City
MSW	municipal solid waste
PADEP	Pennsylvania Department of Environmental Protection
tpd	tons per day
WTE	waste-to-energy

Definitions	
City	New York City
Consultant	The DSNY's Consultant Team, including Henningson, Durham & Richardson Architecture and Engineering, P.C.; Parsons Brinckerhoff Quade and Douglas, Inc.; Ecodata, Inc.; Franklin Associates, Ltd.; Urbitran Associates, Inc.; HydroQual, Inc.; and Cambridge Environmental, Inc., who prepared the Commercial Waste Management Study
DSNY-managed Waste	Solid waste that DSNY collects from all residential households in the City and the institutional waste of City, state and federal agencies that DSNY collects and/or for which DSNY arranges disposal
Final Study Scope or Final Scope of Work	Commercial Waste Management Study Final Scope of Work issued on July 31, 2003
New SWMP	The new comprehensive Solid Waste Management Plan to be developed in 2004 for both DSNY-managed Waste and commercial waste for the planning period 2004 through 2024
New SWMP Planning Period	The 20-year period from 2004 to 2024 addressed by the City's New Solid Waste Management Plan
Study	Commercial Waste Management Study
Transfer Station	Privately owned and operated transfer station in New York City that accepts, transfers and transports some portion of municipal solid waste or construction and demolition (C&D) debris or fill material generated in the private sector for out-of-City disposal

EXECUTIVE SUMMARY

PREFACE

Local Law 74 of 2000 (LL74) mandated a comprehensive study of commercial waste management (Commercial Waste Management Study or Study) in New York City (City) by a Consultant funded by the City Department of Sanitation (DSNY). This Study undertaken to comply with LL74 will assist the City in managing the commercial waste stream in the most efficient and environmentally sound manner, and assist in the development of the City's Solid Waste Management Plan (New SWMP) for the New SWMP Planning Period.

As stated in the Commercial Waste Management Study Final Scope of Work, one of the Study's objectives is to "*evaluate trends in the supply and cost of waste disposal capacity that will be available to the City.*" Specifically, *"The Study will evaluate the volume of out-of-City waste disposal capacity that is economically accessible by export in transfer trailers from the City. If the Study projects a decline, the Study will also identify the means to encourage a shift in commercial waste transport operations to barge or rail modes to ensure access to more remote disposal sites."*

In addition to this Volume IV, the Study consists of five other volumes:

- Volume I: Private Transfer Station Evaluations;
- Volume II: Commercial Waste Generation and Projections;
- Volume III: Converted Marine Transfer Stations – Commercial Waste Processing and Analysis of Potential Impacts;
- Volume V: Manhattan Transfer Station Siting Study; and
- Volume VI: Waste Vehicle Technology Assessment.

This Volume IV: Evaluation of Waste Disposal Capacity Potentially Available to New York City, examines the waste disposal capacity potentially available within seven states (Georgia, New York, New Jersey, Ohio, Pennsylvania, South Carolina and Virginia) for accepting City waste, either via truck transfer or by barge or rail. Historic market price information was also gathered and reviewed.

EXECUTIVE SUMMARY

Scope of Analysis/Approach

The survey was primarily based on interviews with landfill and waste-to-energy (WTE) operators and municipal solid waste management employees. (The surveyed area includes states that can be reasonably accessed by truck transfer, ocean-going vessel transport, and rail.)

In addition to conducting the surveys, data on historic market prices in the surveyed area were reviewed. Historical market price information was gathered from *Solid Waste Digest* published reports.

An attempt was made to develop a reasonable econometric model based on the survey results. The econometric model approach was formulated and a determination was made that the data gathered was not sufficient to obtain meaningful results, primarily due to the lack of responses from the landfill operators on questions concerning long-term contract tip fees. Though the econometric model was not developed, the data was analyzed to estimate or determine:

- The excess capacity at high-capacity[1] landfills;
- Trends of historical spot market disposal price (i.e., tip fee) levels;
- Ownership of high-capacity landfills with rail access;
- Comparison of tip fees at rail-accessible and non-rail-accessible landfills; and
- Inflation-adjusted, real per ton tip fees.

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[1] High-capacity landfills are those that accepted at least 1,000 tons per day (tpd) of municipal solid waste (MSW) in 2003.

Findings

The results of this assessment are summarized below:

- In the list of high-capacity[2] disposal sites, there are a number of mega-landfills (landfills with a substantially larger capacity than 1,000 tons per day [tpd]) in states within the mid-Atlantic, Southeast and Midwest regions, exclusive of Pennsylvania and New York, that appear to have sufficient physical capacity to meet the additional demand of both DSNY-managed Waste and commercial waste generated by the City.

- Dispose of all the DSNY-managed Waste and commercial waste generated by the City over the New SWMP Planning Period. Most of the identified long-term disposal capacity is located more than 400 miles from the City and, therefore, is most likely economically accessible by rail, and to a lesser extent, by barge.

- Assuming the continuation of existing regulatory policies, landfill capacity in Pennsylvania will continue to decrease, and real tip fees should increase. (It is reasonable to assume, however, that some additional landfill capacity will be permitted to accommodate waste generated in Pennsylvania.) Data gathered during 2002 and 2003 indicate that there have been limited expansion/modification permits granted to mega-landfills in Pennsylvania, and while real (inflation-adjusted) spot market tip fee prices decreased over the six-year period of 1997 to 2003, these fees have increased in real dollars during the past two years (2002 to 2003). Part, but not all, of this increase is due to the Pennsylvania Department of Environmental Protection (PADEP)-imposed $4.00 per ton fee applied to all solid waste disposed of in Pennsylvania municipal solid waste (MSW) landfills, which went into effect in June of 2002.

- Assuming a relatively competitive marketplace, and given that there appears to be a sufficient amount of landfill capacity in the surveyed area, it is reasonable to expect that the long-term real (inflation-adjusted) contract tip fees in the surveyed area (exclusive of New York and Pennsylvania) will remain relatively stable in the near term.

- The above conclusion assumes a relatively competitive marketplace for disposal capacity. Two firms own approximately 70% of the high-capacity landfills with rail access, including 100% of the capacity in both Georgia and South Carolina, and more than 80% of the landfills meeting this criteria in Pennsylvania. The result of this effective duopoly could lead to market conditions and pricing structures that deviate from normal, competitive marketplaces.

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[2] There were 87 high-capacity landfills identified in this report. Of these 87 landfills, 30 have rail access and one has barge access.

EVALUATION OF WASTE DISPOSAL CAPACITY POTENTIALLY AVAILABLE TO NEW YORK CITY

1.0 OVERVIEW AND SUMMARY CONCLUSIONS

To better understand New York City's (City's) requirements for a commercial waste transfer infrastructure over the New SWMP Planning Period, as part of the Commercial Waste Management Study (Study), an economic study was performed to develop information on the economic market for the disposal of waste exported from the City. As part of the assessment, surveys were conducted of 282 landfill and waste-to-energy (WTE) facility operators and municipal solid waste management employees in seven states (Georgia, New York, New Jersey, Ohio, Pennsylvania, South Carolina and Virginia – collectively referred to as the "surveyed area"). In addition to these surveys, available data from state regulatory agencies and *Solid Waste Digest* published reports were analyzed. From this data, an assessment was made of the potential available disposal capacity and pricing, which included consideration of the regulatory policies, economic accessibility and market competition that may affect the pricing.

The results of this assessment are summarized below:

- In the list of high-capacity[1] disposal sites, there are a number of mega-landfills (landfills with a substantially larger capacity than 1,000 tons per day [tpd]) in states within the mid-Atlantic, Southeast and Midwest regions, exclusive of Pennsylvania and New York, that appear to have sufficient physical capacity to meet the additional demand of both DSNY-managed Waste and commercial waste generated by the City.

- Dispose of all the DSNY-managed Waste and commercial waste generated by the City over the New SWMP Planning Period. Most of the identified long-term disposal capacity is located more than 400 miles from the City and, therefore, is most likely economically accessible by rail, and to a lesser extent, by barge.

- Assuming the continuation of existing regulatory policies, landfill capacity in Pennsylvania will continue to decrease, and real tip fees should increase. (It is reasonable to assume, however, that some additional landfill capacity will be permitted to accommodate waste generated in Pennsylvania.) Data gathered during 2002 and 2003 indicate that there have been limited expansion/modification permits granted to mega-landfills in Pennsylvania, and while real (inflation-adjusted) spot

[1] There were 87 high-capacity landfills identified in this report. Of these 87 landfills, 30 have rail access and one has barge access.

market tip fee prices decreased over the six-year period of 1997 to 2003, these fees have increased in real dollars during the past two years (2002 to 2003). Part, but not all, of this increase is due to the Pennsylvania Department of Environmental Protection (PADEP)-imposed $4.00 per ton fee applied to all solid waste disposed of in Pennsylvania municipal solid waste (MSW) landfills, which went into effect in June of 2002.

- Assuming a relatively competitive marketplace, and given that there appears to be a sufficient amount of landfill capacity in the surveyed area, it is reasonable to expect that the long-term real (inflation-adjusted) contract tip fees in the surveyed area (exclusive of New York and Pennsylvania) will remain relatively stable in the near term

- The above conclusion assumes a relatively competitive marketplace for disposal capacity. Two firms own approximately 70% of the high-capacity landfills with rail access, including 100% of the capacity in both Georgia and South Carolina, and more than 80% of the landfills meeting this criteria in Pennsylvania. The result of this effective duopoly could lead to market conditions and pricing structures that deviate from normal, competitive marketplaces.

2.0 METHODOLOGY

The survey was primarily based on interviews with landfill and WTE operators and municipal solid waste management employees. (The surveyed area includes states that can be reasonably accessed by truck transfer, ocean-going vessel transport, and rail.)

In addition to conducting the surveys, data on historic market prices in the surveyed area were reviewed. Historical market price information was gathered from *Solid Waste Digest* published reports.

An attempt was made to develop a reasonable econometric model based on the survey results. The econometric model approach was formulated and a determination was made that the data gathered was not sufficient to obtain meaningful results, primarily due to the lack of responses from the landfill operators on questions concerning long-term contract tip fees. Though the econometric model was not developed, the data was analyzed to estimate or determine:

- The excess capacity at high-capacity[2] landfills;
- Trends of historical spot market disposal price (i.e., tip fee) levels;
- Ownership of high-capacity landfills with rail access;
- Comparison of tip fees at rail-accessible and non-rail-accessible landfills; and
- Inflation-adjusted, real per ton tip fees.

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[2] High-capacity landfills are those that accepted at least 1,000 tpd of municipal solid waste (MSW) in 2003.

3.0 RESULTS

3.1 Potentially Available Long-Term Disposal Capacity

The survey results were not sufficient to estimate the actual remaining excess capacity of all or most of the landfills in the surveyed area. This was due to both a lack of complete responses to the survey and responses indicating landfills with "unlimited" permitted capacity that didn't provide the physical capacity information, which would have been used to estimate excess capacity of the landfill. However, the information gathered from the sources mentioned above was combined to assess the available capacity. The results of this assessment are shown in Table 3.1-1.

Table 3.1-1
Available Landfill Capacity and Average Tip Fees

One-Way Travel Distance from New York City (miles)(1)	Number of Landfills(2)	2003 Calculated Available Excess Capacity(3) (tpd)	2003 Average Spot Market Tip Fees ($/ton)
0-150	7	N/A(4)	$57.60
150-400	5	1,750	$42.80
>400	16	44,000	$31.10
TOTAL	**28**	**45,750**	

Notes:
(1) Over-the-road distance.
(2) Of the 282 surveyed landfills, these are the only ones that met the criteria of having a significant (1,000 tpd) amount of excess capacity, or in the case of the landfills within 150 miles of the City, having 2003 average levels of intake of at least 2,500 tpd.
(3) For landfills with no daily limits on capacity, tpd excess capacity was calculated based on an assumed 20-year landfill life and subtraction of the 2003 tpd intake.
(4) Unless current regulatory policy trends change, there appears to be less than 20 years of remaining capacity within 150 miles of the City, assuming a continuation of current intake levels.

A total of 28 landfills within the surveyed area with current significant available capacity are included in the results from this survey and research effort. Sixteen of the landfills are located more than 400 miles from the City. The cost of truck transportation increases significantly once the distance that a single driver can travel (round trip) in one day without an extended off-duty break is exceeded, as required by the U.S. Department of Transportation Federal Motor Carrier Safety Administration guidelines. These guidelines limit the hours that drivers may drive without going off-duty. A truck relay is an option, but the increased operations or capital costs required for this option increases the truck transportation costs. While barging is also an export option, only one landfill surveyed (located in Virginia) is accessible by barge.

The 44,000 tpd of estimated excess capacity in landfills greater than 400 miles from the City is primarily attributable to six remote regional mega-landfills with no daily permit limits. The operators of these six landfills indicated having a minimum of 30 million tons of remaining capacity. The available daily capacity at these landfills was based on an assumed 20-year landfill life. In addition to the predominance of capacity available in the 400-mile plus range, these landfills reported significantly lower tip fees than those closer to the major centers of waste generation. As indicated in Table 3.1-1, costs tend to decrease inversely with distance from the New York metropolitan area.

3.2 Disposal Capacity in Pennsylvania

The primary results of "A Report on Pennsylvania Landfill Capacity for the New York Department of Sanitation" completed in April 2002 for the City Department of Sanitation (DSNY) are:

- *"Based on current utilization rates and assuming a favorable permit renewal policy, the existing permitted capacity in Pennsylvania that is within 250 miles of New York City would be exhausted in approximately 7.6 years and all of the state's landfill capacity would be exhausted in 11.1 years. This assumes a continuation of steady-state conditions. But data obtained from landfill operators shows a significant increase [in] utilization rates in 2001 over 2000 and the City is but one of numerous out-of-state sources that are heavily dependent on Pennsylvania's landfill capacity."*

- *"There are applications for an additional 50,000,000 tons of landfill capacity within the 250-mile radius pending before the Pennsylvania Department of Environmental Protection ([PA]DEP)[3]. Approval of all of these applications for expansions and renewals would increase the available capacity within a 250-mile radius of New York by 32%."*

[3] Based on survey information obtained by HDR from [PA]DEP and landfill operators/owners.

- *"Pennsylvania environmental officials are advocating legislation on the state and federal level that would, respectively: (i) legalize what is now a temporary moratorium on issuance of permit expansions and renewals; and (ii) increase state authority to limit and otherwise regulate imports.*[4] *In recent actions, Pennsylvania DEP has denied landfill expansion (Empire Alliance) and renewal (Tullytown) applications."*

Since the submittal of the above report, there have been several developments in the status of the permit expansions/modifications for mega-landfills in Pennsylvania, as summarized below:

- Tullytown Resource Recovery Facility – PADEP approved an expansion that will add about 2.5 years of disposal life to the landfill at its current average daily volume. Without expansion, the landfill would have reached capacity in about six months or less.
- Southern Alleghanies Landfill – PADEP approved a modification that increased the capacity of the landfill by approximately 60 acres of disposal area, but does not increase the daily tonnage of waste to be accepted.
- Conestoga Landfill – PADEP approved a modification that increased the average daily volume of waste by 2,000 tpd.
- J&J Landfill – PADEP approved an expansion that increases waste acceptance from 650 tpd on average to 1,200 tpd. Expansion of the J&J Landfill will extend the operational life of the facility by approximately 11 years.
- Dauphin Meadows Landfill – PADEP denied an expansion on the basis that the harms outweighed the benefits.
- Pottstown Landfill – the operators have dropped their plans for a vertical expansion on the western portion of the landfill.

In addition to the permit expansion and modification updates since the time of the April 2002 report, remaining capacity information in Pennsylvania was gathered, as shown in Table 3.2-1. These data shows the remaining capacity in Pennsylvania continuing to decline in 2002, albeit at a lower rate than the previous two years. It is reasonable to assume, however, that additional capacity will be permitted to dispose of waste generated in Pennsylvania.

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[4] 2001 Testimony of David Hess, Secretary of Pennsylvania DEP [PADEP] before state and federal legislative committees.

Table 3.2-1
Pennsylvania Landfill Remaining Capacity

Year	Remaining Capacity (Tons)	Year over Year % Change
1999	255,897,000	
2000	230,849,000	-10%
2001	203,945,000	-12%
2002	187,869,000	-7.9%

Both the permit expansion/modification updates and remaining capacity quantities for 2002 support the conclusions reached in the April 2002 report. While the expansion/modification permits granted to Tullytown, Southern Alleghanies, Conestoga and J&J landfills may increase the time period originally estimated for the exhaustion of landfill capacity, the data continues to support the conclusion that the landfill capacity in Pennsylvania over the New SWMP Planning Period will not be sufficient to dispose of both DSNY-managed Waste and commercial waste.

3.3 Landfill Disposal Tip Fee Pricing Structure

While only seven mega-landfill operators were willing to discuss possible long-term contract fees, the information gathered from these operators proved valuable. On average, these landfill operators indicated these long-term (defined as 20 years) contract tip fees to be approximately 50% lower than the spot market tip fees. This supports the reasonable assumption that a party that can make a long-term commitment of a large volume of waste would obtain a substantially better price than the spot market rate.

In order to make an assessment of the overall pricing structure, trends of spot market tip fees of high-capacity landfills over the six-year period between 1997-2003 were analyzed. Tip fee data was provided by *Solid Waste Digest* published reports. Only those landfills where all six years of spot market tip fee data were available were included. Table 3.3-1 shows the results of the analysis of all the landfills satisfying the above criteria.

Table 3.3-1
Trends in Average Spot Market Tip Fees by State and by Year of Selected High-Capacity Landfills

State		1997	1998	1999	2000	2001	2002	2003	Average Spot Market Tip Fee (1997-2003) in 2003$	6-yr Change (1997-2003)
Ohio	Avg Spot Mkt Price per Ton	$29.87	$29.90	$30.38	$29.62	$29.29	$29.58	$30.40		**$0.52**
	Inflation Adjusted Avg Spot Mkt Price per Ton	$34.24	$33.74	$33.55	$31.64	$30.43	$30.25	$30.40	$32.03	
	Inflation Adjusted Annual Percent Change in Tip Fees	-	-1.4%	-0.6%	-5.7%	-3.8%	-0.6%	0.5%		**-11.2%**
South Carolina	Avg Spot Mkt Price per Ton	$27.20	$27.78	$29.82	$30.97	$31.00	$31.33	$33.94		**$6.74**
	Inflation Adjusted Avg Spot Mkt Price per Ton	$31.17	$31.35	$32.94	$33.08	$32.21	$32.05	$33.94	$32.39	
	Inflation Adjusted Annual Percent Change in Tip Fees	-	0.6%	5.1%	0.4%	-2.6%	-0.5%	5.9%		**8.9%**
Georgia	Avg Spot Mkt Price per Ton	$29.94	$30.61	$32.17	$32.24	$32.73	$32.75	$33.98		**$4.03**
	Inflation Adjusted Avg Spot Mkt Price per Ton	$34.32	$34.54	$35.52	$34.45	$34.00	$33.49	$33.98	$34.33	
	Inflation Adjusted Annual Percent Change in Tip Fees	-	0.7%	2.8%	-3.0%	-1.3%	-1.5%	1.4%		**-1.0%**
Virginia	Avg Spot Mkt Price per Ton	$41.02	$39.72	$39.86	$41.01	$41.26	$42.11	$42.83		**$1.81**
	Inflation Adjusted Avg Spot Mkt Price per Ton	$47.02	$44.83	$44.02	$43.81	$42.87	$43.06	$42.83	$44.06	
	Inflation Adjusted Annual Percent Change in Tip Fees	-	-4.7%	-1.8%	-0.5%	-2.1%	0.4%	-0.5%		**-8.9%**
New York	Avg Spot Mkt Price per Ton	$45.03	$42.04	$42.51	$42.58	$42.65	$41.38	$38.50		**-$6.53**
	Inflation Adjusted Avg Spot Mkt Price per Ton	$51.60	$47.44	$46.94	$45.49	$44.31	$42.31	$38.50	$45.23	
	Inflation Adjusted Annual Percent Change in Tip Fees	-	-8.1%	-1.1%	-3.1%	-2.6%	-4.5%	-9.0%		**-25.4%**
Pennsylvania	Avg Spot Mkt Price per Ton	$48.32	$48.45	$49.32	$49.71	$49.36	$50.54	$53.11		**$4.80**
	Inflation Adjusted Avg Spot Mkt Price per Ton	$55.37	$54.67	$54.46	$53.10	$51.28	$51.69	$53.11	$53.38	
	Inflation Adjusted Annual Percent Change in Tip Fees	-	-1.3%	-0.4%	-2.5%	-3.4%	0.8%	2.8%		**-4.1%**
New Jersey[(1)]	Avg Spot Mkt Price per Ton		N/A	N/A	N/A	N/A	N/A	N/A	N/A	**N/A**

Note:
[(1)] There were no high-capacity New Jersey landfills.

Table 3.3-1 shows that the average spot market tip fees are less expensive in states that are a greater distance from the New York metropolitan area. In addition, the data on this table show that in all states except South Carolina, spot market tip fees decreased in real (inflation-adjusted) dollars from 1997 to 2003. The trends shown for tip fees in Pennsylvania support the discussion earlier in this report on the diminishing remaining capacity and the resulting increasing tip fees, as can be observed in the 2002 and 2003 real (inflation-adjusted) increases in tip fees.

3.4 Potential Effect of Ownership of Landfills on the Competition in the Disposal Marketplace

As shown in Table 3.4-1, two firms own approximately 70% of the high-capacity landfills with rail access, including 100% of the capacity in both Georgia and South Carolina, and more than 80% of the landfills meeting this criteria in Pennsylvania. The result of this effective duopoly could lead to market conditions and pricing structures that deviate from normal, competitive marketplaces.

Table 3.4-1
Ownership of Selected High-Capacity Landfills with Rail Access

State	Number of Landfills Meeting Selection Criteria	Number of Landfills owned by Two Companies	Percent of Total Selected Landfills Owned by Two Companies
Georgia	2	2	100%
South Carolina	4	4	100%
Pennsylvania	12	10	83%
Ohio	8	5	63%
Virginia	2	0	0%
New York	2	0	0%
Totals	**30**	**21**	**70%**

ATTACHMENT A

QUESTIONS FOR LANDFILL OWNERS/OPERATORS

Questions for Landfill Owners/Operators

State/Landfill Name:

Public/Private Ownership:

Date/Time:

Person Called/Title:

Phone Number:

The questions below pertain to a survey that HDR Engineering Inc., as consultants to the New York City Department of Sanitation, is conducting to determine the putrescible solid waste landfill market.

1. What wastes (MSW, Commercial, C&D, ash residue, hazardous waste) are accepted at the landfill?

2a. What is your historical spot market tip fee? Please specify number of days/week and days/year that are used in your calculations.

2b. What is your average contract tip fee? Please provide public rate schedule.

3a. At current rate of usage, what is the permitted remaining life of the landfill (in tons)? And what is the physical remaining life of the landfill?

3b. What is your permitted average tons per day (tpd)?

3c. What is the permitted maximum tpd?

3d. What is the current average tpd?

4. Do you accept waste from sources outside of your state? From New York City (NYC)? How much waste is currently accepted from the NYC, tpd?

5. Do you have a host community agreement to accept out-of-state waste? Example: Would you require a host community agreement with a city in another community, region, or state, such as NYC?

6. Do you accept waste from Municipalities and/or Private companies? What is your % breakdown between municipal and private customers?

7. Which municipalities are currently sending waste to your landfill? Please provide a copy of any contracts you have with municipalities.

8. Which private companies are currently sending waste to your landfill? Please provide a copy of any contracts you have with private companies.

9. Is the landfill accessible by rail? If so, is there a transfer facility at the landfill for loading and unloading rail cars?

10. Have you filed for an expansion permit for the landfill? How big is the expansion? What is the status of the expansion permit?

11. What are the operational hours and days for receiving waste?

12. How many operational days are there in one calendar year?

13. When does the landfill's operational permit expire? How many years is a typical permit for?

14. What would the tip fee be for a contract to deliver 600-1,200 tpd of commercial waste to the landfill for 20 years?

ATTACHMENT B

QUESTIONS FOR WASTE-TO-ENERGY FACILITY OWNERS/OPERATORS

Questions for Waste-to-Energy Facility Owners/Operators

State/Facility Name:

Public/Private Ownership:

Date/Time:

Person Called/Title:

Phone Number:

The questions below pertain to a survey that HDR Engineering Inc., as consultants to the New York City Department of Sanitation, is conducting to determine the putrescible solid waste marketplace.

1. What wastes besides Municipal Solid Waste (MSW) are accepted at the facility?

2. What is your historical spot market disposal fee? (Please specify number of days/week and days/year that are used in your calculations.)

3a. What is your average contract tip fee? (Please provide public rate schedule.)

3b. What is your permitted average tons per day (tpd)?

3c. What is the permitted maximum tpd?

3d. What is the current average tpd?

4. Do you accept waste from sources outside of your state? From New York City (NYC)? How much waste is currently accepted from NYC, tpd?

5. Do you have a host community agreement to accept out-of-state waste? Example: Would you require a host community agreement with a city in another community, region, or state, such as NYC? What is the host community fee payment (per ton)? Please provide a copy of the host community agreement.

6. Do you pay a PILOT (Payment in Lieu of Taxes) payment to your community? If so, how much is this payment (per ton)?

7. Do you accept waste from Municipalities and/or Private companies? What is your % breakdown between municipal and private clients?

8. Which municipalities are currently sending waste to your facility? Please provide copies of any contracts you have with municipalities.

9. Which private companies are currently sending waste to your facility? Please provide copies of any contracts you have with private companies.

10. Is the facility accessible by rail? If so, is there a transfer facility at the facility for loading and unloading rail cars?

11. What are the operational hours and days for receiving waste?

12. How many operational days are there in one calendar year?

13. When does the facility's operational permit expire? How many years is a typical permit for?

14. Do you have plans for expansion at your facility?

15. What would the tip fee be for a contract to deliver 600-1,200 tpd of commercial waste to your facility for 20 years?

ATTACHMENT C

QUESTIONS FOR MUNICIPAL SOLID WASTE MANAGEMENT EMPLOYEES

Questions for Municipal Solid Waste Management Employees

State/Community Name:

Date/Time:

Person Called/Title:

Phone Number:

The questions below pertain to a survey that HDR Engineering Inc., as consultants to the New York City Department of Sanitation, is conducting to determine the putrescible solid waste landfill market.

1. How many tons of MSW (Municipal Solid Waste) does your community export per day? Per year?

2. What landfills and/or Waste-to-Energy facilities are you currently sending your waste to?

3. Please estimate the percent of your community's waste going to each of these landfills/facilities.

4. Please list the tipping/disposal fees that you pay for each of the landfills/facilities.

5. Please list any Private companies that transport your community's waste. Please also provide approximate tonnage that these Private companies transport.

6. Please provide a copy of any contracts you have with landfills/Waste-to-Energy facilities.

COMMERCIAL WASTE MANAGEMENT STUDY

VOLUME V

MANHATTAN TRANSFER STATION SITING STUDY REPORT

March 2004

Prepared for:

New York City Department of Sanitation
for submission to the New York City Council

Prepared by:

Henningson, Durham & Richardson
Architecture and Engineering, P.C.

This report was prepared by

Henningson, Durham & Richardson
Architecture and Engineering, P.C.

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Acronyms	
DSNY	New York City Department of Sanitation
FHL	Friends of the High Line
LL74	Local Law 74, effective December 19, 2000, enacted by the City Council, requiring a comprehensive assessment of commercial solid waste management in New York City
MTS	marine transfer station
tpd	tons per day
TYP	typical

Definitions	
2001 Plan	February 2001 Final Comprehensive Solid Waste Management Plan Modification and Final Environmental Impact Statement
City	New York City
Consultant	The DSNY's Consultant Team, including Henningson, Durham & Richardson Architecture and Engineering, P.C.; Parsons Brinckerhoff Quade and Douglas, Inc.; Ecodata, Inc.; Franklin Associates, Ltd.; Urbitran Associates, Inc.; HydroQual, Inc.; and Cambridge Environmental, Inc., who prepared the Commercial Waste Management Study
Converted MTS	One of DSNY's eight marine transfer stations, modified to containerize waste for out-of-City export by barge or rail
Final Study Scope or Final Scope of Work	Commercial Waste Management Study Final Scope of Work issued on July 31, 2003
New SWMP	The new comprehensive Solid Waste Management Plan to be developed in 2004 for both DSNY-managed Waste and commercial waste for the planning period 2004 through 2024
New SWMP Planning Period	The 20-year period from 2004 to 2024 addressed by the City's New Solid Waste Management Plan
Study	Commercial Waste Management Study
Transfer Station(s)	Privately owned and operated transfer station in New York City that accepts, transfers and transports some portion of municipal solid waste or construction and demolition debris or fill material generated in the private sector for out-of-City disposal

EXECUTIVE SUMMARY

PREFACE

Local Law 74 of 2000 (LL74) mandated a comprehensive study of commercial waste management (Commercial Waste Management Study or Study) in New York City (City) by a Consultant funded by the City Department of Sanitation (DSNY). This Study undertaken to comply with LL74 will assist the City in managing the commercial waste stream in the most efficient and environmentally sound manner, and assist in the development of the City's Solid Waste Management Plan (New SWMP) for the New SWMP Planning Period.

As stated in the Commercial Waste Management Study Final Scope of Work: *"The potential need for new commercial waste transfer station capacity will be investigated…"* As one element of this investigation, the Consultant *"…will investigate potential sites for truck-to-barge or truck-to-rail transfer stations in lower and midtown Manhattan. This analysis will define facility design criteria, identify any sites that conform to these criteria, conduct a fatal flaw analysis of factors that would preclude siting at these locations, and, if no such flaws are identified, summarize the advantages and disadvantages of the sites that appear feasible."*

In addition to this Volume V, the Study consists of five other volumes:

- Volume I: Private Transfer Station Evaluations;
- Volume II: Commercial Waste Generation and Projections;
- Volume III: Converted Marine Transfer Stations – Commercial Waste Processing and Analysis of Potential Impacts;
- Volume IV: Evaluation of Waste Disposal Capacity Potentially Available to New York City; and
- Volume VI: Waste Vehicle Technology Assessment.

Manhattan generates approximately 42% of the putrescible waste collected by private carters in the City, yet there are no private putrescible waste Transfer Stations located in this borough. This volume, Volume V: Manhattan Transfer Station Siting Study, investigates and evaluates potential sites for locating new transfer stations in Manhattan.

EXECUTIVE SUMMARY

Scope of Analysis/Approach

The purpose of this report is to evaluate the potential to develop Manhattan-based truck-to-barge or truck-to-rail transfer stations. Facility conceptual designs and site plans were prepared to determine the feasibility of using each site as a transfer station, and research on land use regulations and applicable laws was also undertaken to identify other obstacles to development.

Five screening criteria were established, which, for further consideration, potential sites were required to meet. These criteria were:

- Technical and operationally feasible transfer station sites with the capability to process at least 1,000 tons per day (tpd) of waste.
- Conformance to the zoning and proximity to sensitive-use criteria outlined in DSNY's Siting Rules.
- Adherence to legislative restrictions on the use of the site for transfer stations.
- Suitability for export of waste by barge or rail.
- Collection vehicle access from nearby truck routes.

Four sites were evaluated: West 140th Street, Pier 42, West 30th Street and West 13th Street (Gansevoort Property). None of these four sites currently serve or are permitted as waste transfer facilities.

Findings

- The West 140th Street site was determined to be infeasible due to technical reasons. Specifically, there is insufficient property available to ramp trucks up to the required site level and at an acceptable grade due to the rail elevation. Other operational problems included lack of maneuvering room, traffic problems and limited on-site parking. In addition, the site is zoned M1 and is within 400 feet of Riverbank State Park.

- The Pier 42 site has significant technical disadvantages. Prohibitions against its use as a transfer station agreed to between the City and other parties present serious obstacles to its development as a transfer station. In addition, it is located in an M1-4 zone and is within 400 feet of a playground and park.

- The West 30th Street site was determined to be infeasible for technical reasons. It lies within two zones -- M1-6 and M2-3 -- and the portion located within the compliant M2-3 zone is too small to construct a 1,000 tpd transfer station. In addition, due to the site's limited size, rail operations would not be feasible, there would be insufficient space for storage of waste or for containers, there would be no room for on-site parking, and there would be limited queuing and maneuvering space.

- The West 13th Street site is overseen and operated by the Hudson River Park Trust and is situated within the Hudson River Park. It formerly served as the location of a marine transfer station (MTS) and is zoned M3-2. In order for it to serve as a site for a new waste transfer facility, the state legislation that created the Hudson River Park would have to be amended. Additionally, federal and state permits issued to allow for the development of the park, in particular those related to development over the water, would have to be modified. Important obstacles exist to making this site a transfer station.

As a result of the considerations noted above, all four Manhattan sites were determined to either be technically infeasible or have significant legislative, zoning, land use and/or technical obstacles for the development of a private putrescible transfer station.

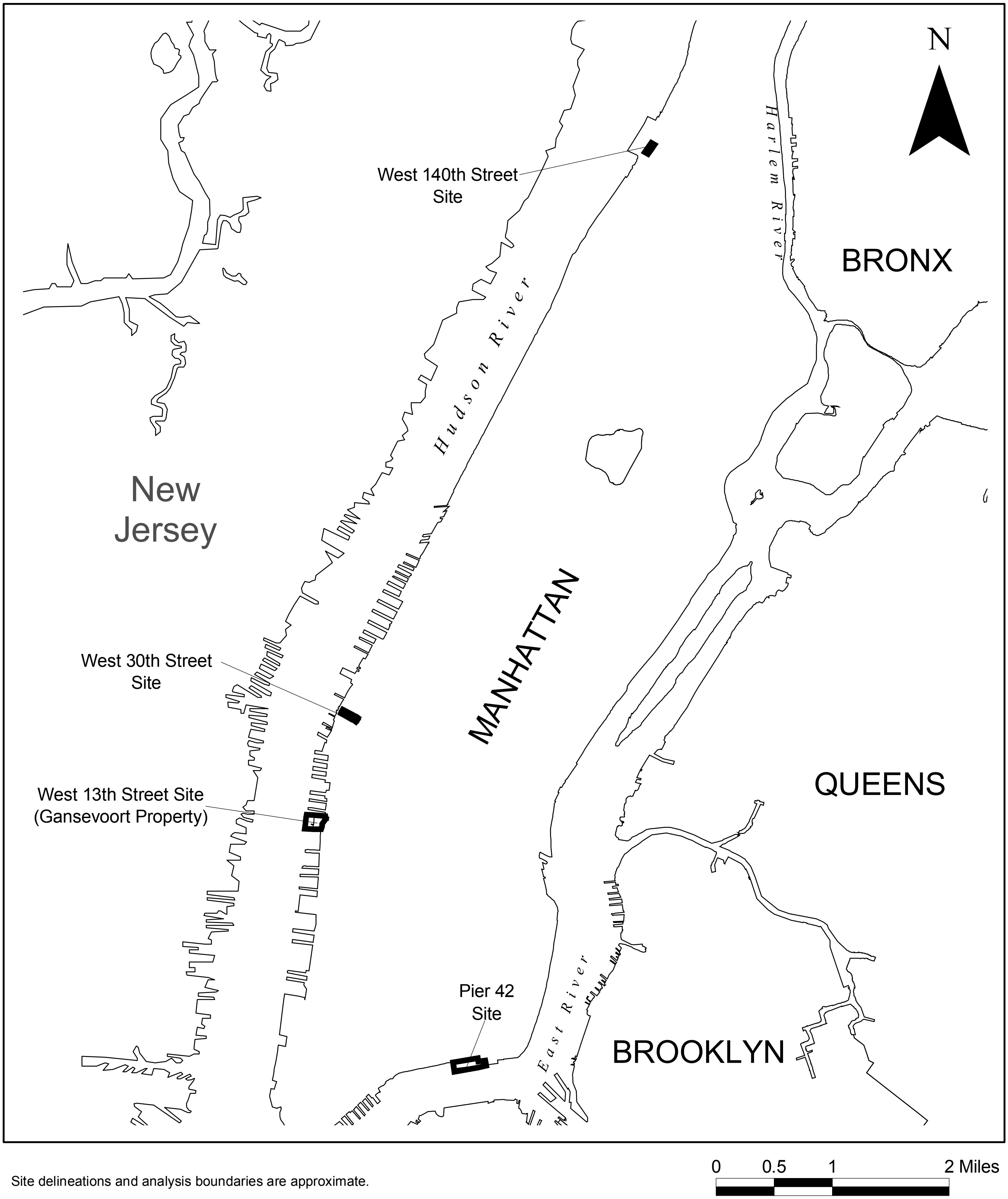
MANHATTAN TRANSFER STATION SITING STUDY REPORT

1.0 OVERVIEW

The Final Study Scope of the Commercial Waste Management Study (Study) includes an investigation of potential sites for new waste transfer stations in Manhattan.

As reported in Volume II of this Study (Commercial Waste Generation and Projections), Manhattan generates approximately 42% of the putrescible waste in New York City (City) collected by private carters. There are no private putrescible waste Transfer Stations in Manhattan. The City Department of Sanitation (DSNY) has three marine transfer stations (MTSs) in the borough that have been inactive as waste transfer facilities for three years. However, the West 59th Street MTS continues to be used to transfer paper from DSNY's Curbside Program to the Visy Plant on Staten Island.

The Study evaluated three sites south of and one site north of 80th Street in Manhattan that met the minimum criteria discussed below. Sites were selected based upon comments received during the Study scoping meetings, as well as sites previously identified in the 2001 Plan. The four sites are: West 140th Street, Pier 42, West 30th Street and West 13th Street (Gansevoort Property), shown in Figure 1-1, Site Location Map. None of these four sites currently serve or are permitted as waste transfer facilities. Facility conceptual designs and site plans were prepared to determine the feasibility of using each site as a transfer station. Research on land use regulations and laws applicable to these sites was also undertaken to identify regulatory or legislative obstacles to development of these sites.



Site delineations and analysis boundaries are approximate.

HDR HydroQual	**Figure 1-1** **Site Location Map** **CITY OF NEW YORK** **DEPARTMENT OF SANITATION**	THE CITY OF NEW YORK DEPARTMENT OF SANITATION

2.0 SCREENING CRITERIA

Five screening criteria were established, which, for further consideration, potential sites were required to meet. These criteria were:

- Technical and operationally feasible transfer station sites with the capability to process at least 1,000 tons per day (tpd) of waste.
- Conformance to the zoning and proximity to sensitive-use criteria outlined in DSNY's Siting Rules.
- Adherence to legislative restrictions on the use of the site for transfer stations.
- Suitability for export of waste by barge or rail.
- Collection vehicle access from nearby truck routes.

While the 1998 Siting Rules were challenged in court after being announced and DSNY has committed to revise them, the published version (October 1998) of these rules was used for the purpose of evaluating the sites in this report. This was done in anticipation that some aspects of those Siting Rules will be reflected in the modified Siting Rules, to be announced July 31, 2004. Therefore, the Siting Rules for new putrescible transfer stations used for this report include the following:

- Transfer stations may only be located in either an M2 or an M3 zone;
- Transfer stations may not be located in M1 zones; and
- Transfer stations may not be located within 400 feet of a residential district, a public park or a school.

According to the 1998 Siting Rules, the above restrictions would not apply to a putrescible transfer station that receives and removes by rail or barge all of the solid waste that it processes, provided all of such transfer station's waste processing operations are enclosed. However, since these Siting Rules will be revised, it was decided that these rules should be applied to all sites, regardless of mode of export. This is to ensure the most thorough analysis, given the uncertainty of the content of the anticipated Siting Rules.

The minimum requirement for distance from a residential district, public park or school is 400 feet (although a variance might be available if the facility would not cause adverse environmental impacts). This distance was therefore used to identify the "Usable" portion of each site. The figures labeled "Siting Requirements" for each site show the "Usable" portions of each site, according to the Siting Rules described above.

3.0 ASSESSMENT OF SITES

The following describes each evaluated site, indicating location, land use, technical, operational and legislative considerations.[1]

3.1 West 140th Street Site

The West 140th Street site is located on Block 2101, which runs between the North River Water Pollution Control Plant on the Hudson River and the Henry Hudson Parkway, from about West 145th Street to just south of West 137th Street. The site abuts the Henry Hudson Parkway and the Riverbank State Park directly to the west. Directly to the east, the site abuts Riverside Park North, which in turn abuts Riverside Drive and a residential area zoned R8. (See Figure 3.1-1, West 140th Street Zoning.) There is a mapped recreational area north of the site at approximately 146th Street.

The site is mapped as a public park and is zoned M1. The M1 zone extends from Riverside Park North westward to the U.S. Pierhead Line in the Hudson River. The existing rail lines run north-south through the site and are elevated approximately 20 feet over the existing grade. Site access is gained via an existing access road at ground level from the southwest.

The conceptual design evaluated for a truck-to-barge transfer station at West 140th Street has trucks entering and exiting the site using the existing access road. (See Figure 3.1-2, West 140th Street Site Plan.) The trucks are directed to any one of six tipping bays to unload onto the loading floor, which is at the same elevation as the tipping floor. Front-end loaders then move the solid waste into one of three loading slots with empty open top-loaded containers located beneath the slots.

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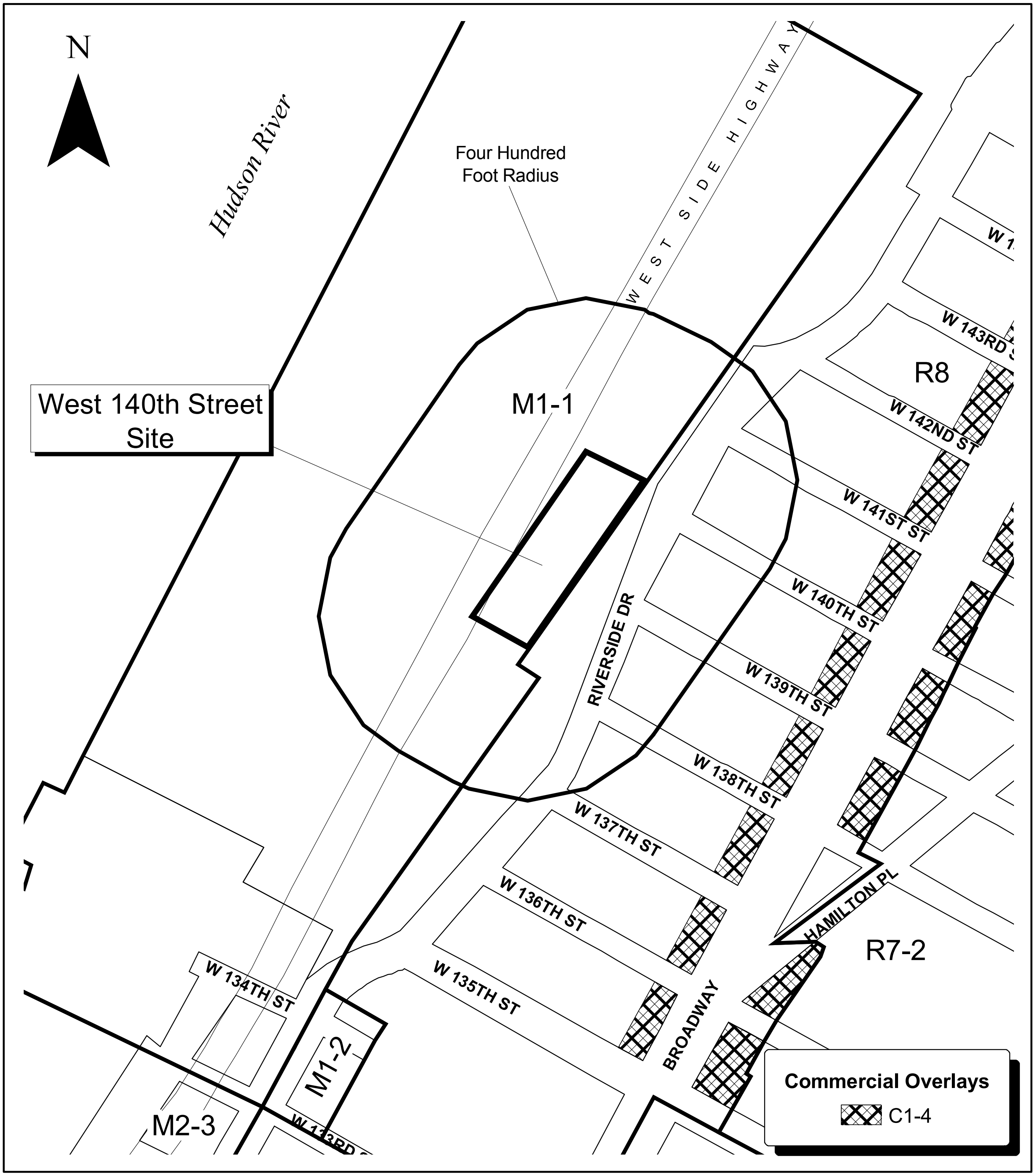
[1] The lots and blocks were as identified by either the DSNY Office of Real Estate or the Tax Assessor's Office.



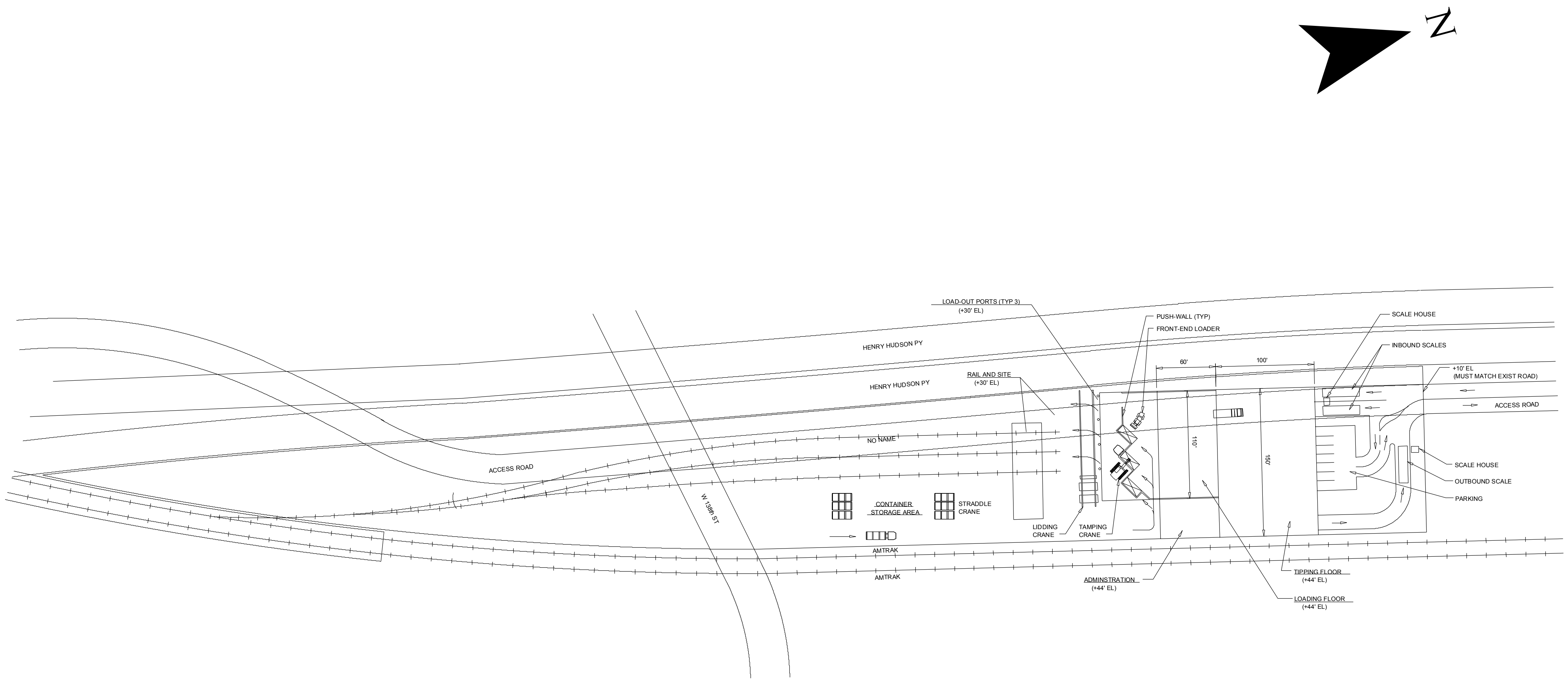
Site delineations and analysis boundaries are approximate.
Base Map Source: New York City Department of City Planning

Figure 3.1-1 West 140th Street Zoning

CITY OF NEW YORK
DEPARTMENT OF SANITATION

Figure 3.1-2
West 140th Street
Site Plan

City of New York
Department of Sanitation



TECHNICAL/OPERATIONAL CONSIDERATIONS:

1. HIGH VOLUME OF BACKFILL IS NECESSARY TO LEVEL THE SITE. APPROXIMATELY 96,800 CY OF BACKFILL WOULD BE NECESSARY TO ALLOW CONNECTION TO EXISTING RAIL LINES.
2. BACKFILLING WOULD ELIMINATE AN EXISTING ACCESS ROAD.
3. INSUFFICIENT AREA FOR TRUCK MANEUVERING.
4. SUBSTANTIALLY INSUFFICIENT PROPERTY TO RAMP TRUCKS UP TO REQUIRED SITE LEVEL.
5. LIMITED ON-SITE PARKING
6. THE EXISTING RAIL ELEVATION (+30') IS DRIVING THE BUILDING ELEVATION (+44').

Hydraulic excavators are used to tamp and pack the waste into the containers. These containers are then lidded and moved into position where they can be loaded onto rail cars by a straddle crane. Each 85-foot rail car has the capacity to carry four 8½-foot-wide-by-12-foot-high-by-20-foot-long open top-loaded containers. The average throughput for this facility is 3,003 tpd, assuming that two loading slots are in operation processing seven containers per hour with an average of 22 tons of waste per container for 19.5 hours a day.

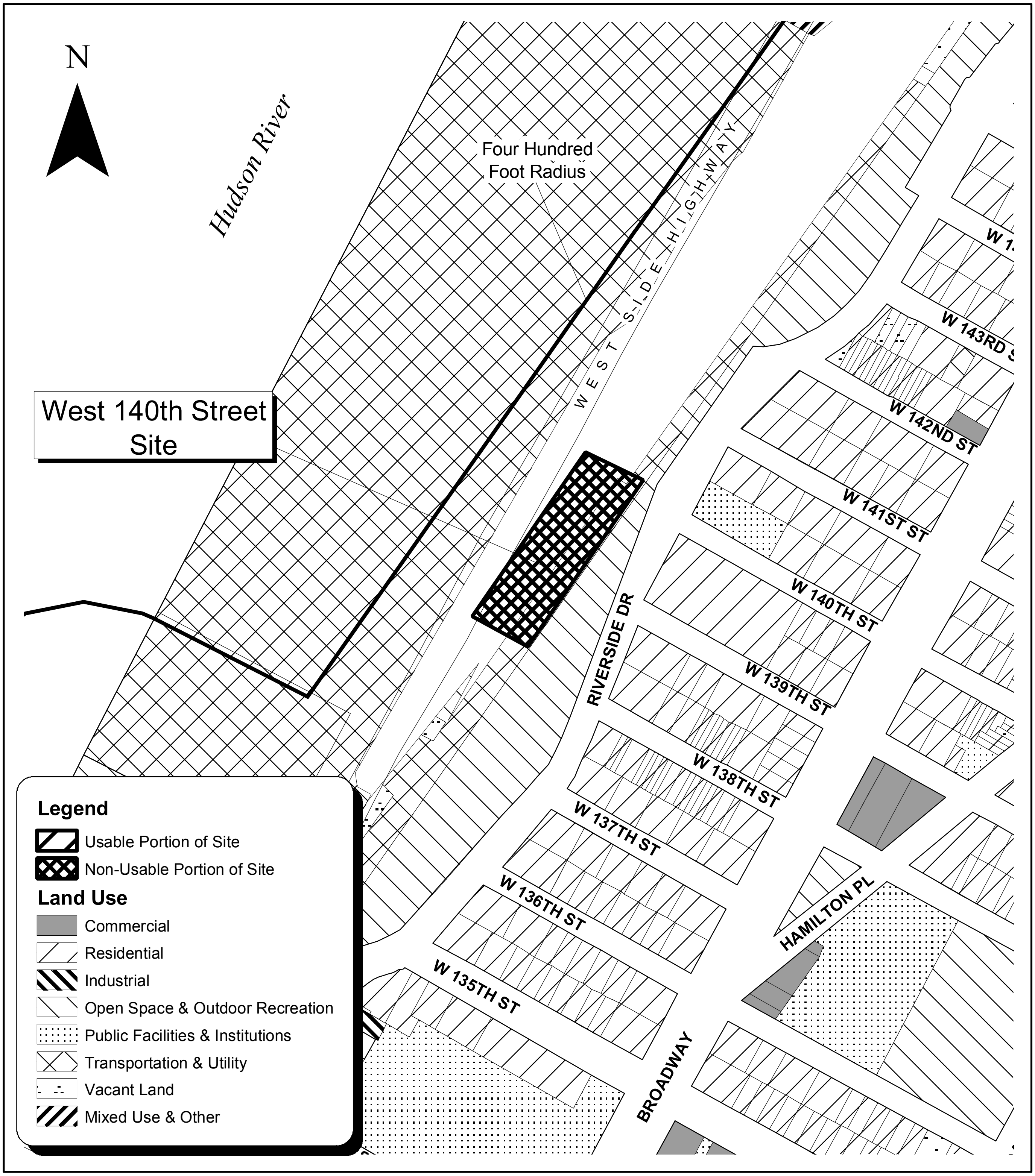
The investigation of the West 140th Street site for use as a waste transfer facility found it to be infeasible for the following reasons:

- There is insufficient property to ramp trucks up to the required site level; and
- The existing rail elevation (+30') determines the building elevation (+44'). The building elevation (+44') is substantially higher than the existing road (+10') and there is insufficient room to ramp up to the facility at an acceptable grade.

In addition to these technical flaws, the assessment of the West 140th Street site also identified the following design and operational considerations:

- Approximately 100,000 cubic yards of backfill would be required to construct a facility at the same elevation as the existing rail line;
- Backfilling would eliminate the existing access road;
- A new ramp providing truck access between the transfer station and West 144th Street would interfere with the current access to an existing facility in the northeast section of the site;
- On-site truck maneuvering room would be severely constrained and is considered to be insufficient -- outbound commercial trucks would have tight turning radii and minimal queuing distance prior to the outbound scale;
- Employee traffic will be mixed with collection truck traffic entering and leaving the site; and
- There is limited on-site parking (the maximum number of parking stalls that fit on the design is seven).

The site did not satisfy the Siting Rules criteria for zoning and minimum distance from a public park. (See Figure 3.1-3, West 140th Street Siting Requirements.) The entire site is within 400 feet of Riverbank State Park. Except for a small portion of the upland area, the site is also located within 400 feet of a residential zoning (R8) area to the east. In conclusion, the West 140th Street site was found technically infeasible and in conflict with Siting Rules criteria.



Site delineations and analysis boundaries are approximate.
Base Map Source: New York City Department of City Planning

0 200 400 800 Feet

Figure 3.1-3 West 140th Street Siting Requirements

CITY OF NEW YORK
DEPARTMENT OF SANITATION

3.2 Pier 42 Site

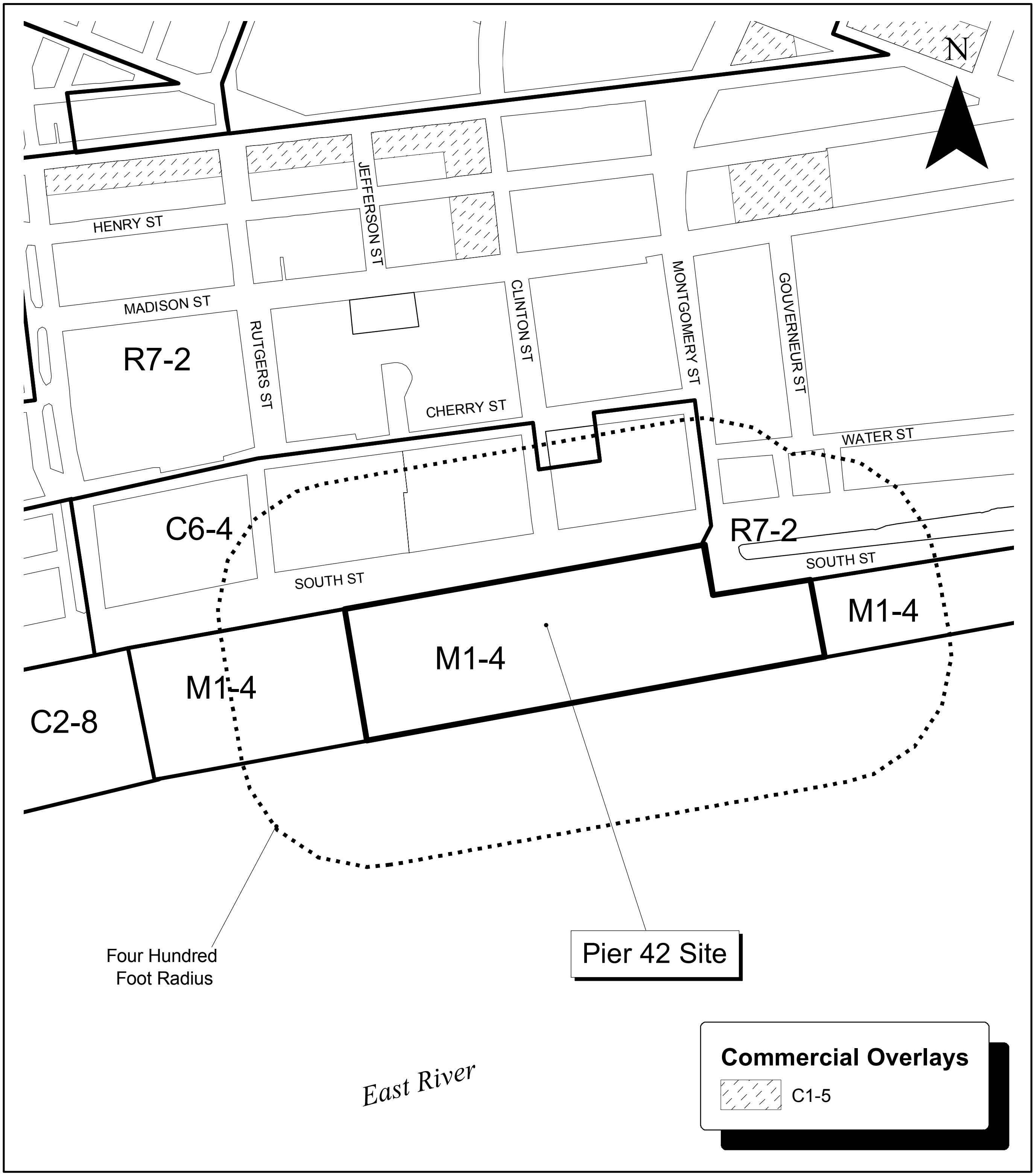
Pier 42 is located on the East River and is bounded by South Street to the north and the U.S. Pierhead Line to the south. Piers 41 and 44 abut the site to the west and east, respectively. The site is located within an M1-4 zone that extends inland towards South Street. The area to the north of South Street has C6-4 zoning. (See Figure 3.2-1, Pier 42 Zoning.)

The conceptual design evaluated for a truck-to-barge MTS at Pier 42 has collection vehicles entering and leaving the site from South Street. (See Figure 3.2-2, Pier 42 Site Plan.) Vehicles enter and exit the tipping floor from the north side of the transfer station. They are directed to any one of six tipping bays to unload onto the loading floor, which is at the same elevation as the tipping floor. Front-end loaders then pile the waste near the hydraulic excavators that are used for lift and load operations to fill and pack the containers.

Container shuttle cars, located on the pier level of the transfer station, would be used to convey the containers back and forth between the gantry cranes, lidding stations and lidding slots. After the containers are filled with waste, the shuttle cars convey them to the lidding station, where water-tight lids will be attached to the containers. The containers are then loaded onto a deck barge by a gantry crane. The deck barge has the capacity to transport 48 8½-foot-wide-by-12-foot-high-by-20-foot-long open top-loaded containers to and from the transfer station. The average throughput for this facility is 2,145 tpd assuming two ports in operation processing five containers per hour with an average of 22 tons of waste per container for 19.5 hours a day.

While there were no technical or operational fatal flaws in the proposed conceptual plan, an assessment of the Pier 42 site identified the following design and operational considerations:

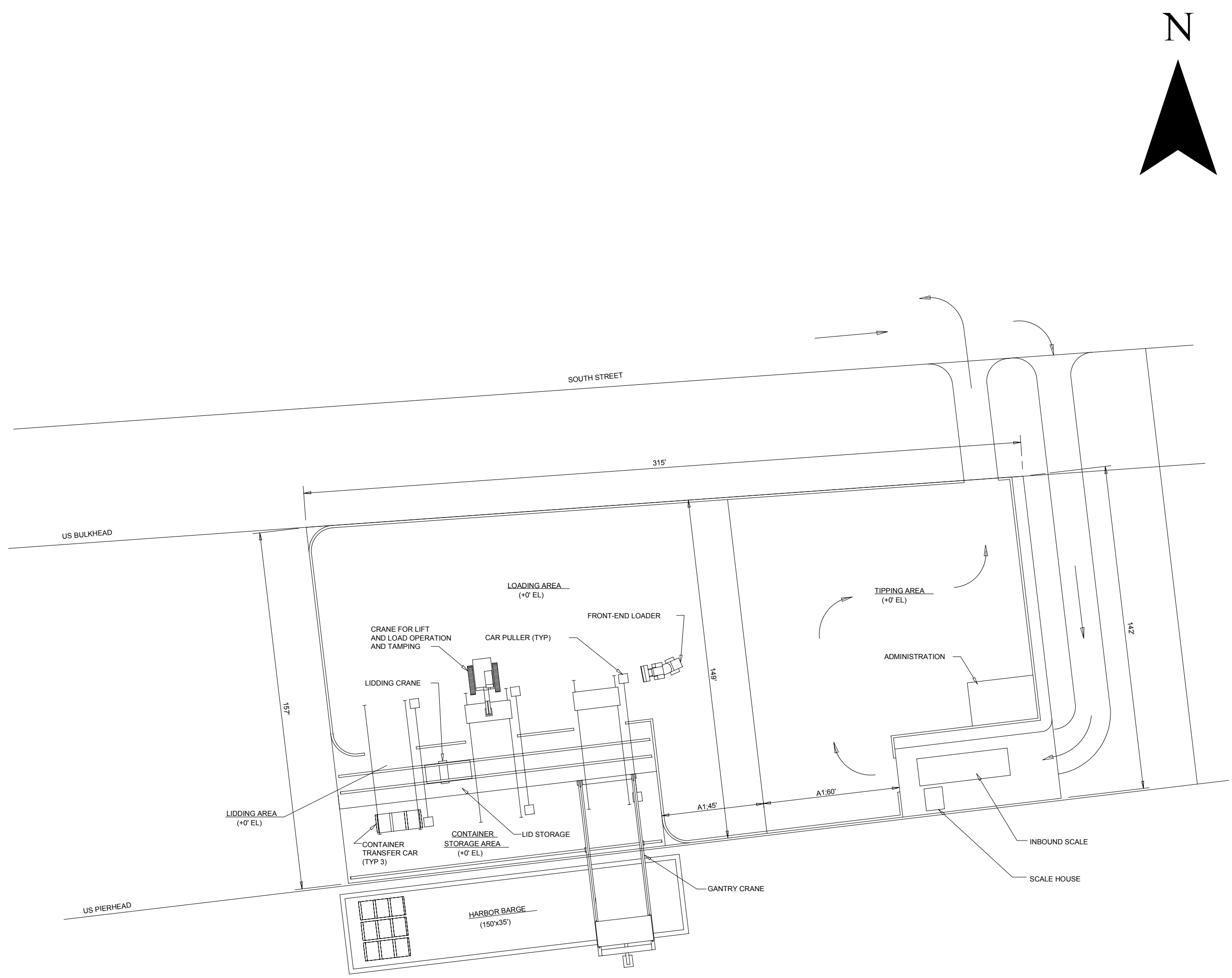
- Queuing would be limited to only one truck on site.
- As can be observed in the Site Plan (Figure 3.2-2), the relatively small size of the site would cause potential problems in locating an outbound scale and parking on site, and in providing adequate maneuvering room for trucks, front-end loaders and a gantry crane.



Site delineations and analysis boundaries are approximate.
Base Map Source: New York City Department of City Planning

0 200 400 800 Feet

HDR HydroQual	**Figure 3.2-1 Pier 42** **Zoning** CITY OF NEW YORK DEPARTMENT OF SANITATION	THE CITY OF NEW YORK DEPARTMENT OF SANITATION



TECHNICAL/OPERATIONAL CONSIDERATIONS:

1. NO TRUCK MANEUVERING AREA FOR BOTH CONTAINER TRANSFER AND TIPPING FLOOR.
2. NO AREA FOR OUTBOUND SCALE.
3. LIMITED OPERATING ROOM FOR FRONT-END LOADER.
4. NO ON-SITE PARKING.
5. INSUFFICIENT SPACE FOR OCEAN-GOING BARGE LOADING WITH GANTRY CRANE
6. GANTRY CRANE CANNOT PERMANENTLY PROJECT OVER U.S. PIERHEAD LINE. CRANE WOULD NEED TO RETRACT WHEN NOT IN USE.
7. LIMITED TO ONE HARBOR BARGE LOADING AT A TIME.
8. NO ROOM FOR RAMPS. THEREFORE, LIFT AND LOAD OPERATION IS NECESSARY.
9. NO ACCESS TO DOCK.
10. MINIMAL ON-SITE QUEUING.

HDR HydroQual

Figure 3.2-2 Pier 42
Site Plan

CITY OF NEW YORK
DEPARTMENT OF SANITATION

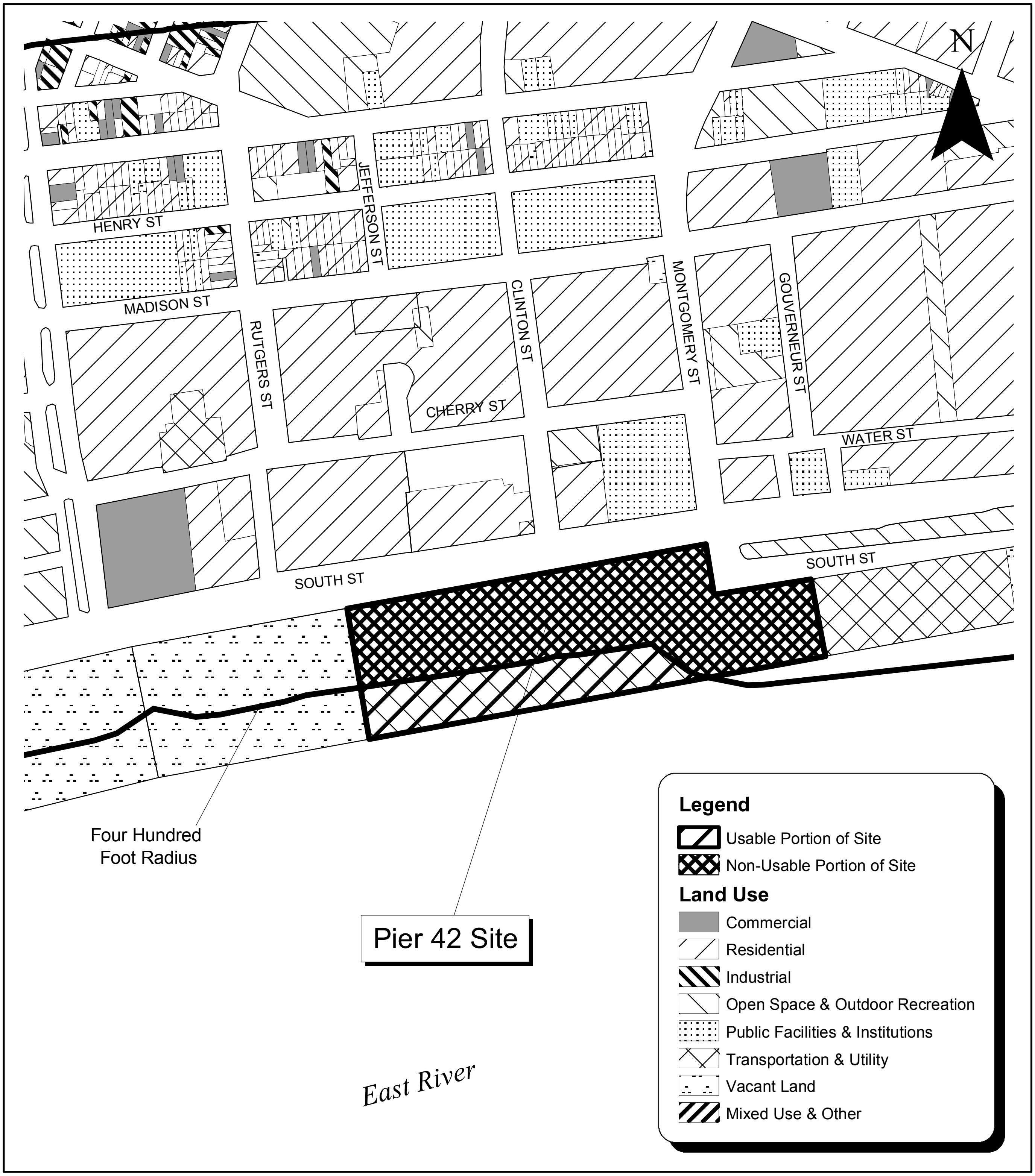
- Since the gantry crane cannot permanently project over the U.S. Pierhead Line, the crane would need to retract when not in use.
- There is no room for ramps. Therefore, containers would be filled with waste, using a less efficient lift and load operation.
- There is no access to the dock. This limitation will not allow for waste processing equipment stock to be located at the dock level.

In addition to the design and operational considerations mentioned above, an assessment of the Pier 42 site also identified the following traffic considerations:

- All access to the Pier 42 site is gained by a proposed access drive at the intersection of South and Montgomery Streets. The intersection is currently signalized. South Street is a local, two-way, four-lane surface street that runs parallel to the elevated FDR Drive. Montgomery Street is a two-way, two-lane roadway featuring a wide, painted, center median.

- South Street is designated by the City as a local truck route between State Street and Pike Slip. To access the site, trucks will be required to travel along South Street between Pike Slip and Montgomery Street, which is a section of South Street that is not designated as a local truck route. For these movements to occur, the designation of South Street as a local truck route will need to be extended, by the City, to the Montgomery Street intersection. This may be difficult to accomplish because the neighborhoods along the north side of South Street are heavily residential and are located in the "Zone E – Lower East Side" limited truck zone.

The site did not satisfy the Siting Rules criteria with regards to zoning and land use, including minimum distance from a public park. (See Figure 3.2-3, Pier 42 Siting Requirements.) A playground on Cherry Street and a portion of East River Park are both within 400 feet of the site. The entire site is also zoned M1-4 and is therefore precluded from use by the Siting Rules. Additionally, language contained in a 1994 Memorandum of Understanding among the City, State Assembly Leader Sheldon Silver and Gouverneur Gardens Housing Corporation specifically precludes the City's use of Pier 42 as a site for a waste transfer facility. In conclusion, the Pier 42 site has significant technical disadvantages, and prohibitions against its use as a transfer station agreed to between the City and other parties present serious obstacles to its development.



Site delineations and analysis boundaries are approximate.
Base Map Source: New York City Department of City Planning

0 200 400 800 Feet

Figure 3.2-3 Pier 42
Siting Requirements

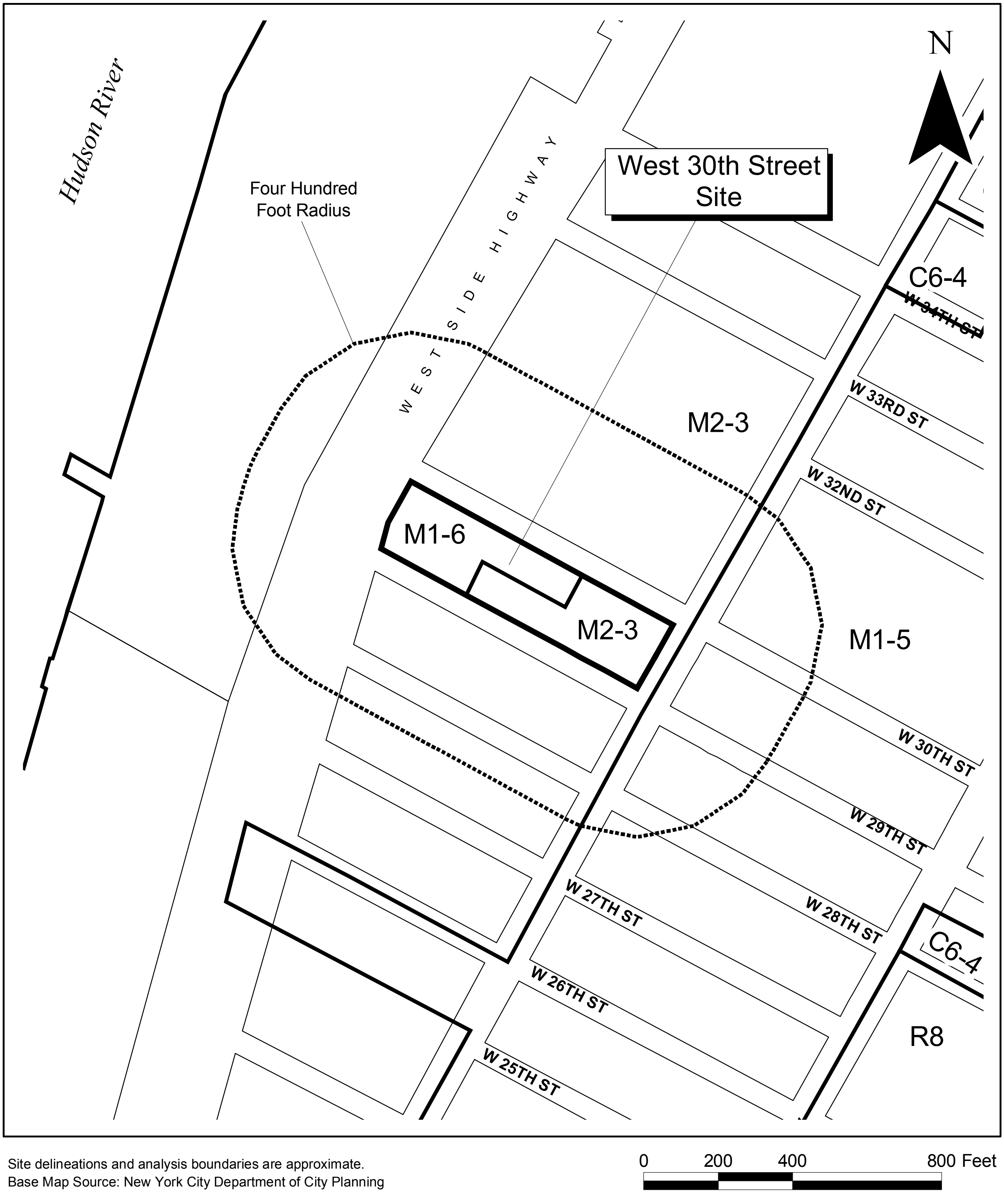
CITY OF NEW YORK
DEPARTMENT OF SANITATION

3.3 West 30th Street Site

The West 30th Street site, defined as Block 675, is bounded by 11th Avenue to the east, 12th Avenue (West Side Highway) to the west, West 29th Street to the south and West 30th Street to the north. The site is zoned as M1-6 and M2-3 for the western and eastern portions, respectively. (See Figure 3.3-1, West 30th Street Zoning.) An existing gas station with underground fuel storage tanks is located on the northeast portion of the site. An existing (inactive) elevated rail line runs along the north side of West 30th Street.

The elevated rail (also called the High Line) and the rail easement atop it are owned by CSX. The land beneath the High Line is owned in parcels by New York State, the City and over 20 private property owners. The High Line is currently not in use; the last train ran on the High Line in 1980. A 501 (c)(3) organization called Friends of the High Line (FHL), made up of City residents, business owners, artists and gallery owners, architects and design professionals, is dedicated to its preservation and adaptive reuse. As part of a federally-sanctioned railbanking program, a not-for-profit organization (such as FHL), or the City or state, can negotiate with a railroad for interim trail use of an out-of-service line. FHL won an Article 78 lawsuit in March 2002 effectively halting a demolition proposal negotiated in the early 1990s. At this time, there is a financial feasibility study being conducted on the reuse of the High Line. FHL is lobbying for its consideration as a park. In opposition, an organization called the Chelsea Property Owners group, made up of landowners who own property beneath, and adjacent to, the High Line, is lobbying for its demolition.

The two groups mentioned above are dedicated to planned uses of the High Line and appear to pose significant obstacles to the redevelopment of the High Line as an active rail line. In addition to these obstacles, interconnecting with the existing elevated rail line would require construction of a processing facility and platform at the same elevation as the rail line and require providing a ramp up from the ground level. The portion of the site that is appropriately zoned under the Siting Rules is limited to approximately 79,120 square feet. The site's limited size does not accommodate the structural arrangements necessary to connect to the existing overhead rail and, therefore, rail operations would not be feasible.



Site delineations and analysis boundaries are approximate.
Base Map Source: New York City Department of City Planning

Figure 3.3-1 West 30th Street Zoning

CITY OF NEW YORK
DEPARTMENT OF SANITATION

A conceptual evaluation of a transfer station at this site also found the following fundamental flaws:

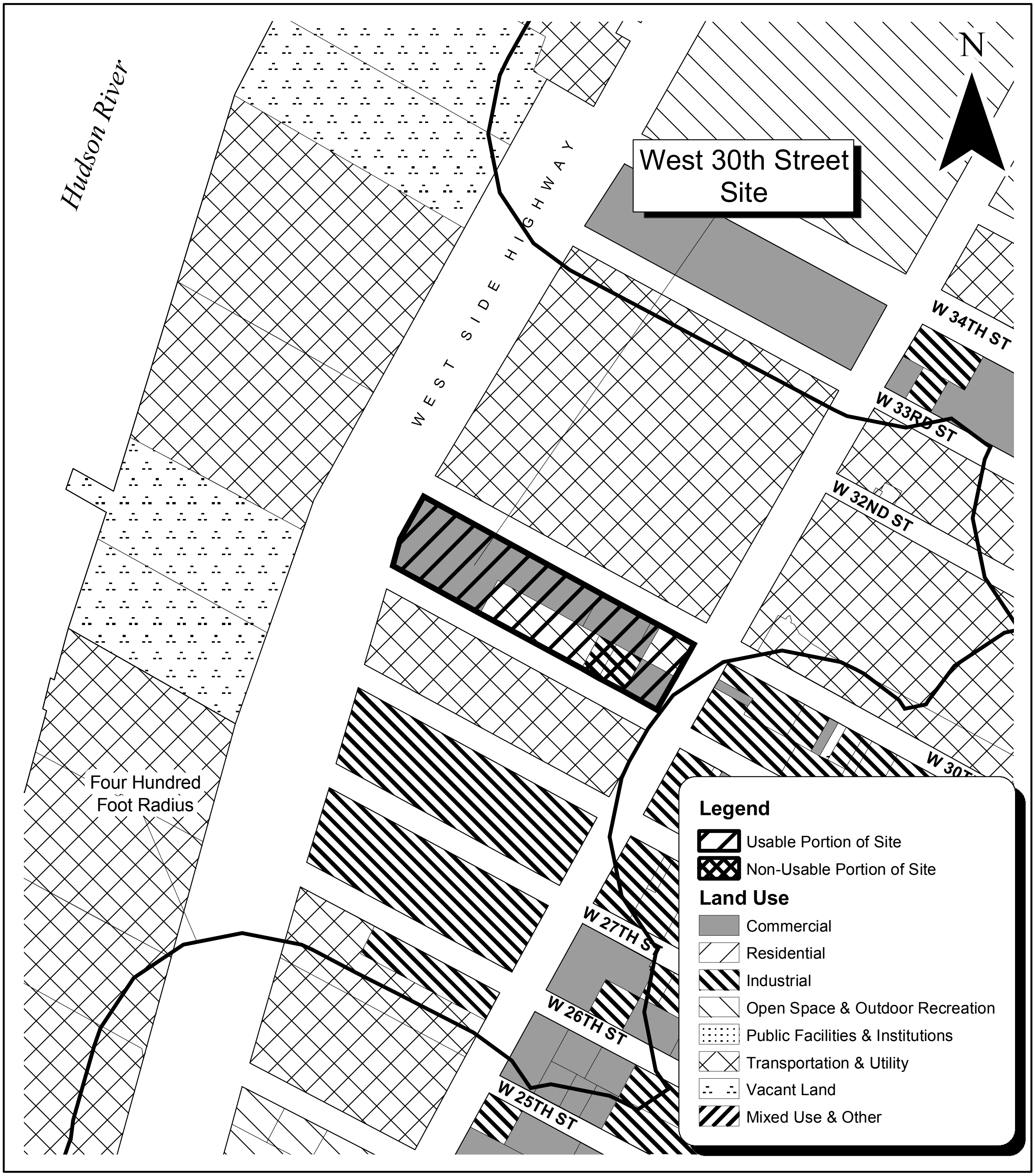
- There is insufficient storage area for waste;
- There is no room on site for parking;
- There is no room for container storage; and
- The available square footage of the conforming portion of the site would severely limit queuing and maneuvering space.

In addition to the design and operational considerations mentioned above, an assessment of the West 30th Street site also identified the following traffic considerations:

- West 30th Street is the only street available for the trucks to access the site. At the location of the site, West 30th Street is a one-way eastbound street. The intersection of 12th Avenue and West 30th Street is a signalized intersection. Twelfth Avenue is designated by the City as a local truck route, as well as West 30th Street between Broadway and 11th Avenue. However, the section of West 30th Street used by traffic traveling to the proposed facility is not designated as a local truck route. For operation of trucks to occur on West 30th Street between 12th Avenue and 11th Avenue, the City will need to extend the truck route designation to this section.

- The intersection of West 30th Street and 11th Avenue is a signalized intersection. Eleventh Avenue is a one-way southbound street at the intersection with West 30th Street, and is designated by the City as a local truck route. Upon exiting the facility, trucks must travel onto West 30th Street. Access to the network of local truck routes can be gained via West 30th Street, 11th Avenue, 10th Avenue and West 23rd Street. The addition of the truck traffic expected at this facility may impact the operation of the site intersections.

No portion of the site is within 400 feet of mapped residential districts, public parks or schools. The western portion of the site is zoned M1-6 and therefore does not comply with the DSNY's Siting Criteria. (See Figure 3.3-2, West 30th Street Siting Requirements.) The remaining eastern portion of the site (approximately 79,120 square feet) is zoned M2-3 and therefore does comply with the Siting Rules. Although a portion of the West 30th Street site was found to comply with the Siting Rules, this site is considered to be infeasible because the compliant portion is not large enough to construct a transfer station with the required capacity.



Site delineations and analysis boundaries are approximate.
Base Map Source: New York City Department of City Planning

0 200 400 800 Feet

HDR HydroQual

Figure 3.3-2 West 30th Street Siting Requirements

CITY OF NEW YORK
DEPARTMENT OF SANITATION

3.4 West 13th Street Site (Gansevoort Property)

Located on Block 651 along the Hudson River, the West 13th Street site is bounded by a pedestrian walkway along the West Side Highway to the east and the U.S. Pierhead Line to the west. Bloomfield Street and Gansevoort Street abut the site to the north and south, respectively. The site is zoned M3-2, use group 18, which allows for all manufacturing uses. (See Figure 3.4-1, West 13th Street [Gansevoort Property] Zoning.) The site was formerly used as an MTS, but was shut down in July 1991.

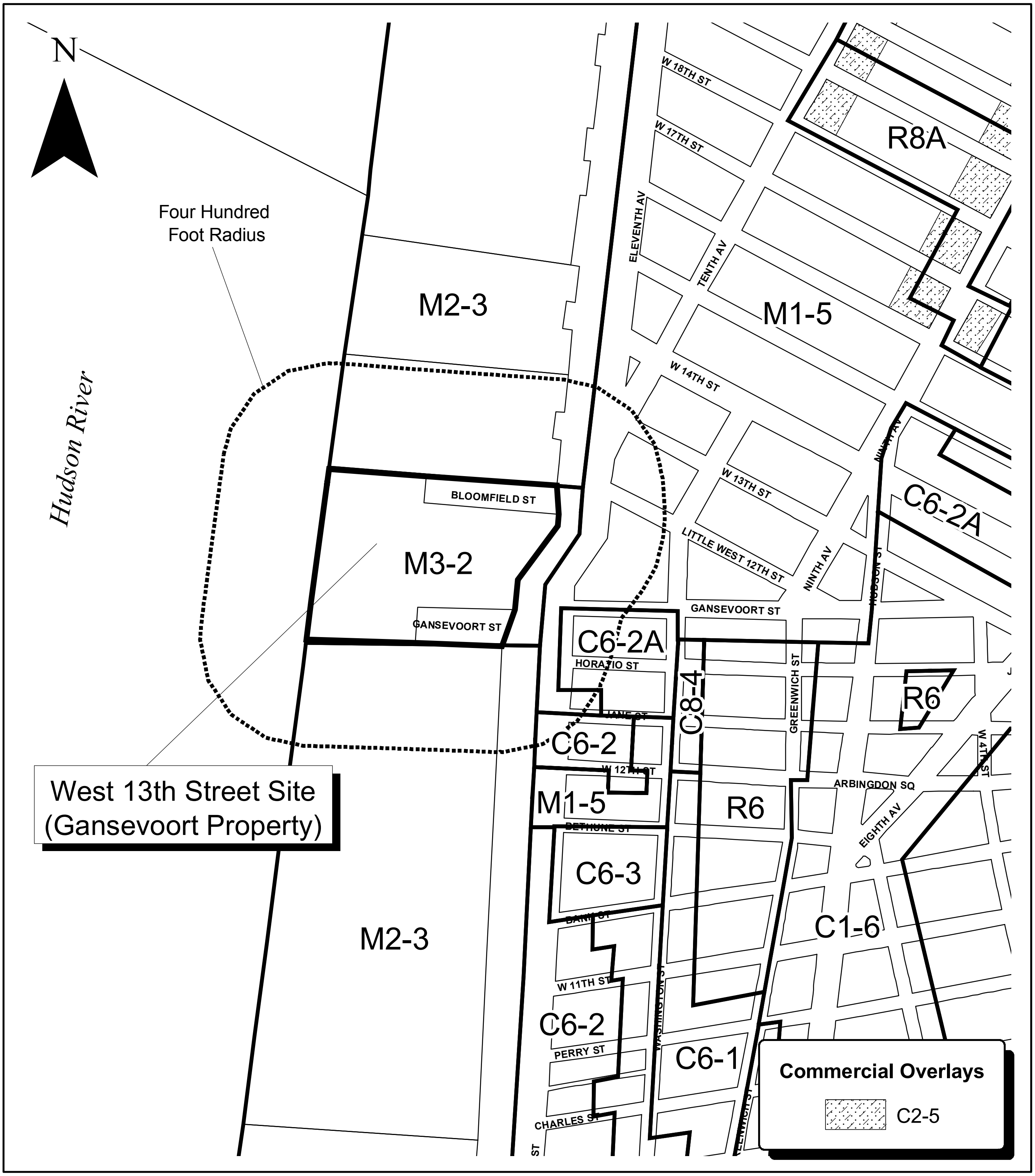
The Gansevoort site plan in this report was developed by modifying a design similar to that proposed for DSNY's Converted MTSs on upland sites such as the Greenpoint, Brooklyn, facility. (See Figure 3.4-2, West 13th Street [Gansevoort Property] Site Plan.) While there were no technical or operational fatal flaws in the proposed conceptual plan, an assessment of the Gansevoort site identified the following design and operational considerations:

- Ramps would need to be structural ramps in lieu of earth-supported;
- Construction of the in-bound ramp on Bloomfield Street and the facility on Gansevoort Street would be subject to the City's Uniform Land Use Review Procedure; and
- The out-bound ramp projects over Marginal Street. This will impact pedestrian access to the parkland usages along the pedestrian way directly adjacent to the eastern end of the site.

In addition to the design and operational considerations mentioned above, an assessment of the Gansevoort site also identified the following traffic considerations:

- In-bound trucks must arrive at the site via 11th Avenue southbound. Eleventh Avenue is recognized by the City as both a through truck route and a local truck route. Local truck routes, which would provide in-bound access to 11th Avenue, are 12th Avenue and 10th Avenue, both of which merge with 11th Avenue north of Gansevoort Street, and West 14th Street.

- Upon exiting the facility, trucks must travel south on 11th Avenue. West Houston Street and Canal Street, located 16 blocks and 19 blocks south, respectively, of the site, are the closest truck routes that provide a means for exiting vehicles to reverse their direction.



Site delineations and analysis boundaries are approximate.
Base Map Source: New York City Department of City Planning

0 250 500 1,000 Feet

HDR HydroQual

Figure 3.4-1 West 13th Street (Gansevoort Property) - Zoning

CITY OF NEW YORK
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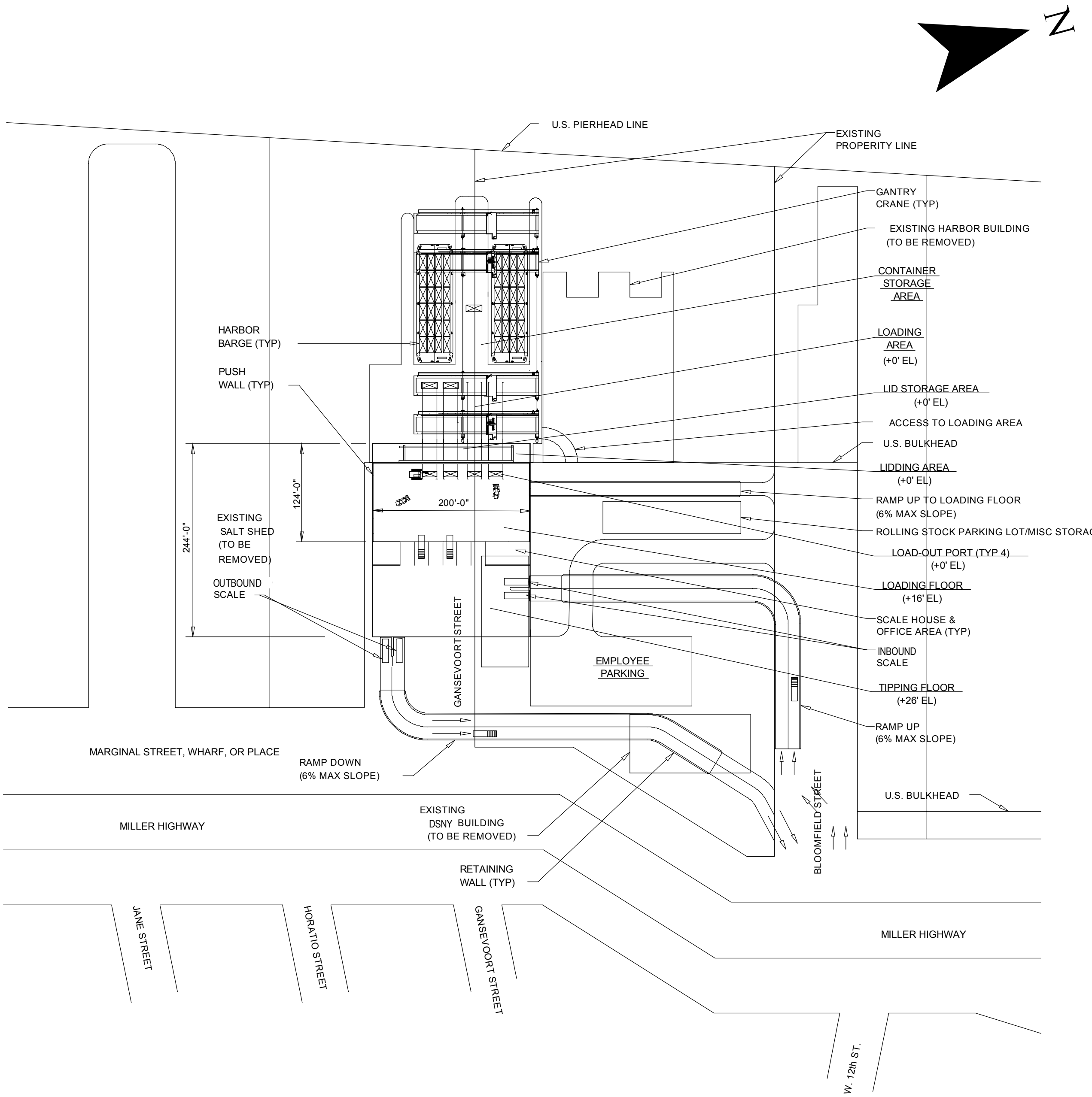

TECHNICAL/OPERATIONAL CONSIDERATIONS:

1. SUBSTANTIAL DEMOLITION WOULD BE REQUIRED ON SITE. DSNY BUILDING, SALT SHED AND HARBOR BUILDING WOULD NEED TO BE REMOVED.
2. RAMPS WOULD NEED TO BE STRUCTURAL RAMPS IN LIEU OF EARTH SUPPORTED.
3. TRAFFIC SIGNALS WILL BE NEEDED TO ALLOW FOR OUTBOUND TRAFFIC TO ENTER THE HIGHWAY.
4. OUTBOUND RAMP PROJECTS OVER "MARGINAL STREET."

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Figure 3.4-2 West 13th Street (Gansevoort Property) - Site Plan

CITY OF NEW YORK
DEPARTMENT OF SANITATION

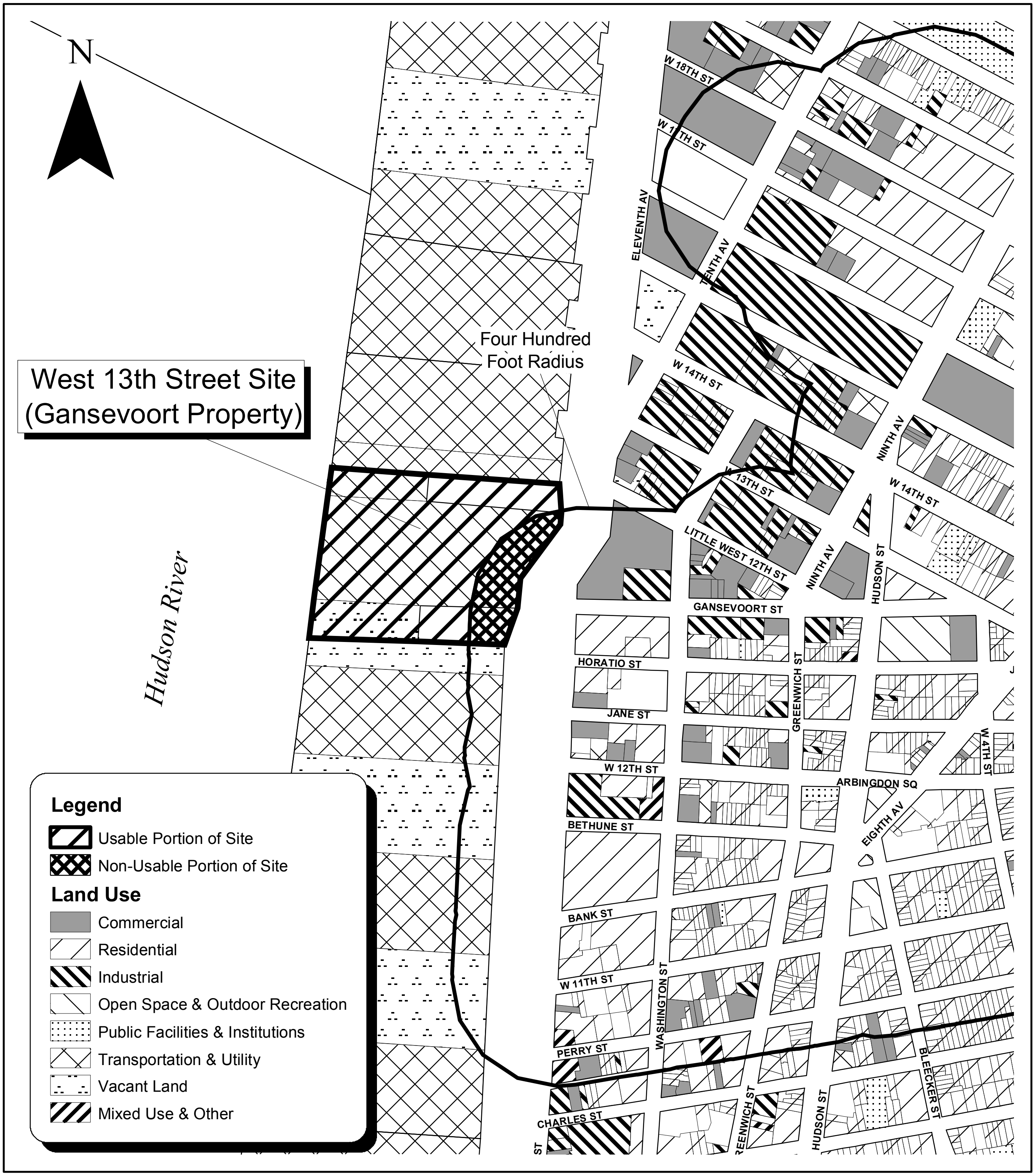
THE CITY OF NEW YORK DEPARTMENT OF SANITATION

Furthermore, there may be potential difficulties with respect to the Siting Rules, since the site is no longer owned by DSNY and is part of a public park. (See Figure 3.4-3, West 13th Street [Gansevoort Property] Siting Requirements.)

The Hudson Park River Trust, the city/state partnership charged with the development of the Hudson River Park, oversees and operates the site, and is currently in the planning stages for converting the Gansevoort property into parkland with recreational activities. These recreational areas will include a sandy beach, baseball fields, batting cages, a play lawn, a sunning beach and a marina, as well as a stop for water taxis. Fire Department Marine Company One, Manhattan's only remaining waterside fire station, will remain on Pier 53, adjacent to the Gansevoort property to the North. Other future plans include an overlook platform and park concessions. This plan is a part of a larger plan to convert the waterfront, from Battery Park City to West 59th Street, into park facilities between the U.S. Pierhead Line and the western boundary of West 11th and 12th Streets.

Current Law (Assembly Bill 9833-B of March 10, 1998) states: "The City of New York shall use its best efforts for the relocation of the sanitation garage and by December 31, 2003 relocate the salt pile and remove the incinerator." If the DSNY sought to change this language and pursued the development of the transfer station at Gansevoort, the legislation that created the park would have to be amended. The DSNY would be seeking to develop non-park use on managed parkland. Approval of this type of legislation is rare.

State law also requires that any "alienation of parkland" pertaining to the Gansevoort property (as part of the larger parkland overseen by the Hudson River Park Trust) not only necessitates an act of the Legislature, but also requires that it be subject to the City's Uniform Land Use Review Procedure. Furthermore, the law designates the waterside area of the property, and all the property along the designated parkland, as an "estuarine sanctuary" and is thereby subject to applicable environmental conservation law. Additionally, federal and state permits issued to allow for the development of the park, in particular those related to development over the water, would have to be modified. Important obstacles exist to making this site a transfer station.



Site delineations and analysis boundaries are approximate.
Base Map Source: New York City Department of City Planning

0 250 500 1,000 Feet

HDR | HydroQual

Figure 3.4-3 West 13th Street (Gansevoort Property) - Siting Requirements

CITY OF NEW YORK
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In addition to the legislative restrictions mentioned above, the site is adjacent to public parks on Pier 51 that include a new maritime-themed playground, a water play area, climbing equipment and slides and viewing scopes, which have been open to the public since Spring 2003.

In conclusion, it may be possible to obtain a permit for the site, but the substantial land use and legislative constraints pose obstacles to the development of this site as a transfer station.

4.0 CONCLUSIONS

This Study has reviewed four potential sites for possible use as waste transfer facilities capable of processing 1,000 tpd. The four sites are: West 140th Street, Pier 42, West 30th Street and West 13th Street (Gansevoort Property). As a result of location, land use, technical, operational and legislative criteria considerations, all four potential sites present either significant problems in terms of technical feasibility or present major obstacles in terms of legislative or land use constraints, as summarized in Table 4-1.

Table 4-1
Results of Screening Evaluation

Site	Screening Result
West 140th Street	Infeasible due to technical issues
Pier 42	Very significant technical and land use obstacles to overcome
West 30th Street	Infeasible due to technical issues
West 13th Street (Gansevoort Property)	Important legislative and zoning obstacles exist to making this a transfer station

COMMERCIAL WASTE MANAGEMENT STUDY

VOLUME VI

WASTE VEHICLE TECHNOLOGY ASSESSMENT

March 2004

Prepared for:

New York City Department of Sanitation
for submission to the New York City Council

Prepared by:

Henningson, Durham & Richardson
Architecture and Engineering, P.C.'s
Subconsultant, Urbitran, Inc.

This report was prepared for

HDR

Henningson, Durham & Richardson
Architecture and Engineering, P.C.

by its
Subconsultant

URBITRAN

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Acronyms	
AFV	alternative fuel vehicle
CAA	Clean Air Act
CH_4	methane gas
CMAQ	Congestion Mitigation and Air Quality Improvement Program
CNG	compressed natural gas
CO	carbon monoxide
CO_2	carbon dioxide
DOC	diesel oxidation catalyst
DOE	Department of Energy
DPF	diesel particulate filter
DSNY	New York City Department of Sanitation
EGR	exhaust gas recirculation
EPACT	Energy Policy Act
ETBE	ethyl tertiary butyl ether
GVWR	gross vehicle weight rating
HAP	hazardous air pollutant
HC	hydrocarbon
HEV	hybrid electric vehicle
hp	horsepower
hp-hr	horsepower-hour

Acronyms	
LL74	Local Law 74, effective December 19, 2000, enacted by the City Council, requiring a comprehensive assessment of commercial solid waste management in New York City
LNG	liquefied natural gas
MTA	Metropolitan Transportation Authority
NO_X	nitrogen oxide
NYCDEP	New York City Department of Environmental Protection
NYCDOT	New York City Department of Transportation
NYCT	New York City Transit
NYSDEC	New York State Department of Environmental Conservation
NYSERDA	New York State Energy Research and Development Authority
O_3	ozone
OEM	original equipment manufacturer
PM	particulate matter
ppm	parts per million
psi	pounds per square inch
SCR	selective catalytic reduction
SO_2	sulfur dioxide
TEA-21	Transportation Equity Act for the 21st Century
USDA	United States Department of Agriculture
ULSD	ultra-low-sulfur diesel fuel
USEPA	United States Environmental Protection Agency

Definitions	
City	New York City
B5	A blend of biodiesel fuel, made up of 95% petroleum-based diesel fuel and 5% biodiesel fuel
B20	A blend of biodiesel fuel, made up of 80% petroleum-based diesel fuel and 20% biodiesel fuel
B100	Biodiesel fuel in its pure form with no petroleum diesel fuel added
Consultant	The DSNY's Consultant Team, including Henningson, Durham & Richardson Architecture and Engineering, P.C.; Parsons Brinckerhoff Quade and Douglas, Inc.; Ecodata, Inc.; Franklin Associates, Ltd.; Urbitran Associates, Inc.; HydroQual, Inc.; and Cambridge Environmental, Inc., who prepared the Commercial Waste Management Study
E10	Ethanol blend of 10% ethanol and 90% gasoline
E85	Ethanol blend of 85% ethanol and 15% gasoline
E95	Ethanol blend of 95% ethanol and 5% gasoline
Final Study Scope or Final Scope of Work	Commercial Waste Management Study Final Scope of Work issued on July 31, 2003
M85	Mixture of 85% methanol and 15% gasoline
M100	Pure methanol
New SWMP	The new comprehensive Solid Waste Management Plan to be developed in 2004 for both DSNY-managed Waste and commercial waste for the planning period 2004 through 2024
New SWMP Planning Period	The 20-year period from 2004 to 2024 addressed by the City's New Solid Waste Management Plan
Study	Commercial Waste Management Study

EXECUTIVE SUMMARY

PREFACE

Local Law 74 of 2000 (LL74) mandated a comprehensive study of commercial waste management (Commercial Waste Management Study or Study) in New York City (City) by a Consultant funded by the City Department of Sanitation (DSNY). This Study undertaken to comply with LL74 will assist the City in managing the commercial waste stream in the most efficient and environmentally sound manner, and to assist in the development of the City's Solid Waste Management Plan (New SWMP) for the New SWMP Planning Period.

Among the topics that LL74 requires the Study to address are: *". . . the size and type of vehicles that should be authorized to transport sold waste to or from putrescible and non-putrescible solid waste transfer stations and fuel type requirements for such vehicles."* The Commercial Waste Management Study Final Scope of Work elaborates on this requirement, stating: *"Under almost any scenario for the future, the movement of solid waste in the City will remain heavily dependent upon diesel-powered trucks. The ideal and most effective measure to reduce air pollution would be to reduce the emissions by these trucks. The main objective of this Task is to determine if particulate traps, alternate fuels, or truck types might be feasible and lawful means of reducing truck emissions. In consultation with DSNY, which has extensive experience in testing alternative fuels and emissions control equipment on its collection fleet, the Consultant Team will provide an overview of the different options for alternative fuels and vehicle types/retrofits. The focus will be on proven technologies and vehicle types. If regulations are to be imposed or incentives provided, they must represent realistic emission reduction technology and options that would not create undue hardship for truck fleet operators. . . . An evaluation will be performed to determine if a particular type or types of vehicle would be more economically and environmentally feasible. To assess whether alternatives can be implemented, the following will be examined: Regulatory Options . . . [and] . . . Institutional Barriers."*

In addition to this Volume VI, this Study consists of five other volumes:

- Volume I: Private Transfer Station Evaluations;
- Volume II: Commercial Waste Generation and Projections;
- Volume III: Converted Marine Transfer Stations – Commercial Waste Processing and Analysis of Potential Impacts;
- Volume IV: Evaluation of Waste Disposal Capacity Potentially Available to New York City; and
- Volume V: Manhattan Transfer Station Siting Study.

This volume, Volume VI: Waste Vehicle Technology Assessment, reports on a survey of alternative fuels, new engine technologies and vehicle emission retrofit options that are appropriate for use on waste collection vehicles and profiles the innovative DSNY programs and initiatives implemented to evaluate alternative fuels, engine technologies and retrofit options. The volume provides an assessment of the advantages and disadvantages of the various options to reduce consumption of fossil fuels and/or reduce vehicle emissions, and recommends cleaner technologies, including technologies that DSNY had previously tested and, in some cases, targeted for implementation.

EXECUTIVE SUMMARY

Scope of Analysis/Approach

The purpose of this evaluation is to explore the different types of alternative and clean fuel technologies available to determine which clean and alternative fuel technologies are most feasible for the unique demands of heavy-duty refuse haulers operating in the City. The review presented in the Waste Vehicle Technology Assessment report weighs the economic, environmental and logistical advantages and disadvantages of various clean and alternative fuel technologies. After thorough research and analysis of all available viable options, including several case studies, options that are best suited for heavy-duty refuse haulers operating in the City are presented.

Findings

The report found that clean diesel technology is best suited for the City's refuse hauling vehicles. It provides substantial emission reduction benefits without having a major impact on fuel efficiency and cost. Natural gas technologies are also well suited for the City's refuse hauling vehicles. However, the use of this technology entails significant infrastructure investment, and, because of high demand for natural gas, has greater cost uncertainties.

Clean Diesel Options

The clean diesel options discussed in the report can cut vehicle emissions by 90% or more.

Engine tune-ups are the least expensive way to reduce particulate matter (PM) emissions. This emission reduction strategy can also lower operating costs, extend engine life and improve fuel economy. However, it should be noted that repairs and maintenance of diesel engines tend to increase nitrogen oxide (NO_X) emissions.

In addition to tune-ups, in certain circumstances, the **replacement of older diesel engines and equipment** may be the most sensible and cost-effective emissions improvement options. When old vehicles are replaced, fleet managers can substitute their oldest and worst emissions performers with new technology present in new diesel engines that are designed to produce much lower emissions.

Sulfur found in fuel degrades the effectiveness and life of after-treatment devices by inhibiting the function of existing filters and catalysts. By using **ultra-low-sulfur diesel** (ULSD) (which has a sulfur content of 15 parts per million [ppm] or less) and/or low-sulfur diesel fuel (sulfur content between 30 ppm and 15 ppm), there can be improvements in the performance of after-treatment technologies seeking to reduce emission levels. However, ULSD fuel only reduces PM and sulfur dioxide (SO_2) emissions. Without after-treatment devices, it does not reduce emissions such as hydrocarbons (HC), carbon monoxide (CO) or NO_X emissions. Some operating and maintenance concerns associated with ULSD fuel include a slightly lower fuel economy as compared with regular diesel, and concerns regarding the lubrication properties of the fuel. DSNY, a leader in experimenting with heavy-duty refuse vehicles, currently has 600 of its 2,040 refuse collection trucks using low-sulfur diesel fuel.

Diesel oxidation catalysts (DOCs) devices are considered the most proven of after-treatment options and can be used with existing or used engines to pollute less by retrofitting them.[1] According to the Diesel Technology Forum, emissions benefits include reductions of total PM by 20% to 50% and CO and HC by 60% to 90%.[2] They do not reduce NO_X emissions.

Diesel particulate filters (DPFs), when used with ULSD fuel, can reduce PM emissions by 50% to 90%, and HC and CO emissions by as much as 90%. However, like oxidation catalysts, these devices do not reduce NO_X emissions.

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[1] Diesel Technology Forum, *Clean Air, Better Performance*, 2003.
[2] *Ibid.*

Although the use of DOCs and DPFs is not yet widely available for waste collection trucks, tests are ongoing that are assessing the use of these after-treatment options. DSNY is taking the lead in testing these technologies.

Another emission reduction strategy is to use **exhaust gas recirculation** to decrease NO_X levels. With the new, lower-sulfur diesel fuels, production of sulfuric acid will be minimized. This technology can reduce NO_X emissions by as much as 40%, and can also be used with engines being retrofitted.

Selective catalytic reduction (SCR) has been used for over 15 years to reduce NO_X emissions from stationary sources. Emission reductions include NO_X by 75% to 90%, HC reductions up to 80% and PM reductions of 20% to 30%.

Currently, **NO_X catalysts** are being experimented with in the United States on retrofitted vehicles. Two NOx catalyst technologies, "lean NO_X catalyst" and "NO_X absorber," are currently being developed, and can reduce NO_X emissions up to 70%.

Natural Gas

The main incentive for choosing natural gas as an alternative fuel for heavy-duty refuse trucks is the emissions benefits. Studies of heavy-duty engines running on compressed natural gas (CNG) and diesel have shown that engines fueled with CNG emit significantly less PM (80% to 90% less) and NO_X (50% to 60% less) emissions than diesel engines. Another benefit of using a CNG engine is the reduction of engine noise, as CNG engines are significantly quieter than diesel engines. Furthermore, investing in CNG facilities now will ease future transitions to hydrogen fuel cells as a vehicle-fueling source.[3]

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[3] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*

One of the major disincentives to creating a CNG refuse truck fleet is the cost related to purchasing the trucks and the infrastructure needed for a CNG facility. A CNG trash hauler can cost up to $70,000 more than a conventional diesel truck. In addition, the cost of a CNG facility with fueling, proper ventilation and leakage alarms can cost $500,000 to $1,250,000 to construct.[4] Another disadvantage of CNG is that most of the natural gas used in CNG engines comes from reserves in North America. Due to unmet demand for natural gas in the U.S., natural gas has seen extreme price fluctuations. In addition to the high costs, other issues, such as lower fuel efficiency than conventional diesel garbage trucks (due to heavier weight and longer size of vehicles), limited vehicle range, and high methane (CH_4) and CO_2 emissions, must be considered.

Other Available Technologies

The report also evaluates the costs and benefits of other alternatives, including biodiesel, fuel cells, battery electric, propane, ethanol, methanol, and hybrid electric vehicles (HEVs), but none were deemed as promising and cost effective to DSNY as the clean diesel and natural gas options.

Based on this report, DSNY should consider the following options:

- Continuing to utilize and experiment with ULSD fuel and clean diesel technology in existing vehicles with the goal of all diesel vehicles, currently in operation, utilizing clean diesel technology to meet United States Environmental Protection Agency (USEPA) 2004 and 2007 emissions standards.
- Continuing to make clean diesel technology the preferred vehicle standard for new heavy-duty refuse vehicle purchases.
- Continuing to test and compare alternative fuel exhaust emissions in order to evaluate hybrid electric refuse vehicles.

[4] *Ibid.*

- Continuing to pursue its CNG heavy-duty program, so that DSNY will be able to take advantage of potential advancements in CNG technology and fuel cell technology.
- Continuing to develop partnerships with fuel suppliers, original equipment manufacturers (OEMs) and infrastructure providers in order to help reduce the cost of clean fuel implementation.
- For light-duty vehicles, continuing with ethanol purchase and plans for ethanol fueling facilities.
- Utilizing government grants and economic incentives to offset the higher costs associated with natural gas, hybrid electric and ethanol vehicles.

Private waste haulers in the City should consider these options:

- Retrofitting old diesel vehicles with clean diesel technology.
- Beginning to use ULSD ahead of June 2006 mandate.
- Deploying and purchasing clean diesel vehicles now to avoid future expenses that will be needed to meet new strict USEPA emission standards.
- Utilizing government grants and economic incentives to help offset the incremental capital costs associated with natural gas refuse vehicles.
- In conjunction with infrastructure supplier and engine manufacturers, exploring the future option of CNG heavy-duty refuse vehicles.

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[5] Diesel Technology Forum, *Clean Air, Better Performance*, 2003.
[6] *Ibid.*
[7] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*
[8] *Ibid.*

WASTE VEHICLE TECHNOLOGY ASSESSMENT

1.0 INTRODUCTION

1.1 The Growing Need For Clean Fuel Technologies

After the Second World War, petroleum began to replace coal as the primary energy source in the United States. Engineering developments and increased availability of petroleum resulted in a greater supply and lower cost of gas and oil. This fact, coupled with a post-war economic boom and increased U.S. investment in roads and highways, including the development of an interstate highway system, helped to spur greater automobile usage in this country. U.S. dependence on petroleum-based fuels grew as the automobile helped families migrate from cities to the suburbs, municipalities replaced trolley-car public transportation systems with buses, and trucks supplanted trains as the main transporter of goods.

The increased usage of petroleum-fueled vehicles did not come without a cost. Pollution levels began to rise, particularly in and around American cities, leading to heightened public concern about the relationship between emissions from petroleum fuel combustion and degraded air quality, acid rain and global warming. A by-product of petroleum fuel combustion is the release of gases and minute particles that pollute the atmosphere and create a public health concern. These health and pollution concerns are the primary reason for the push to convert fleets to alternative and clean low emissions fuels in the United States and much of the world.

1.1.1 Pollutants from Fossil Fuel Combustion

Among the gases emitted from fossil fuel combustion is carbon dioxide (CO_2). CO_2 is a naturally prevalent gas in the atmosphere and is as important to plant growth as oxygen is to animal growth. However, CO_2 is also responsible for absorbing radiation and helping to keep the planet warm. The release of CO_2 from fossil fuel combustion in recent decades has caused increased concentrations of CO_2 in the earth's atmosphere. Because CO_2 is an absorber of infrared radiation, it tends to restrict heat loss to space, and this has raised concerns about possible global warming, known as the "greenhouse effect."

Another gas emitted from petroleum fuel combustion is nitrogen oxide (NO_X). The release of NO_X is of particular concern to residents of large cities because it reacts with hydrocarbons (HC) in the presence of sunlight to create ground level ozone (O_3), more commonly referred to as smog. High levels of smog can cause lung and respiratory disorders; even short-term exposure can cause health problems, particularly in children and the elderly.

Particulate matter (PM) is released in the emission of petroleum fuel combustion. PM is the term for particles found in the air, including dust, dirt, soot, smoke and liquid droplets. PM can be large enough to be seen, as is the case with soot, or so fine that it is invisible to the naked eye. High levels of PM in the air can cause respiratory ailments, damage buildings and structures, and pollute water and soil. PM emitted from heavy-duty vehicles' diesel fuel combustion, such as trucks and buses, is of particular concern in dense metropolitan areas. Studies have shown that associations exist between airborne pollutants generated by diesel-powered vehicles and health risks, such as reduced lung function, lung damage, increased asthma attacks and premature mortality.

Other pollutants emitted from fossil fuel combustion are sulfur dioxide (SO_2) and carbon monoxide (CO). SO_2 escapes into the atmosphere where complex chemical reactions take place, converting the SO_2 into sulfuric acid. The sulfuric acid returns to the earth in the form of acid rain. Acid rain can adversely affect certain water bodies and forests, especially those with limited natural acid buffering capacity. CO, the by-product of the incomplete combustion of petroleum fuel, is emitted directly from vehicle tailpipes. CO is a poisonous gas that can affect the cardiovascular and central nervous system by limiting the ability of hemoglobin to carry oxygen.

1.1.2 Dependence on Foreign Oil Supplies

In addition to pollution, the limited supply of crude oil worldwide and the United States dependence on foreign oil sources are additional concerns related to fossil fuel use by transportation vehicles and fleets. Worldwide crude oil production is approaching its peak. Conservative estimates, made by experts associated with oil companies, indicate that the world's crude oil supply will peak around the year 2025.[1] After peaking, petroleum production will begin to decline, causing the price of petroleum to increase. Serious implications for the U.S. economy are likely to result, as currently over 97% of the fuel used for transportation is petroleum-based. Over the past 20 to 30 years, the United States has become more and more dependent on foreign sources of oil. Domestic petroleum production peaked in the early 1970s and as a result the U.S. economy has become increasingly reliant on foreign sources of oil, particularly from the politically volatile Middle East.[2] World oil reserves nearing their peak and increased U.S. dependence on foreign oil supplies have underscored the need for a transition from petroleum-based fuels to alternative and more efficient fuels or sources of energy.

1.2 Efforts To Promote Clean Fuel Technologies

In order to spur use of clean fuel technologies, federal, state and local governments have passed legislation and set requirements that mandate the use of clean alternative fuels in public and private vehicle fleets. In some cases, government agencies have also subsidized purchases of alternative fuel vehicles (AFVs). The purpose of these efforts is to create a greater market for clean and alternative fuel technologies and foster a wider use of clean and alternative fuels throughout the country.

1.2.1 Federal Mandates That Promote Clean Fuel Technologies

The Clean Air Act (CAA) was first passed in 1970, with significant amendments occurring in 1977 and 1990. The CAA and its implementing regulations are intended to reduce stationary and mobile source air pollution nationwide. CAA regulations set emissions and air quality standards to reduce human and environmental exposure to pollutants. Among the requirements of the CAA are stipulations for certain centrally-fueled vehicle fleets in cities that are in non-attainment areas for CO or O_3 (as defined by the CAA), and to phase in a percentage of new vehicles that meet CAA emission standards.[3]

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[1] National Conference of State Legislatures, *Ground Transportation for the 21st Century*, August 1999.
[2] *Ibid.*
[3] Section 246 of the Clean Air Act as amended 1990, http://www.epa.gov/air/caa/caa246.txt.

1.2.2 Federal Agencies' Role in Promoting Clean Fuel Technologies

The United States Environmental Protection Agency (USEPA) sets the standards for the amount of pollution vehicles can emit and tests heavy-duty engines for emissions certification. The USEPA has recently established a national program to further regulate heavy-duty vehicle emissions, with new standards to become effective in 2007. To comply with the new standards, the USEPA is requiring diesel fuel to have reduced sulfur amounts by 2006.[4] Table 1.2.2-1 summarizes some of the USEPA standards for newly manufactured heavy-duty trucks with a gross vehicle weight rating (GVWR) over 33,000 pounds.

Table 1.2.2-1
Select USEPA Emission Certification Standards (grams/brake hp-hr) for Newly Manufactured Heavy-Duty Trucks over 33,000 pounds

Pollutant	1998-2003	2004-2007	2007+
Non-Methane Hydrocarbons	1.3	*	0.14
NO_X	4.0	*	0.2
Carbon Monoxide	15.5	15.5	15.5
Particulates	0.10	0.10	0.01

Source: INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*
*2004 Standards set total NO_X + non-methane hydrocarbons limit of 2.4 grams/brake hp-hr.

The Department of Energy (DOE) is responsible for providing federal leadership on clean fuels technologies by encouraging the purchase and use of AFVs. The DOE provides, through its voluntary Clean Cities program, information and funding for the purchase of alternative fuels. The DOE also manages the State and Alternative Fuel Provider Fleets Credits Program. This program allows credits to be taken for AFV purchases to prove AFV acquisition requirements.

The Federal Department of Transportation provides funding for the acquisition and use of AFVs. Through the Congestion Mitigation and Air Quality Improvement Program (CMAQ), it provides funding to states and cities in non-attainment areas for projects or programs that aim to reduce vehicle emissions and improve air quality. CMAQ funding is authorized through the Transportation Equity Act for the 21st Century (TEA-21).[5]

[4] U.S. Environmental Protection Agency, Office of Transportation and Air Quality, Heavy Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements (EPAA420-F-00-057), December 2000.
[5] U.S. Federal Highway Administration, Office of Environment, *CMAQ Congestion Brochure*, http://www.fhwa.dot.gov.environment/cmaq/funding.htm.

1.2.3 State and Local Initiatives and Mandates

New York City (City) and New York State also have initiatives aimed at stimulating the use of alternative fuels. New York City Local Law 6, passed in 1991, requires the City to purchase AFVs. After passage of this law, the City implemented a multi-agency program with New York City Department of Environmental Protection (NYCDEP), New York City Department of Transportation (NYCDOT), and New York City Administrative Services to buy alternative vehicles and help to develop necessary fueling infrastructure. However, Local Law 6, as with the case of the federal Energy Policy Act of 1992 (EPACT), does not mandate the actual use of alternative fuels but rather the purchase of AFVs. EPACT has mandated the purchases of AFVs for federal government and state government agencies.[6]

The NYCDOT and the New York State Energy Research and Development Authority (NYSERDA) provide grant funding that seeks to offset the incremental costs associated with the purchase of new or converted AFVs. This program is known as the New York City Private Fleet Alternative Fuel Program. Covered under this program are incremental costs (above diesel costs) of vehicle acquisition, conversions and fueling infrastructure, and medium- and heavy-duty natural gas, electric and hybrid electric vehicles (HEVs). However, funding is not available for any additional fuel costs. The City and NYSERDA use federal CMAQ funds for this program.[7] Manhattan Beer, the first private company in the Bronx to use heavy-duty compressed natural gas (CNG) vehicles, received funding under the City's Alternative Fuel Program in 2002.[8]

Funds to purchase AFVs, such as alternative fuel garbage trucks, are also available through the Clean Air Communities program. This program was established in 1999 by the New York State Department of Environmental Conservation (NYSDEC), Northeast States Clean Air Foundation, Northeast States Coordinated Air Use Management and members of the private and non-profit sectors. The program funds clean air transportation programs in the City.[9]

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[6] Alternative Fuel Vehicles Summit, Outcomes & Recommendations, April 11, 2002.
[7] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*
[8] Alternative Fuel Vehicles Summit, *Outcomes & Recommendations*, April 11, 2002.
[9] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*

The New York City Department of Sanitation (DSNY) has also been successful at obtaining funding for its use of alternative fuel programs. DSNY has been able to acquire CMAQ funding to help purchase CNG refuse trucks; there are currently 26 CNG refuse trucks in its fleet.[10]

Federal tax code allows federal income tax deductions for businesses that purchase AFVs or build a refueling facility that utilizes alternative fuels. These tax deductions are only for the incremental costs compared with diesel vehicles and diesel fueling facilities. The deductions are for converted or retrofitted vehicles and vehicles purchased from original equipment manufacturers (OEMs). The fueling deduction is applicable to each fueling station installed by a business at a single location.

Along with federal tax deductions that target the incremental costs associated with clean fuel vehicles and clean fuel facilities, New York State provides tax credits for AFVs and infrastructure. In addition, New York State has a sales tax exemption for AFVs.[11]

[10] Based on meeting with Spiro Kattan, Supervisor of Mechanics, Bureau of Motor Equipment, DSNY, July 9, 2003.
[11] *Ibid.*

2.0 CLEAN FUEL TECHNOLOGIES BEST SUITED FOR NEW YORK CITY REFUSE HAULERS

2.1 Clean Diesel Technologies

Due to more stringent USEPA regulations concerning diesel engine tailpipe emissions, since the 1970s the diesel engine industry has produced technology innovations that have reduced the emissions produced by heavy-duty diesel engines. Diesel engines produced today emit 83% less PM and 63% less NO_X than comparable engines did in 1988. Furthermore, for on-highway heavy-duty diesel engines built in model year 2007 and beyond, USEPA regulations require reductions of 98% from 1988 levels in both PM and NO_X. Reductions in these emissions are important because diesel engines emit significantly higher levels than gasoline engines. However, diesel engines emit less CO, HC and CO_2 than gasoline engines.[12]

USEPA estimates indicate that the incremental costs of retrofitting a diesel heavy-duty truck to meet 2004 standards will include an average hardware cost of $8,000. This increase in cost will likely add 3% to 8% to the cost of a new garbage truck. Table 2.1-1 indicates that the 2007 standards will also result in new hardware and life-cycle operating cost increases.[13]

Table 2.1-1
USEPA Cost Projections for Heavy-Duty Diesel
2004 & 2007 Emissions Standards (1991 dollars)

Standards (Year)	Hardware Costs	Life-Cycle Operation Costs	Total Incremental Costs
2004 Standards	$5,200-$16,500	$0	$5,200-$16,500
2007 Standards	$2,020-$3,230	$4,180-$4,630	$6,200-$7,860

Source: INFORM, Inc., Greening Garbage Trucks: New Technologies for Cleaner Air.[14]

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[12] Diesel Technology Forum, *Cleaner Air, Better Performance Strategies for Upgrading and Modernizing Diesel Engines*, 2003.
[13] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*
[14] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air*; See also U.S. Environmental Protection Agency, Nonconformance Penalties for Heavy-Duty Diesel Engines, Environmental Fact Sheet, EPA420-F-01-034, December 2001, http://www.epa.gov/otaq/regs/hd-hwy/ncp/f01034.htm; Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements, Regulatory Announcement, EPA420-F-00-57, December 2000, http://www.epa.gov/otaq/regs/hd2007/frm/f00057.htm; U.S. Environmental Protection Agency, *Regulatory Impact Analysis: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements*, EPA-420-R-00-026, December 2000, http://www.epa.gov/otaq/regs/hd2007/frm/exec-sum/pdf.

Because well-maintained diesel engines can be operated for 20 to 30 years, this section outlines clean diesel technologies that can be applied to the engines comprising the nation's existing fleet of more than five million diesel trucks not covered under the 2004 and 2007 USEPA emission regulations. Engines built prior to 2007 will still be used up until 2035. Furthermore, 41% of the waste collection vehicles currently in service are more than 10 years old. These vehicles become more polluting as they age and can generate tens or hundreds of times more pollution than their newer engines. Clean fuel technology is a cost-effective way of meeting future regulatory mandates and reducing emissions from older and existing engines that are not covered under the new 2004 and 2007 USEPA emissions standards.[15]

The clean diesel options discussed in this section include advanced exhaust after-treatment, engine modification technologies and ultra-low-sulfur diesel (ULSD) fuel. These technologies can cut vehicle emissions by 90% or more. The remainder of this section will discuss the options and enhancements available to reduce emissions produced from diesel engines. These options and emission reductions are summarized in Table 2.1-2.

2.1.1 Engine Tune-Ups

Proper diesel engine maintenance helps ensure fuel is completely burned during combustion. Fuel that is incompletely burned is emitted as exhaust PM. Proper maintenance and tuning is the least expensive way to reduce PM emissions. This emission reduction strategy can also lower operating costs, extend engine life and improve fuel economy. Common maintenance problems that when fixed improve emissions include improper fuel injection timing, problems with fuel injectors and injection pumps, clogged air filters, poor fuel quality, low air box pressure and malfunctioning turbochargers and after-coolers. Studies looking at the results of repair and maintenance of diesel engines indicate that HC emissions can be reduced 78%, CO 17%, and PM 40%.[16]

[15] Diesel Report Outlines five R's for Cleaner Air, *Mass Transit*, July/August 2003; Diesel Technology Forum, *Cleaner Air, Better Performance: Strategies for Upgrading and Modernizing Diesel Engines*, 2003.
[16] *Ibid.*

Table 2.1-2
Clean Diesel Enhancement Options and Projected Emission Reductions

Enhancement Option	Particulate Matter	NO_X	Hydro-carbons	Carbon Monoxide	Unit Cost
Basic Emissions Tune-Up[17]	40%	Return to Certification Levels	78%	17%	\$500-\$2,500
Low-Sulfur Diesel Fuel[18]	17%	---	---	---	\$0.01-\$0.02/gal[19]
Diesel Oxidation Catalysts (DOCs)[20]	20%-50%	---	60%-90%+	90%+	\$465-\$1,750
Diesel Particulate Filters (DPFs)[21]	50%-90%	---	90%	90%	\$7,500
Exhaust Gas Recirculation (EGR)[22]	---	40%	---	---	\$13,000-\$15,000
Selective Catalytic Reduction (SCR)[23]	20%-30%	75%-90%	80%	---	\$10,000-\$15,000
NO_X Catalysts	---	10%-70%	---	---	Under Development
2002 Model Year Engine[24]	83%	63%	---	---	\$30,000-\$40,000[25]
2004 Model Year Engine[26]	83%	81%	---	---	---
2007 Model Year Engine[27]	98%	98%	---	---	---

Source: Diesel Technology Forum, *Cleaner Air, Better Performance Strategies for Upgrading and Modernizing Diesel Engines*, 2003.

[17] Colorado Institute for Fuels and Engine Research, Colorado School of Mines and Energy and Environmental Analysis, Inc, *Quantifying the Emissions Benefit of Opacity Testing and Repair of Heavy-Duty Diesel Vehicles*, June 2000.
[18] Estimate for switching from off-road diesel, which averages around 3,000 ppm sulfur to today's federal highway diesel, which averages around 300 ppm sulfur. This percentage is based on data from emission test data from a study conducted by the USEPA. USEPA Office of Mobile Sources, *Exhaust Emission Factors for Non-Road Emission Modeling-Compression Ignition*, June 1998.
[19] The marginal costs increase will vary according to supplier, delivery location, market price, and any pre-negotiated pricing contracts. *Hart's Diesel Fuel News*, May 27, 2002.
[20] Manufacturers of Emission Controls Association, *Retrofitting Emissions Controls on Diesel-Powered Vehicles*, March 2002; MECA Retrofit Fact Sheet, http://www.meca.org/retrofitFAQ.PDF.
[21] *Ibid*.
[22] *Ibid*.
[23] *Ibid*.
[24] Reductions are based on USEPA heavy-duty diesel engine certification standards for new on-highway engines. Percent reductions compared to new engine standards for base model year of 1988. Diesel Technology Forum, *Cleaner Air, Better Performance: Strategies for Upgrading and Modernizing Diesel Engines*, 2003.
[25] Diesel Technology Forum, *Cleaner Air, Better Performance: Strategies for Upgrading and Modernizing Diesel Engines*, 2003; Michael D. Jackson and Fanta Kamakate, NOx Emissions Reduction Technology Status and Solutions, October 2002.
[26] Reductions are based on USEPA heavy-duty diesel engine certification standards for new on-highway engines. Percent reductions compared to new engine standards for base model year of 1988. Diesel Technology Forum, *Cleaner Air, Better Performance: Strategies for Upgrading and Modernizing Diesel Engines*, 2003.
[27] Ibid.

It should be noted that repairs and maintenance of diesel engines tend to increase NO_X emissions. This is expected because engine strategies and repairs that lower PM by increasing combustion efficiency and temperatures increase NO_X emissions. Deterioration of engine equipment that lowers combustion temperature and reduces engine efficiency tends to increase PM emissions and lowers NO_X emissions.

According to a study co-sponsored by the USEPA, repair costs and tune-ups can range from $500 to $2,500, with the average repair cost of $1,088 per vehicle.[28]

2.1.2 Ultra-Low-Sulfur Diesel Fuel and Low-Sulfur Diesel Fuel

Sulfur found in fuel degrades the effectiveness and life of after-treatment devices by inhibiting the function of filters and catalysts found in these devices. Diesel fuel with reduced sulfur content is known as ULSD (sulfur content of 15 parts per million [ppm] or less); low-sulfur diesel fuel contains sulfur content between 30 ppm and 15 ppm. The main purpose of lower sulfur content in diesel fuel is to improve the performance of after-treatment technologies that seek to reduce emission levels. USEPA regulations call for reducing the maximum allowable sulfur in on-road diesel fuel from the current level of 500 ppm to the ultra-low level of 15 ppm by 2006 – a 97% reduction.[29]

It should be noted that ULSD only reduces PM and SO_2 emissions. Used alone without after-treatment devices it does not reduce emissions such as HC, CO or NO_X emissions.

Some operating and maintenance concerns associated with ULSD include a slightly lower fuel economy and concerns regarding the lubrication properties of the fuel. ULSD can result in a slightly lower fuel economy when compared with regular diesel. When sulfur is removed from diesel, the fuel has a slightly lower energy content. Precise measurements of the ULSD fuel economy impacts are challenging because fuel energy content can vary depending on the

[28] Diesel Technology Forum, *Cleaner Air, Better Performance: Strategies for Upgrading and Modernizing Diesel Engines*, 2003.
[29] New York City Department of Sanitation, *Alternative Fuels/Emissions Reduction Program*; Diesel Technology Forum, *Cleaner Air, Better Performance: Strategies for Upgrading and Modernizing Diesel Engines*, 2003.

refinery and exact diesel blend used. In addition, operation conditions need to be taken into account when comparing fuel economies. Studies indicate that the energy content of ULSD can be from 2.4% to 2.8% lower than ordinary highway diesel. Correspondingly the fuel economy of trucks using ULSD is roughly 3% lower than trucks running on regular diesel.[30]

The lubricating properties of diesel degrade when sulfur is removed from the fuel. To address this issue, oil refiners add lubricity additives. Industry lubricity standards are currently being developed for ultra-low diesel fuels. In general, in order to determine if the ULSD fuel is compatible with engine part components, operators should contact their OEMs before using ULSD in pre-1994 engines. In the past, ULSD fuel was causing problems with certain fuel injection devices; these problems have been eliminated for engines built since 1993.[31]

USEPA estimates indicate that new sulfur standards will increase the cost of producing and distributing diesel fuel by $0.045 to $0.05 cents per gallon. Low-sulfur diesel is currently used and being tested in locations in the United States that have significant air quality problems, such as California and the City. DSNY currently uses low-sulfur fuel in approximately 30% of its refuse truck fleet and pays slightly more per gallon (approximately $0.15 on average) for the low-sulfur fuel than for conventional diesel fuel. In 2001, the Metropolitan Transportation Authority (MTA) paid an extra $0.12 cents per gallon for low-sulfur diesel fuel and the Massachusetts Bay Transportation Authority (Boston) paid an additional $0.17 cents per gallon.[32]

2.1.3 Diesel Oxidation Catalysts

Diesel oxidation catalysts (DOCs) have been used for over 30 years; more than 1.5 million units have been installed on heavy-duty trucks built since 1994. They've also been used extensively on urban buses in the United States. These devices are considered the most proven of after-treatment options and can be used with existing or used engines to pollute less by retrofitting them.[33]

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[30] Puget Sound Clean Air Agency, *Facts About Ultra-Low Sulfur Diesel Fuel, Diesel Solutions: Cleaner Air For Tomorrow, Today*; INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*
[31] *Ibid.*
[32] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*
[33] Diesel Technology Forum, *Clean Air, Better Performance*, 2003.

According to the Diesel Technology Forum, emissions benefits include reductions of total PM by 20% to 50% and CO and HC by 60% to 90%.[34] (Oxidation catalysts do not reduce NO_X emissions.) However, the USEPA states that DOC reduces emissions by a smaller amount. They contend that DOC reduces emissions of PM by at least 20%, CO by 40% and HC by 50%.[35]

Oxidation catalysts interact with the exhaust stream by oxidizing pollutants into water vapor and gases such as CO_2 and SO_2. Most oxidation catalysts are stainless steel canisters with a honeycomb-like structure inside, called a substrate. Precious metals, such as platinum and palladium, coat the interior surface of the substrate, helping to produce a chemical reaction that oxidizes the pollutants found in the exhaust stream. Oxidation catalysts can be used with regular diesel fuel, but the effectiveness may be increased with the use of ULSD fuel (15 ppm sulfur).

Costs for these devices range from $465 to $1,750, and may take from one to three hours to install. Like a catalytic converter on a car, once a DOC is installed it rarely requires maintenance. They last from 7 to 15 years and usually have a 100,000 to 150,000 mile warranty.

Figure 2.1.3-1
Diesel Oxidation Catalyst

[34] *Ibid.*
[35] U.S. Environmental Protection Agency, Office of Transportation and Air Quality, *Questions and Answers on Using Diesel Oxidation Catalysts in Heavy-Duty Trucks and Buses*, June 2003.

2.1.4 Diesel Particulate Filters

Diesel particulate filters (DPFs), when used with ULSD, can reduce PM emissions by 50% to 90%, and HC and CO emissions by as much as 90%. However, like oxidation catalysts, these devices do not reduce NO_X emissions. Particulate filters cost roughly $7,500.[36]

DSNY filters cost $6,000 each. Testing by DSNY and West Virginia University of DPFs on heavy-duty sanitation vehicles has shown that particulate filters have the ability to reduce PM emissions by 81% to 97%. These tests compared diesel sanitation trucks that were equipped with DPFs against vehicles that were not equipped with the same filters.[37]

Particulate filters consist of a filter placed in the exhaust stream to collect particulate emissions as the pollutants pass through the filter. One main problem with these devices is that the filters become clogged over time and trap less and less particulate. Current research is focused on developing methods to dispose of this particulate by oxidizing it within the filter (filter regeneration). Like DOCs, particulate filters can be used with retrofitted engines. Tests are ongoing that are assessing the use of DOCs and DPFs in waste collection trucks. These after-treatment options are not yet widely available for waste collection trucks. DSNY is taking the lead in testing these technologies.

Figure 2.1.4-1
Particulate Filter

[36] Diesel Technology Forum, *Cleaner Air, Better Performance: Strategies for Upgrading and Modernizing Diesel Engines*, 2003.
[37] West Virginia University, Transportable Heavy Vehicle Emissions Testing Laboratory, *DPF Demonstration Program: Final Data Report,* November 2002.

2.1.5 Exhaust Gas Recirculation

Using exhaust gas recirculation can reduce NO_X emissions. It lowers NO_X by reducing the oxygen content in the combustion chamber. A share of the engine exhaust is recycled back to the engine air intake. The exhaust gas is then mixed into the fresh air that enters the combustion chamber. Because the exhaust gas is oxygen-depleted, this gas then reduces the oxygen content within the combustion chamber, resulting in a lower temperature burn and lower NO_X emission levels.

Due to the formation of sulfuric acid from the sulfur present in the fuel and lubricating oil, exhaust gas recirculation tends to reduce engine durability. However, with the new, lower-sulfur diesel fuels, production of sulfuric acid will be minimized. Exhaust gas recirculation can reduce NO_X emissions by as much as 40%, and can be used with engines that are being retrofitted.

Solid waste vehicles and buses in the United States are currently experimenting with exhaust gas recirculation. This engine modification system costs between $13,000 and $15,000.[38]

2.1.6 Selective Catalytic Reduction Devices

Selective catalytic reduction (SCR) has been used for over 15 years to reduce NO_X emissions from stationary sources. In the United States, SCR has been used in electrical utility boilers that burn coal and natural gas and in combustion turbines burning natural gas. SCR is now being developed in retrofit projects on mobile sources, including trucks and marine vessels. Emission reductions include NO_X by 75% to 90%, HC reductions up to 80% and PM reductions of 20% to 30%.

SCR operates like an oxidation catalyst by using chemical reactions that change pollution compounds. In addition to the catalytic activity, a reducing agent – usually ammonia or urea – is added to the exhaust stream. The reducing agent converts NO_X to nitrogen and oxygen. The exhaust gas and the reducing agent pass over the catalyst-coated substrate, where NO_X, PM and HC are converted to nontoxic emissions, such as molecular nitrogen and water. SCR devices cost between $10,000 and $50,000 per vehicle.[39]

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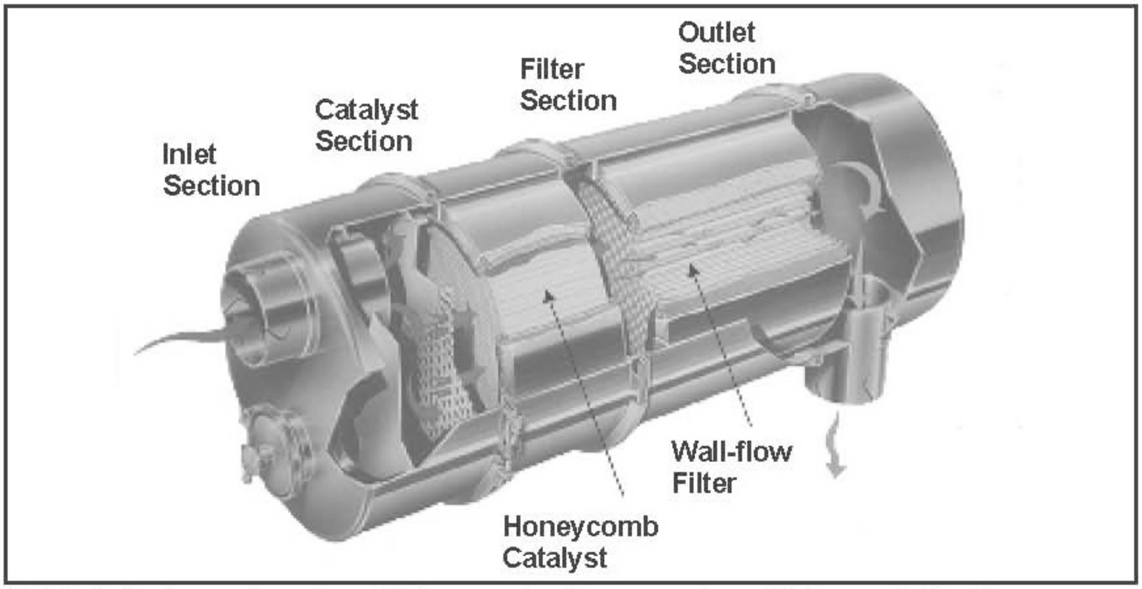
[38] *Ibid.*
[39] *Ibid.*

Figure 2.1.6-1
Cutaway View of a Catalytic Converter



2.1.7 NO_X Catalysts

Currently, NO_X catalysts are being experimented with in the United States on retrofitted vehicles. Two NOx catalyst technologies are currently being developed that can reduce NO_X emissions up to 70%.

The first technology is called "lean NO_X catalyst." It works in the same manner as SCR by adding a reducing agent to the exhaust stream in order to speed up catalytic conversion. Diesel fuel is injected into the exhaust gas to add HC, which acts as a reducing agent. The NO_X gas is then converted into nitrogen and water vapor.

The second technology is called "NO_X absorber." This technology operates in two stages. The NO_X is converted and absorbed into a chemical storage site within the system. When the absorber becomes saturated, it is regenerated by adding extra diesel fuel to the exhaust stream. The added fuel causes the NO_X to transform into nitrogen and oxygen that is then released from the system. These devices are still under development and unit costs are unavailable.[40]

[40] *Ibid.*

2.1.8 New Engine Technology

In certain circumstances the replacement of older diesel engines and equipment may represent for the operator and fleet manager the most sensible and cost-effective emissions improvement options. When old vehicles are replaced, fleet managers can substitute their oldest and worst emissions performers with new technology present in new diesel engines. PM emissions from new on-highway diesel engines have been reduced by 83% and emissions of NO_X by 63% since 1983. New engines will continue to get cleaner as tougher emission standards take effect in 2004 and 2007; by 2007, new engines will provide 98% reductions in both PM and NO_X over 1988 engines. These reductions can be attributed to improvements in fuel delivery, the design of combustion chambers and turbo-charging. For example, current engines provide for a more complete burn by enabling the fuel to be injected at high pressures, and the timing of the fuel injection can be varied to allow for different emissions goals when vehicles operate under various vehicle-operating conditions.[41]

2.1.9 Implementation Issues

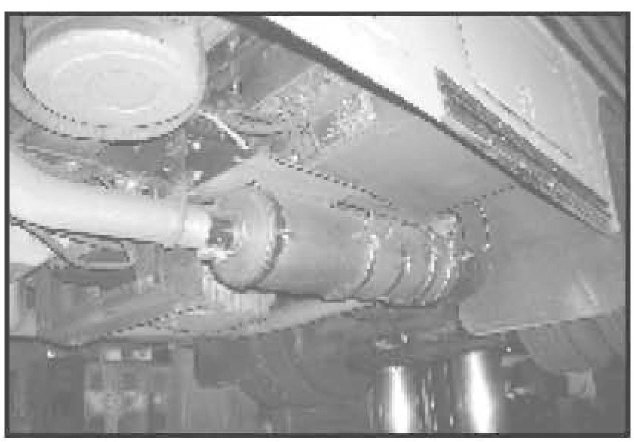
Many of the clean fuel enhancement technologies discussed above have certain requirements, such as ULSD, specific maintenance and monitoring requirements. In order to guarantee successful emission reductions, fleet managers must consult with engine manufacturers and technology vendors to address implementation issues. If engine retrofitting is desired, the selection of appropriate engines and corresponding appropriate after-treatment technologies must take place. Some engines make better retrofit candidates than others; some engines and vehicles may be inappropriate for upgraded investment. This section will briefly address some implementation issues regarding ULSD, engine enhancement technologies and exhaust after-treatment devices.

[41] *Ibid.*

Proper installation of after-treatment devices is an issue of prime importance. Many such devices replace the original exhaust muffler but are larger and heavier than the original. For certain truck models, specific engineering may be required for proper installation and filter support, and customized installation hardware may be required. Clearance between the filter and the cab may also be an issue. It should be noted that improper servicing or sizing of the filters would generally not be covered by the filter warranty or engine maker.[42]

When ULSD is required with an after-treatment device, it is important to make sure that only ULSD is used with that particular device. The most effective way to avoid misfueling vehicles that require ULSD is to convert the entire fleet and fueling facility to USLD. If this cannot be done or is not feasible, lockable fuel caps and segregated fuel storage tanks should be used. If fleet vehicles are not centrally fueled and there might be a risk of fueling with higher sulfur diesel off site, detailed planning should be undertaken. Educating fuelers and drivers of this issue is of prime importance. Other important implementation issues include understanding the duty-cycle that the filter will be exposed to, determining the service intervals, and filter maintenance procedures. Service intervals are typically determined by looking at the service environment, engine duty cycle and engine oil consumption.[43]

Figure 2.1.9-1
School Bus Retrofitted with a Particulate Trap



[42] *Ibid.*
[43] Puget Sound Clean Air Agency, *Facts About Ultra-Low Sulfur Diesel Fuel, Diesel Solutions: Cleaner Air For Tomorrow, Today*; INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*

2.1.10 Clean Diesel Case Studies

2.1.10.1 New York City - Department of Sanitation[44]

DSNY currently has 600 of its 2,040 garbage trucks using low-sulfur diesel fuel, which contains sulfur up to 30 ppm by weight. DSNY is currently testing the effectiveness of a particulate trap used in combination with this fuel. (A study from the California Air Resources Board found the use of ULSD [sulfur content of 15 ppm] with a particulate trap has cleaner emissions than CNG.) If it proves worthwhile, they will outfit all trucks with particulate traps. So far, DSNY is quite pleased with the emission results of low-sulfur diesel fuel and particulate traps; they've been a leader in experimenting with use for heavy-duty refuse vehicles. By the end of this year DSNY is scheduled to complete construction on a heavy-duty vehicle emissions testing facility that will allow them to test diesel and alternative fuel exhaust emissions.

2.1.10.2 City of Los Angeles - Bureau of Sanitation[45]

In response to the Clean Fuel Policy adopted by the Los Angeles City Council in June of 2000, the Bureau of Sanitation has implemented an Alternative Fuel Program. The Bureau is committed to retrofitting the existing diesel-only sanitation trucks in its fleet with clean diesel technology, such as particulate traps and low-sulfur diesel. The fleet consists of 660 diesel fuel and dual fuel heavy-duty vehicles, including side loaders, front loaders, rear loaders, transfers and rolloffs.

Use of ultra-low-sulfur fuel began in November 2001 and particulate trap utilization started in July of 2002. All of the Bureau's vehicles that have particulate filters (except for two) use Englehard DPX DPFs. These particular traps are passive systems that use a catalyst (a combination of platinum and a base metal oxide) that is found in the porous walls of the filter. The catalyst helps to oxidize the collected PM by lowering the exhaust temperature.

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[44] Based on meeting with Spiro Kattan, Supervisor of Mechanics, Bureau of Motor Equipment, DSNY, July 9, 2003.
[45] Based on e-mail correspondence with Alex H. Helou, Director, City of Los Angles, Sanitation Bureau, August and September, 2003.

The cost for each DPF (including the device and its installation) is between $6,300 and $6,500. The Bureau did not have any particulate filter maintenance or operating cost data. Vendors originally stated that the filters would not have to be serviced unless signaled by the back-pressure monitoring system lights. However, they have recently started to suggest that the traps be serviced once a year or every 12,000 miles.

Prior to implementation, Los Angeles conducted testing for a year in order to determine the effectiveness of particulate traps. A study conducted by the City of Los Angeles and the National Renewable Energy Laboratory found that PM emissions were reduced by 90% in the diesel-only refuse collection vehicles equipped with DPFs and operated on ULSD, compared to diesel-only refuse collection vehicles that were not equipped with particulate traps and were operated using regular California Air Resources Control Board diesel. The study stated that vehicles retrofitted with DPFs had lower levels of HC and CO emissions. The pollution reductions of refuse vehicles currently in operation have met the Bureau's expectations and have been found to be similar to tests and studies completed prior to implementation.

2.2 Natural Gas

Natural gas is a mixture of HC, with methane gas (CH_4) as the primary component. The gas is an abundant domestic resource that can be extracted from underground reserves or produced as a by-product of landfill operations. After extraction, natural gas requires only a purification (from sulfur compounds) and separation (from heavier hydrocarbons) process before being ready for use, thereby avoiding the expensive refining process needed for petroleum fuels. Natural gas is used extensively in the home heating market and a vast natural gas pipeline delivery system of 1.3 million miles is in place in the continental United States.[46]

2.2.1 Fuel Characteristics

Natural gas can be used as an alternative fuel source to power vehicles in either a gaseous or liquid state. In the gas form, natural gas is compressed to 3,000 pounds per square inch to 3,600 pounds per square inch and is stored on the vehicle in high-pressure tanks. The compressed form of the gas, referred to as CNG, is transferred to the vehicle at the fueling

[46] Helen Cothran, ed., *Energy Alternatives,* November 2002.

station. To create liquefied natural gas (LNG), natural gas is cooled to minus 260 degrees Fahrenheit. The liquefaction process occurs either at the refueling site or off site and delivered by truck.[47]

There are different processes for the combustion of natural gas in an engine, including stoichimetric, lean-burn and dual-fuel diesel. Stoichimetric is a spark-ignited internal combustion that uses equal parts of fuel and air. Lean-burn is also spark-ignited but uses more air to minimize NO_X emissions. Dual-fuel diesel natural gas engines run on both diesel and natural gas. They utilize a compression ignition system (such a system is required for diesel ignition) in which a small amount of diesel is used to ignite the natural gas. At low speeds or when idling, dual-fuel engines run on diesel, but at higher speeds the amount of natural gas used can increase to 80% to 85% of the fuel being consumed by the vehicle. The majority of CNG vehicles use the lean-burn technology, due to the NO_X reduction benefits.[48]

CNG and LNG refuse trucks are in waste collection truck fleets in municipalities throughout the United States, including the City. DSNY began using CNG trucks in their refuse hauler fleet in 1989, with 16 such trucks. They were the first municipal sanitation agency in the United States to begin testing natural gas refuse vehicles.[49] Currently DSNY has 26 CNG garbage trucks in their refuse hauler fleet and nine CNG street sweepers. They also have about 350 CNG light-duty vehicles that have dual fueling capabilities (gasoline or CNG).

2.2.2 CNG vs. LNG

When compared, CNG and LNG each have advantages and disadvantages. The advantage of LNG over CNG is that it offers a greater range for the vehicle; in the liquid state more natural gas can be stored. The liquefied state also allows for faster fueling of LNG vehicles. CNG fueling can take a few minutes or several hours, depending on the type of fueling system. The quick-fill fueling system uses a high-pressure tank compressor to fill the vehicle's tank within a few minutes. The slow-fill fueling system does not require the high-pressure compressor system, but can take six to eight hours to fill the tank of a CNG vehicle.[50]

[47] Energy Information Administration, *Developments in U.S. Alternative Fuel Markets,* 1999.
[48] The World Bank, *Breathing Clean: Considering the Switch to Natural Gas Buses*, 2001.
[49] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*
[50] *Ibid.*

The advantages of CNG over LNG are mostly safety related. If LNG is accidentally spilled, it will pool on the ground, creating a potential fire hazard if an ignition source is nearby. CNG is lighter than air and if spilled will rise, lessening the chance of ignition. Odorants can also be added to CNG, which will help in the detection of a spill. In addition, methane detectors are often utilized with CNG for added safety protection. (Methane is the largest component of natural gas.) LNG is odorless and odorants cannot be added in order to facilitate easy detection - leak detection is based solely on a methane detection system.[51]

There is currently a moratorium in the City on the establishment of LNG fueling facilities.[52] CNG is the only natural gas option available in the short and near term for the private and public refuse haulers due to this moratorium. Therefore, LNG will not be discussed further in this report.

2.2.3 Safety

Like petroleum fuels, CNG is stable but flammable. The danger of CNG is from leakage coming from the tanks or during the fueling process. However, unlike other fuels, CNG is a gas under pressure and requires a different facility and personnel-training procedures than conventional fuels.[53]

There are several essential elements that need to be in place in order to have a safe CNG facility. Facilities need high ceilings with ventilation systems to dissipate any escaped natural gas that will rise and collect in the ceiling of a facility; methane gas sensors are also usually installed to detect gas build-up. CNG buses and tanks should not be stored near strong ignition sources that could ignite leaked gas. (Possible ignition sources include open-flame gas heaters or spark-producing electrical equipment.) Finally, personnel training on the unique properties of CNG fuel and proper procedures to follow is necessary to ensure a safe CNG operation.[54]

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[51] *Ibid.*
[52] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*
[53] U.S. Department of Energy, *Running Refuse Haulers on Compressed Natural Gas*, November 1997.
[54] *Ibid.*

2.2.4 Costs

The cost of acquiring CNG vehicles and the infrastructure needed is one of the main drawbacks for fleet operators seeking to use CNG as an alternative fuel. The incremental cost of a CNG refuse truck ranges from $38,000 to $70,000 over a standard diesel refuse hauler. However, this price differential may decrease in the future as the prices of diesel engines increase in response to stricter USEPA diesel engine requirements that will be in place in 2007.[55]

In addition to requiring a more expensive truck, CNG requires a capital investment in fueling infrastructure. The cost of a CNG infrastructure can range between $500,000 and $1,250,000. These costs cover the compressor needed for the natural gas and ventilation and alarm systems.[56]

Another cost to consider for CNG garbage trucks is the cost of fuel. In the City the cost of a natural gas gallon equivalent is more than the cost of a gallon of conventional diesel fuel.[57] In addition, the natural gas market is subject to price volatility that is more extreme than for the price of oil. The demand for natural gas has increased in past years and the production has not been able to keep up. Increasing the supply of natural gas faces many obstacles; increased drilling for natural gas in North America raises environmental concerns, and access to foreign supplies is hampered by an insufficient number of tankers and terminals in the U.S. that are needed to import natural gas.[58]

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[55] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*
[56] *Ibid.*
[57] *Ibid.*
[58] Simon Romero, Short Supply of Natural Gas Raises Economic Worries, New York Times, June 17, 2003.

2.2.5 Fuel Emissions

The principal benefit of CNG over conventional diesel fuel is the reduction of tailpipe emissions. Experiences of CNG operators and several studies on the subject have documented the reduction of pollutant emissions of CNG over standard diesel. One such study completed by the Northeast Advanced Vehicle Consortium found that CNG engines had 50% to 60% lower NO_X emissions than conventional diesel. It also showed that PM emissions were 80% to 90% lower for CNG engines than for diesel engines.[59]

These reductions in NO_X and PM are corroborated by a report completed by INFORM, an independent environmental research group. After surveying several refuse haulers using CNG, INFORM reports that PM emissions were reduced anywhere from 67% to 94%, and NO_X emissions were reduced 32% to 73%. Additionally, INFORM results show CNG refuse fleets reporting non-methane HC emissions reductions of 69% to 83%.[60]

One drawback of CNG emissions is related to the release of greenhouse gases, particularly CO_2 and CH_4. Intuitively, CNG should have lower carbon emissions, since it is comprised mainly of CH_4 (which has a high hydrogen to carbon ratio). Theoretically, this should translate into low CO_2 emissions relative to diesel fuel (which has a lower hydrogen to carbon ratio). However, according to the aforementioned report completed by the Northeast Advanced Vehicle Consortium, the extra weight and throttle loss of CNG vehicles relative to conventional diesel vehicles results in a lower fuel economy for CNG trucks and cancels out the potential CO_2 emission benefits of CNG. Moreover, CNG vehicles release unburned fuel in the form of CH_4, which is classified as a greenhouse gas. The factors lead to CNG actually emitting more greenhouse gases than conventional diesel fuel vehicles.[61]

[59] Northeast Advanced Vehicle Consortium, *Hybrid-Electric Drive Heavy Duty Vehicle Testing Project*, February 2000.
[60] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*
[61] Northeast Advanced Consortium, *Hybrid-Electric Drive Heavy-Duty Vehicle Testing Project*, February 2000.

2.2.6 Incentives and Disincentives

The main incentive for choosing natural gas as an alternative fuel for heavy-duty refuse trucks is the emissions benefits. Studies of heavy-duty engines running on CNG and diesel have shown that engines fueled with CNG emit significantly less PM (80% to 90% less) and NO_X (50% to 60% less) emissions than diesel engines. However, CNG engines emit higher total HC than diesel engines, which is mostly due to higher CH_4 release.[62]

Another benefit of using a CNG engine is the reduction of engine noise. CNG engines are significantly quieter than diesel engines. Some studies have reported a 50% to 98% reduction in noise with CNG trucks, depending on the position of sanitation personnel relative to the engine. Much of the engine noise reduction is gained during idling and slow speeds.[63]

CNG use as an alternative fuel is seen as a bridge to the eventual use of hydrogen as a fuel for vehicles. Though still far off, hydrogen fuel cell technology is advancing and one day its use as a fuel could be as prevalent as diesel and gasoline are today. Natural gas is a source of hydrogen for fuel cells and investing in CNG facilities now will ease future transitions to hydrogen fuel cells as a vehicle fueling source.[64] (Fuel Cells will be discussed later in this report.)

One of the major disincentives to creating a CNG refuse truck fleet is the cost related to purchasing the trucks and the infrastructure needed for a CNG facility. Trash haulers, either private companies or public agencies, have limited budgets and are concerned about their financial bottom line. A CNG trash hauler can cost up to $70,000 more than a conventional diesel truck. In addition, the cost of a CNG facility with fueling, proper ventilation and leakage alarms can cost $500,000 to $1,250,000 to construct.[65]

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[62] *Ibid.*
[63] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*
[64] *Ibid.*
[65] *Ibid.*

Another disadvantage of CNG is that most of the natural gas used in CNG engines comes from reserves in North America. Demand for natural gas has increased in the past few years and the supply has not been able to keep pace. This has caused extreme price fluctuations. Attempts to increase supply by drilling for additional natural gas reserves has met resistance from environmental groups and the importation of natural gas (in a liquid form) requires an investment in proper docking facilities and a transport infrastructure necessary to handle natural gas.[66]

In addition to the cost implications of CNG, there are logistical issues that could be disincentives to using CNG with refuse haulers. CNG vehicles have limited range and the expense of constructing fueling stations prohibits a network of fueling stations from being constructed. This does not offer operators much flexibility to use CNG trucks on various routes, as distance from the fueling station must always be considered. The CNG refuse trucks are also heavier and longer than conventional diesel garbage trucks, leading to the CNG trucks having lower fuel efficiency than diesel engines and making it harder for CNG trucks to maneuver through narrow city streets.[67]

Finally, there are some environmental drawbacks from the emissions associated with CNG combustion. CNG engines have been found to emit noticeable levels of CH_4 and CO_2, both of which are greenhouse gases. The emission of formaldehydes is also a concern with CNG emissions.[68]

2.2.7 CNG Case Studies

2.2.7.1 New York City Department of Sanitation[69]

DSNY has been a leader in using CNG engines in its collection fleet. They began their CNG program in 1989 with 16 CNG garbage trucks. The CNG program has grown to include 26 CNG garbage trucks in the DSNY hauler fleet and nine CNG street sweepers that are considered part of their heavy-duty fleet. DSNY also has about 350 CNG light-duty vehicles that have dual fueling capabilities (gasoline or CNG).

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[66] Simon Romero, Short Supply of Natural Gas Raises Economic Worries, New York Times, June 17, 2003.
[67] Based on meeting with Spiro Kattan, Supervisor of Mechanics, Bureau of Motor Equipment, DSNY, July 9, 2003.
[68] *Ibid.*
[69] *Ibid.*

The major problem with DSNY's CNG truck program is the lack of fueling infrastructure. Currently, DSNY's CNG trucks refuel at Keyspan and Con Edison CNG fueling facilities, which have capacity issues. These facilities have a hard time supporting both the DSNY fleet and their own CNG fleet. The result is that DSNY CNG trucks have fueling times that are significantly longer than their diesel counterparts.

DSNY is planning to build a CNG facility in Woodside, Queens. This will help address the fueling-time issue, but there are other factors related to CNG that are still a concern. One is that the centralized nature of the new CNG facility would run counter to DSNY's somewhat decentralized operations. Having one central CNG facility doesn't let DSNY have the flexibility of fueling at different facilities. This is troubling because CNG trucks have limited range, which is one of the main complaints of the operators using CNG trucks. Diesel trucks are refueled every two to three days -- CNG trucks need to be refueled every day. Construction of additional CNG fueling facilities is difficult as there is community opposition; the facilities are perceived as unsafe and require a great deal of real estate to accommodate the large garbage trucks.

Some of the range issues DSNY has encountered with CNG could be solved if LNG could be used. Since LNG is in liquid form, a truck can hold more fuel, thereby increasing the range of the truck. (Increasing the range of CNG is important as CNG trucks cannot be used for waste export out of the City because of this limitation.) However, there is a moratorium on LNG in the City and there are no current initiatives to lift it.

Another issue related to CNG is that DSNY maintenance and fueling facilities need to be upgraded. Escaping gas is a major concern; air monitors and circulation devices need to be installed and training of DSNY personnel has to occur. A CNG truck is two feet longer than a standard garbage truck. This creates a storage problem, as well as problems navigating the truck through narrow streets. The CNG vehicle is also a heavier vehicle and has less refuse capacity. In addition, the CNG trucks experience a degradation of engine performance as the pressure in the tank decreases.

The price difference of CNG and standard refuse trucks is more than $70,000. CNG trucks cost $212,000 versus $133,000 for standard diesel refuse trucks. Also, CNG costs more per gallon equivalent than diesel. DSNY pays just under $1.00 per gallon for diesel and over

$1.00 per gallon equivalent for CNG (price can vary due to natural gas market conditions). Since CNG has a lower density per gallon compared to diesel, CNG trucks are also not as fuel efficient as diesel trucks, which further increases the cost differential between the two fuels.

2.2.7.2 New York City Transit Gleason Depot CNG Facility[70]

The Jackie Gleason Depot has roughly 250 CNG buses and in the future will hold an additional 250 CNG buses. Located in Sunset Park, Brooklyn, the depot functions as a storage, fueling and maintenance facility (except major overhauls) for CNG buses. The CNG program first started in 1994.

Several drawbacks have been noted with CNG use at the facility. CNG has longer fueling times than conventional buses and higher operational costs (the depot was unable to quantify the higher costs). The CNG buses weigh more, due to the added weight of the tanks, and use 20% to 30% more fuel than diesel buses. However, it was noted that highway driving uses less fuel.

Safety is also a big concern with CNG used at the depot. There is emergency ventilation throughout the facility, emergency doors and alarms, and methane detectors, and special measures are taken to seal electrical equipment and wires, adding to the cost of using CNG. Plus, a one- to two-day CNG training seminar is necessary for drivers and maintenance workers. CNG is not necessarily more dangerous, but it requires different precautions than those for diesel fuel.

In order to have the CNG facility at the depot, a new fueling infrastructure was built and an outside contractor hired to maintain and monitor fueling and CNG on-site infrastructure. A CNG vehicle costs roughly $70,000 more than a diesel bus (a diesel bus is approximately $270,000) and the facility upgrades were a huge cost. In addition, CNG buses have lower reliability and more maintenance requirements than diesel buses, requiring more spark plugs and increased replacement of ignition components.

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[70] Based on meeting with Gordon Coor, Superintendent Research and Development, MTA-NYCT, July 2003.

Although the depot does not have exact emissions data, CNG were noted as having higher greenhouse gas emissions than diesel buses. There is an increase in CO_2 and CH_4. However, CNG PM and NO_X emissions are lower than conventional diesel emissions.

2.3 CNG vs. Clean Diesel (Cost Comparison)

In order to compare compressed natural gas refuse vehicles with vehicles operating on clean diesel technology, the costs associated with both options need to be analyzed. These costs include capital costs, such as vehicle and infrastructure costs. (Infrastructure costs include vehicle storage, maintenance and refueling facilities.) Operating costs (fuel and maintenance) will also need to be evaluated, as well as economic incentives such as government grant programs used to purchase AFVs.

2.3.1 Capital Costs

Major new capital outlays are required before the conversion of a diesel garbage truck fleet to one that operates with natural gas can take place. Capital costs needed may include the purchase of more expensive natural gas refuse vehicles, the modification of existing storage and maintenance facilities, the construction of new storage and maintenance facilities, and the provision of refueling infrastructure.

2.3.1.1 Vehicle Costs

Natural gas garbage trucks are more expensive than conventional, diesel refuse vehicles. Natural gas garbage trucks have more expensive engine and fuel storage systems; manufacturers charge more for CNG vehicles in order to cover the costs of development, certification and warranty service; and the smaller number of CNG vehicle orders contribute to their higher prices.[71]

[71] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*

DSNY reports that the price difference between CNG refuse vehicles and standard refuse trucks is more than $70,000. DSNY states that CNG trucks cost $212,000 vs. $133,000 for standard diesel refuse trucks -- 60% more. The DSNY cost differential is much higher when compared to other required costs. Waste Management, for example, cites an average cost of $234,000 for a new natural gas truck vs. $200,000 for comparable diesel models -- 17% more. The public interest group INFORM attests that natural gas refuse trucks cost an additional $40,000 over the median $170,000 price of a conventional diesel refuse truck -- a 24% cost differential. None of these sources specified if the diesel trucks utilized after-treatment technology or engine modification technology to reduce emissions. It is assumed that the cost figures reported do not include such clean diesel technologies. See Table 2.3.1.1-1 for a comparison of these figures.

Table 2.3.1.1-1
Vehicle Comparison (CNG vs. Conventional Diesel)

Source	CNG	Diesel	Incremental Cost of CNG
DSNY	$212,000	$133,000	$79,000 (60%+)
INFORM	$210,000	$170,000	$40,000 (24%+)
Waste Management	$234,000	$200,000	$34,000 (17%+)

The vehicle costs differences for CNG and diesel refuse vehicles are similar to those found with transit bus vehicle costs. The Natural Resource Defense Council indicates the CNG buses cost 20% to 30% more than diesel buses. Moreover, a U.S. General Accounting Office study, "Mass Transit: Use of Alternative Fuels in Transit Buses," states the transit operators who operate CNG buses pay approximately 15% to 25% more on average for full-sized CNG buses than for similar diesel buses. CNG buses cost between $290,000 and $318,000, while typical standard diesel buses cost between $250,000 and $275,000.[72]

In order to accurately compare vehicles that use clean diesel technology with CNG vehicles, the costs of exhaust after-treatment and engine modification technology need to be taken into account. (See Tables 2.3.1.1-2, 2.3.1.1-3 and 2.3.1.1-4.) Based on data gathered from a Diesel

[72] Natural Resources Defense Council, *The Role of Clean-Fuel Buses in New York City's Transit Future*, September 4, 1997; U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.

Technology Forum report published in May of 2003 entitled "Cleaner Air, Better Performance: Strategies for Upgrading and Modernizing Diesel Engines," unit cost figures for the different clean diesel technologies will be applied to the three different baseline diesel truck cost figures listed in Table 2.3.1.1-1.

NO_X catalysts were not included in the clean diesel and CNG vehicle cost comparison because the technology is still under development and unit costs were not available. In addition, each clean diesel technology is applied by itself to the baseline conventional diesel costs and not in conjunction with other clean diesel technologies. In actuality, a combination of clean diesel technologies may be utilized, further reducing the CNG vehicle cost/conventional diesel vehicle cost differential.

Table 2.3.1.1-2
DSNY Vehicle Cost Comparison (CNG vs. Clean Diesel)

Clean Diesel Technology	CNG Cost	Clean Diesel Cost	Incremental Cost of CNG
Oxidation Catalyst	$212,000	$134,108	$77,892 (58%+)
Particulate Filters	$212,000	$140,500	$71,500 (51%+)
Exhaust Gas Recirculation	$212,000	$147,000	$65,000 (44%)
Selective Catalytic Reduction	$212,000	$163,000	$49,000 (30%)

Table 2.3.1.1-3
INFORM Vehicle Cost Comparison (CNG vs. Clean Diesel)

Clean Diesel Technology	CNG Cost	Clean Diesel Cost	Incremental Cost of CNG
Oxidation Catalyst	$210,000	$171,108	$38,892 (23%+)
Particulate Filters	$210,000	$177,500	$32,500 (18%+)
Exhaust Gas Recirculation	$210,000	$184,000	$26,000 (14%+)
Selective Catalytic Reduction	$210,000	$200,000	$10,000 (5%+)

Table 2.3.1.1-4
Waste Management Vehicle Cost Comparison (CNG vs. Clean Diesel)

Clean Diesel Technology	CNG	Clean Diesel Cost	Incremental Cost of CNG
Oxidation Catalyst	$234,000	$201,108	$32,892 (16%+)
Particulate Filters	$234,000	$207,500	$26,500 (13%+)
Exhaust Gas Recirculation	$234,000	$214,000	$20,000 (9%+)
Selective Catalytic Reduction	$234,000	$230,000	$4,000 (2%+)

It should be noted that the price differential between CNG and diesel vehicles will likely decrease in the future. Stricter USEPA diesel emission requirements are going to take effect in 2007, essentially requiring that diesel engines be equipped with oxidation catalysts and DPFs, thereby increasing a diesel vehicle's overall capital cost. Some economists indicate that demand for CNG vehicles will increase, causing production of these vehicles to rise. The higher demand and likely higher production levels of CNG vehicles will drive down the production costs per vehicle and the overall price per vehicle.[73]

Due to the large capital costs, fleet operators may not want to purchase new CNG trucks. Instead, they may consider retrofitting older diesel engines into CNG vehicles, a process called repowering. During this process, the entire engine and fuel system is replaced. Repowers that convert a diesel vehicle into a CNG vehicle range from $30,000 per truck to $100,000 per truck. This option has lower capital costs than purchasing new CNG or clean diesel vehicles and may be utilized by fleet managers who want avoid the high capital costs of replacing entire vehicles.[74]

2.3.1.2 Infrastructure Costs

The operation of CNG refuse vehicles usually requires building a new refueling infrastructure or the existing fueling facilities undergoing extensive and costly modification. This capital investment is not necessary in order operate clean fuel technology vehicles, as it is assumed that refuse fleet operators already have diesel-bus refueling facilities in place. Clean fuel technology

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[73] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*
[74] *Ibid.*

refuse vehicles operate using ULSD fuel, and this fuel can be used with existing diesel fueling facilities with no modifications or capital costs required. Therefore the fixed capital costs for CNG refueling facilities are incremental to diesel facility fixed capital costs. This assumption may favor clean fuel technology in any cost comparison. Nevertheless, it is realistic given the current widespread use of diesel fleets within the refuse hauling industry. This same assumption also applies to maintenance facilities.[75]

The equipment needed to operate a CNG fueling facility includes gas supply equipment, compressors, control valves, piping, gas conditioners, dispensers and safety equipment. The cost to construct a CNG fast fueling station for refuse fleets generally ranges from $500,000 to $1,250,000.

Due to these high fueling facility costs, many CNG operators choose to share these capital costs by partnering with public or private entities. Local utilities, transit agencies, private refuse companies, delivery truck operators, taxicab companies and municipal governments are all entities that could share in the cost of developing CNG fueling infrastructure. Further, if an existing natural gas refueling facility is already built and it could be shared with a municipal refuse operator or among private waste haulers, significant reductions in infrastructure costs could result. Currently more than 50 U.S. cities are equipped with the infrastructure to refuel natural gas fleets.[76]

Additional infrastructure costs associated with CNG conversion include truck storage and maintenance facility improvements. Operators that switch to CNG must modify indoor storage facilities and maintenance facilities to include proper ventilation and leak detection monitoring systems. Although new CNG maintenance and storage facilities do not cost significantly more than new conventional or clean diesel facilities, retrofitting an existing diesel facility for use with CNG vehicles can be expensive.

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[75] U.S. Department of Agriculture, *Life-Cycle Costs of Alternative Fuels: Is Biodiesel Cost Competitive For Urban Buses*, 1995.
[76] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999; INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air*; U.S. Department of Agriculture, Life-*Cycle Costs of Alternative Fuels: Is Biodiesel Cost Competitive For Urban Buses*, 1995.

Data for CNG refuse vehicles storage and maintenance facilities were not available. However, comparable data was found for CNG transit buses. Typical cost for one maintenance garage is $600,000. Tacoma, Washington's Pierce Transit Authority spent $645,000 to modify their diesel maintenance facility. Larger transit systems such as the Greater Cleveland Regional Transit Authority and Los Angeles County Metropolitan Authority have spent $750,000 and $1,000,000 respectively.[77] (See Table 2.3.1.2-1.)

Table 2.3.1.2-1
Cost of Natural Gas Garbage Trucks and Refueling Infrastructure

Location	Operator	Incremental Cost of New Truck	Cost of Fuel Infrastructure
Irvine, CA	Waste Management	$40,000	$600,000
Moreno Valley, CA	Waste Management	$35,000	$600,000
New York City	Department of Sanitation	$70,000	$1,250,000
Yucca Valley, CA	Waste Management of the Desert	$100,000*	$500,000
Palm Desert, CA	Waste Management	$45,000	$550,000

*Cost of natural gas truck repower

CNG vehicles have significantly higher capital (vehicle and infrastructure) costs than clean diesel vehicles. Comparing diesel/biodiesel vs. CNG, total infrastructure costs per bus (per vehicle) are $1,461 for diesel and biodiesel compared with $10,000 per bus for CNG.[78] (Biodiesel will be discussed in detail in Section 3.1.)

2.3.2 Operating Costs

2.3.2.1 Fuel Costs

Fuel cost is one variable that determines total operating costs. Total fuel cost per vehicle is based on the price per gallon of the fuel and the fuel efficiency of the CNG vehicles in operation. Since CNG vehicles are heavier than conventional diesel counterparts, they are 20% to 40% less fuel-efficient than diesel vehicles.

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[77] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1995.
[78] U.S. Department of Agriculture, *Life-Cycle Costs of Alternative Fuels: Is Biodiesel Cost Competitive For Urban Buses*, 1995.

CNG fuel costs vary depending on what part of the country operators are located in. The overall market for natural gas is more volatile than for diesel fuel. During the past few years the demand for natural gas has increased, but production levels have not been able to keep up. This is a major issue influencing price. Currently, due to environmental concerns, there are barriers to new natural gas drilling in North America. Moreover, access to foreign supplies is currently hampered due to a lack of sufficient tankers and terminals capable of importing the needed quantities of natural gas. The transport of enough natural gas in liquid form to meet future demand will necessitate additional investment in tanker and new terminal facilities nationwide.

Other factors that influence CNG price include the cost to compress the natural gas and the nature or extent of any special contracts refuse haulers have with the local gas company or local gas distributors. Some operators can see fuel cost savings by signing contracts with local gas distributors at decreased prices.

In the City, the cost of CNG (dollars per gallon diesel-equivalent) is more than the cost of a gallon of conventional diesel fuel. (See Table 2.3.2.1-1.) DSNY currently pays just under $1.00 per gallon for diesel and over $1.00 per gallon equivalent for CNG (price may vary due to natural gas market conditions). In comparison, ULSD represents a minimal cost increase over regular diesel fuel -- $0.05 to $0.10 cents per gallon more. The USEPA estimates that ULSD will be $0.045 to $0.05 cents more per gallon in 2006 when more stringent sulfur regulations are in place.[79]

Table 2.3.2.1-1
Regional Fuel Prices (2002)

Region	CNG ($ per gallon diesel-equivalent)	Diesel ($ per gallon)	Biodiesel* ($ per gallon)
New England	1.59	1.29	1.77
Central Atlantic	1.52	1.27	1.80
Lower Atlantic	1.05	1.13	1.06
Midwest	1.21	1.13	1.27
Gulf Coast	1.20	1.12	1.40
Rocky Mountain	1.11	1.13	1.29
West Coast	1.31	1.23	1.40

* B20 - 20% biodiesel & 80% conventional diesel; will be discussed more fully in Section 3.1.
Source: INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air*.

[79] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*

2.3.2.2 Maintenance Costs

Maintenance costs include engine and fuel system repairs and parts replacement. Overall maintenance CNG costs are higher than for conventional diesel engines. Factors that contribute to this include increased fuel system inspection, more expensive parts and higher tune-up costs. Data gathered from operators of CNG refuse vehicles and operators of CNG transit buses indicate that maintenance for CNG vehicles is 10% to 20% higher than for conventional diesel vehicles.[80]

Another factor that can contribute to higher maintenance costs for CNG and natural gas vehicles is that when a fleet is largely composed of diesel trucks, the natural gas trucks in the fleet require separate maintenance, storage and fueling facilities (with separate safety protocols). This tends to increase CNG maintenance costs. Conversion of an entire fleet to natural gas with equipment, labor and facilities dedicated to just one fuel type will lower CNG maintenance costs.

Over time, engine improvements have increased the maintenance intervals required for new natural gas trucks relative to earlier models, thus reducing maintenance costs. Manufacturers of natural gas engines contend that extending the maintenance interval between oil changes would provide savings of thousands of dollars over a garbage truck's lifetime. In addition, the after-treatment and emission control technologies present on clean fuel vehicles that will need to meet USEPA 2007 emission standards are likely to raise the maintenance and operating costs of diesel-fueled trucks, thus reducing the maintenance cost differential between clean diesel vehicles and CNG trucks.[81]

Data based on the U.S. Department of Agriculture report entitled "Life-Cycle Costs of Alternative Fuels" indicates that CNG vehicles are approximately 1.7 times more expensive than diesel vehicles. This paper used a 5% discount rate to calculate the present value per bus mile for the total cost of a transit fleet over the 30-year life-cycle of a refueling infrastructure. Diesel buses had the lowest cost at $0.247 cents per mile. The cost of CNG ranged from $0.375 to $0.42 cents per mile. Although this report did not compare CNG vehicles with clean fuel

[80] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999; INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*
[81] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*

technology vehicles, the minimal fuel cost increases (due to the use of more expensive ULSD) and higher maintenance costs (due to the use of emission control devices) in clean diesel vehicles will likely not offset the higher CNG cost per mile presented in this report. Total costs evaluated in this report include infrastructure costs, and operating costs such as fuel and maintenance. (Vehicle capital costs were not included.) The author cites that the difference in infrastructure costs between diesel and CNG is the main reason for the lower diesel per mile cost.[82]

2.3.3 Programs and Incentives

Tax incentives and grant programs that give economic and financial preference to companies and agencies that operate natural gas vehicles can make CNG vehicles more economically feasible for waste haulers. Grant money is available from both state and federal sources to help fleets defray the higher capital costs associated with CNG vehicles. These grant programs are not available with diesel and clean diesel vehicles.

The NYCDOT, in conjunction with NYSERDA, authorizes the use of federal CMAQ funding available in order to reduce the out-of-pocket costs associated with the purchase of AFVs. Called the Private Fleet Program, the funds can be used to offset the incremental costs of vehicle acquisition. Up to 70% of the incremental costs of new or converted medium- and heavy-duty CNG vehicles are eligible for funding. New York City Clean Air Communities also has funds available for the implementation of clean air transportation programs in the City -- vehicle and infrastructure costs are eligible.[83]

Most large transit fleets that operate natural gas buses utilize federal funding to offset the higher vehicle costs of these vehicles. For example, Long Island Bus has used federal funds such as CMAQ for its purchase of natural gas buses in Nassau County, and the NYCDOT has also used federal funds for its natural gas purchases.

[82] U.S. Department of Agriculture, *Life-Cycle Costs of Alternative Fuels: Is Biodiesel Cost Competitive For Urban Buses*, 1995.
[83] U.S. Department of Transportation, Federal Highway Administration, The Congestion Mitigation and Air Quality Improvement Program, http://www.fhwa.dot.gov/environement/cmaq/funding.htm.

Federal and state tax incentives are also available to help lower the capital costs of CNG vehicles. The federal tax code allows businesses that purchase AFVs or build an alternative fuel refueling facility to take tax deductions. The deductions are allowed for the incremental cost of the AFV or facility compared to the diesel counterpart. In addition, New York State offers a tax credit of up to $10,000 for the purchase of a heavy-duty AFV.[84]

[84] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*

3.0 OTHER CLEAN FUEL TECHNOLOGIES AVAILABLE

3.1 Biodiesel

Biodiesel fuel is a fuel produced from biological sources such as vegetable oils and animal fats. It is biodegradable, nontoxic and nonvolatile. The main benefits of biodiesel include lower exhaust emissions and production from renewable energy sources. The major negative is cost. According to the DOE, biodiesel costs roughly $0.30 to $0.40 cents more per gallon than pure petroleum diesel. However, unlike other alternative fuels, biodiesel does not require expensive equipment modifications to vehicles, fueling infrastructure or storage tanks. Another drawback of biodiesel is that in spite of its reduced CO, HC and PM relative to conventional diesel, it emits more NO_X than diesel. NO_X is a precursor to smog and an issue for major cities in non-attainment areas.[85]

3.1.1 Fuel Characteristics

In order to create biodiesel fuel, an oil source is mixed with an alcohol. (A chemical catalyst is used to speed up the process.) The most common alcohol used is methanol, although ethanol is also sometimes used. After the alcohol is mixed with the oil -- typically soybean oil -- a methyl ester (methanol) or an ethyl ester (ethanol) is produced. Both can be used as fuel for diesel engines. The most common biodiesel fuel is the 80/20 blend (80% petroleum diesel/20% biodiesel) called B20. Blending usually reduces the cost of biodiesel and extends the fuel's storage life. Industry experts recommend that biodiesel be used within six months of purchase. In addition, the use of biodiesel poses a problem during the winter months, as the fuel will begin to gel during cold weather.[86]

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[85] U.S. Department of Energy, *Taking an Alternative Route: A Guide for Fleet Operators and Individual Owners Using Alternative Fuels in Cars and Trucks*, April 2001.
[86] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.

3.1.2 Use and Development

Biodiesel was first developed in South Africa before World War II in order to power heavy-duty vehicles. Currently in Europe there is a much larger base of experience and use with biodiesel than in the United States, and in most European countries, there is a total or near-total exemption from fuel taxes on this fuel. In 1992 the National Biodiesel Board started its efforts to commercialize and promote the use of biodiesel fuel in the United States. This trade group places emphasis on the use of soybean oil methyl ester blended with petroleum-based diesel at various percentages. Blends, specifically the B20 blend, display the best combination of cost efficiency and engine emissions benefits, according to the National Biodiesel Board. B20 is widely used as the biodiesel blend among heavy-duty diesel engine operators in the United States.[87]

There is a sufficient supply of biodiesel currently available in the United States. And, there are currently three billion gallons of excess vegetable oil on the market that can be used to make biodiesel. Most biodiesel fuels are made from soybean, rapeseed or canola oil, which are secondary products of the manufacturing process that makes animal protein supplements and animal feed for livestock. Nutritional awareness has led to the increased use of lighter and unsaturated vegetable oils and is lowering demand in the United States for saturated oils and fats. This development is increasing the availability of animal fats and certain vegetable oils for conversion into biodiesel fuel.

3.1.3 Costs

No major modifications are necessary to maintenance garages and fueling facilities when using biodiesel fuel. There is no increased capital cost associated with biodiesel above the capital cost associated with the use of diesel fuel (pure petroleum diesel). According to the National Biodiesel Board, the B20 blend will generally cost $0.15 to $0.30 cents per gallon more than diesel fuel. The DOE's figures have biodiesel (B20) costing approximately $0.30 to $0.40 cents more per gallon than diesel fuel.[88] No explanation could be found to describe the discrepancy in costs between the DOE and the Biodiesel Board.

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[87] U.S. Department of Energy, *Taking an Alternative Route: A Guide for Fleet Operators and Individual Owners Using Alternative Fuels in Cars and Trucks*, April 2001; U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.
[88] U.S. Department of Energy, *Taking an Alternative Route: A Guide for Fleet Operators and Individual Owners Using Alternative Fuels in Cars and Trucks*, April 2001.

3.1.4 Fuel Emissions

The National Biodiesel Board asserts that, compared to conventional diesel fuel, B100 (pure biodiesel, with no petroleum diesel fuel added) can reduce total unburned HC by 67%, CO by 48% and PM by 47%. In addition, the Board states that B100 will increase NO_X emissions by 10%.[89] The May 2003 edition of BioCycle Energy magazine confirms this by stating that B100 fuel can reduce unburned HC that contribute to smog and O_3 formation by 68% and CO by 44% over conventional diesel fuel.[90]

The data on B20 is more relevant because it is more widespread in use and is used more frequently with heavy-duty vehicles such as refuse trucks. The National Biodiesel Board states that average B20 emissions compared to conventional diesel can reduce total unburned HC by 20%, CO by 12%, and PM by 12%.[91] The NO_X increase is 2%. The increase in NO_X emissions from biodiesel is largely due to the organic portion of the fuel, which, when burned in the engine, releases more NO_X than conventional diesel.

The data reported by public agencies (see Section 3.1.6 Biodiesel Case Studies) that utilize B20 generally corroborates the National Biodiesel Board's data and findings regarding B20 emissions. For example, Arlington County, Virginia reports that using B20 in diesel-powered vehicles has reduced HC emissions for the entire fleet by 30%, CO levels by 20% and PM emissions by 22%. However, emissions of NO_X have increased by 2%. Also, the City of Tacoma, Washington has seen a 20% reduction in CO and PM emissions, with a slight increase in NO_X emissions.

[89] National Biodiesel Board, http://www.biodiesel.org/pdf_files/emissions.PDF.
[90] Biosolids and Biodiesel Team Up for Sustainable Economics, *BioCycle Energy*, May 2003.
[91] National Biodiesel Board, http://www.biodiesel.org/pdf_files/emissions.PDF.

3.1.5 Incentives and Disincentives

An important incentive for biodiesel use is that operators can use conventional diesel fueling equipment, as biodiesel fuel has mechanical and ignition properties that are comparable to conventional diesel fuel. Since biodiesel is less volatile than diesel fuel, there are no modifications regarding safety procedures. And, using biodiesel in pure or blended form does not require engine or storage modifications as with other alternative fuels, such as compressed natural gas. In short, the capital costs associated with diesel and biodiesel are the same.[92]

In addition, biodiesel compared with conventional petroleum diesel has similar heavy-duty diesel engine performance. There is no difference in terms of power, acceleration or fuel consumption between the two types of fuel. However, some engine manufacturers do not guarantee their warranties on biodiesel blends greater than B20. One benefit of biodiesel over petroleum-based diesel is that it provides better lubricity -- it acts as an engine cleaner and can lubricate the engine more thoroughly, which can contribute to longer engine life.[93]

The major disincentive to using biodiesel is cost; as previously mentioned, biodiesel is more costly than regular diesel fuel. Minor disincentives include the potential for fire hazards, biodiesel's cold weather properties and its properties as a solvent. A physical characteristic of biodiesel is the possibility of spontaneous combustion, as some vegetable oils and methyl ester oxidize in the air. This is not considered a serious issue and can be simply resolved by using closed metal cans for storage. There are no fire hazards during transport. Due to its low volatility during a leak or spill, biodiesel is less likely to ignite than diesel. In addition, there are no specific fire hazards during storage or unloading from storage.[94]

There is a greater probability for biodiesel to gel in colder temperatures than conventional diesel. An additive may be needed to prevent this. Other solutions include using a pour point depressant and storing the vehicles near or in a building. Usually, this cold-weather property of biodiesel is not a problem. B20 blends have been used in Iowa and the upper Wisconsin areas without issues.

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[92] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.
[93] U.S. Department of Energy, *Taking an Alternative Route: A Guide for Fleet Operators and Individual Owners Using Alternative Fuels in Cars and Trucks*, April 2001.
[94] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.

Because of the excellent solvent properties of biodiesel, the use of fuel filters may increase when first using this fuel. Petroleum diesel can leave deposits in fuel tanks, fuel lines and delivery systems over time. Biodiesel dissolves these deposits and may initially clog filters, necessitating the increased replacement of such filters.[95]

3.1.6 Biodiesel Case Studies

3.1.6.1 New York City Department of Sanitation[96]

DSNY has explored the use of biodiesel as a fuel source for their diesel refuse truck fleet, including meeting with representatives of World Energy, a group that promotes biodiesel. DSNY has identified some barriers that would have to be overcome before considering its use. Beginning in 2004, Mack engines will power all DSNY garbage trucks. Mack voids warranties if a biodiesel blend of more than 5% biodiesel (B5) is used; however, the environmental benefits from using biodiesel can only be derived from blend that is at least 20% biodiesel (B20). DSNY is also concerned by the increase in NO_X emissions associated with biodiesel compared to conventional diesel fuels, which makes it less than ideal for USEPA non-attainment areas, such as the City. (NO_X contributes to the creation of smog.) Another issue identified by DSNY with the use of biodiesel as a fuel source is that it has limited shelf life and could not be used with seasonal DSNY heavy-duty equipment.

3.1.6.2 Arlington County, Virginia[97]

In September of 2002 Arlington County, located just south of Washington D.C., switched to using biodiesel (B20) for use with refuse vehicles. The county also decided to use biodiesel with other vehicles such as fire trucks, school buses and street sweepers that operate using diesel engines. Arlington County's refuse fleet includes 39 cubic-yard side loaders, 31 cubic-yard rear loaders, 25 cubic-yard rear loaders and 3 to 4 small side loaders.

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[95] U.S. Department of Energy, *Taking an Alternative Route: A Guide for Fleet Operators and Individual Owners Using Alternative Fuels in Cars and Trucks*, April 2001; Rick Markley, Friendly Fuel, *Construction and Mining Trucks;* Tom Moore, Looking for Alternatives, *Fleet Owner*, June 1998.
[96] Based on meeting with Spiro Kattan, Supervisor of Mechanics, Bureau of Motor Equipment, DSNY, July 9, 2003.
[97] Based on phone conversation with Frederic I. Hiller, Chief of Equipment Division, Office of Support Services, Arlington County, Virginia, July 30, 2003.

The main reason the county made the switch was for the reduction in emissions that the use of biodiesel provides. Arlington County is in a non-attainment area for O_3, and HC emissions are an important contributor to O_3 production; the use of biodiesel can reduce these emissions. The reduction in fossil fuel use and the reduction in dependence on foreign oil were other important considerations cited by Arlington County.

The speed it took to implement biodiesel as a fuel for Arlington County's fleet was extremely important in making the decision to use biodiesel. Unlike other alternative fuel options, once the decision was made to switch to biodiesel, it was implemented very quickly. There was no need to modify storage, maintenance or fueling facilities.

Another important factor was cost. Arlington County compared the costs of utilizing CNG and biodiesel, and found there is a large cost difference. The fueling, safety, maintenance and vehicle costs associated with CNG technology are much larger than those for biodiesel. Biodiesel was selected because it is a low-cost alternative.

It should be noted, however, that despite lower biodiesel costs when compared to CNG, Arlington County has seen an increase in fuel costs with the use of biodiesel over what it pays for diesel fuel. It costs the county $1.23 per gallon for biodiesel vs. $0.97 per gallon for diesel fuel.

Arlington County provides extra money for the use of alternative fuel in its vehicle fleet. Hybrid, ethanol and biodiesel vehicles are all currently used. The county sees itself as being proactive in terms of support and funding for the use of alternative fuels. No public sector grants, incentives or mandates were identified as influencing the decision to use biodiesel.

There have been no supply issues. The county contracts out for its fueling needs despite utilizing county-owned fueling facilities. Nationally, engine manufacturers generally honor all warranties with blends of B20 or lower (although Mack does void warranties if blends higher than B5 are used), and there have been no problems regarding warranties for the Ford and Cummings diesel engines Arlington County uses. Overall, there has been no degradation in performance with the use of biodiesel in the county's refuse vehicles. Range and fuel economy are reported to be equal when the county compared both biodiesel and conventional diesel.

As expected, Arlington County has seen overall emissions reductions, with a slight increase in NO_X emissions. Also, two minor maintenance issues have arisen with the use of biodiesel: gelling in cold weather and the excellent solvent and detergent-like qualities of biodiesel. To address the cold weather properties of biodiesel, an additive is used to prevent the fuel from gelling up. In addition, because biodiesel is a good solvent, the vehicle fuel tanks were cleaned when the switch to biodiesel was made, and fuel filters at the fueling pumps were used to remove the deposits left from the use of conventional diesel. Nonetheless, the county reported it has increased its use of primary fuel filters because of biodiesel's solvent-like qualities.

3.1.6.3 Tacoma, Washington[98]

The city of Tacoma, Washington switched to B20 in November of 2001 for use with all of its 85 refuse vehicles. The vehicles include rear, side and front loaders. The city's use of biodiesel has seen a reduction in emissions without compromising the performance of the vehicles or an increase in the city's budget.

In November of 2001, Tacoma contracted out with Kent, Washington-based Petro Card to provide B20 biodiesel and mobile fueling. Mobile fueling is the process in which the contractor delivers the fuel to the city's refuse vehicle storage site in a tanker truck each evening, and is responsible for refueling the refuse trucks. In the contract, Tacoma committed to using 200,000 gallons of fuel per year. Because of such a large commitment, the biodiesel only costs Tacoma $0.20 cents more per gallon than regular diesel. The city states that this increase in fuel costs is completely offset by the savings in wages, fuel and time that results with the use of Petro Card's on-site fueling service. (Previously, drivers of the refuse vehicles would have to drive and fuel their trucks off-site each day.)

Biodiesel has not compromised the performance of the refuse trucks, nor has there been any additional maintenance needed. Maintenance crews originally thought they might have to change the fuel filters more frequently, but they've found this unnecessary. And, there was no special training for operators or mechanics. Additionally, Tacoma has seen a 20% reduction in CO and PM emissions, and a slight increase in NO_X emissions.

[98] Based on phone conversation with Steve Hennessey, Fleet Division Manager, City of Tacoma, Washington, July 30, 2003.

The city made its decision to use biodiesel without any incentives such as grants or regulatory mandates. They also did not look into other alternative fuels regarding its refuse fleet; the costs of natural gas were prohibitive and the natural gas infrastructure was deemed not to be available. Tacoma is currently looking into increasing the number of trucks that use biodiesel.

For its use of biodiesel with all of the city's refuse fleet and reduction in refuse truck emissions, in May 2002 the U.S. DOE inducted Tacoma into the Clean Cities Hall of Fame and awarded them its National Partner Award.

3.2 Fuel Cells

A fuel cell generates electricity from the chemical reaction of combining hydrogen and oxygen into water, without the need for combustion as an intermediate step. Fuel cells can either be directly fueled by hydrogen stored on board the vehicle, or by reformers that generate hydrogen from sources such as natural gas or methanol.

The combination of very high energy efficiency and low emissions makes the concept of fuel cells extremely attractive as an alternative fuel source.[99] However, they are currently only in the development stage for heavy-duty vehicles and buses.[100] They are not expected to be a viable option for at least ten years.[101]

To determine the total net environmental benefit of fuel cells, the energy expended and pollutants released from the process to liberate the hydrogen needed for fuel cells should be considered. If, for example, the burning of coal is involved in the process of making hydrogen, the emissions associated with coal would potentially need to be included in the determination of emissions from the total fuel cell process.[102]

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[99] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.
[100] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air*; U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.
[101] *Ibid.*
[102] Matthew L. Wald, *Turning to Hydrogen for Energy is Harder than it Seems*, International Herald Tribune, November 13, 2003.

3.2.1 Fuel Characteristics

Hydrogen is the most abundant element in the universe. It has the highest energy per unit of weight of any chemical fuel and is non-polluting when used to generate power. However, in order to be used as a primary fuel with fuel cells, hydrogen needs to be transformed from water, fossil fuels, biomass or other materials that are rich in hydrogen. Natural gas, petroleum, coal, ethanol, methanol and landfill waste are all potential sources.[103]

Fuel cells are actually not alternative fuels, but fuel conversion systems. They can be conceptualized as being batteries that operate with hydrogen and oxygen. Water and electricity are the by-products of the hydrogen reacting with the oxygen. Chemical energy is transformed into electrical energy with little or no noise or pollution, and energy conversion efficiencies of approximately 80% are theoretically possible -- burning fuels in heat engines produce efficiencies around 40%.[104]

3.2.2 Use and Development

Currently, there are no fuel cells that power heavy-duty vehicles being produced – use of hydrogen in vehicles is primarily limited to experimental and prototype vehicles. In the future, with increased research and development, hydrogen as a transportation fuel will likely occur.

3.2.3 Costs

Since there are no heavy-duty vehicles powered by fuel cells in production, firm cost data is hard to ascertain or estimate. With any new technology, unit costs will fall as production rates and manufacturing experience increase. One fuel cell engine manufacturer, Ballard, has estimated that, with large commercial production, transit buses using fuel cells could be priced competitively with CNG buses.[105]

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[103] U.S. Department of Energy, *Taking an Alternative Route: A Guide for Fleet Operators and Individual Owners Using Alternative Fuels in Cars and Trucks*, April 2001.
[104] National Conference of State Legislatures *Ground Transportation for the 21st Century*, August, 1999.
[105] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.

In addition to vehicle costs, the actual costs of the hydrogen or other fuels in which the hydrogen is generated need to be taken into account. Hydrogen can be stored on board or generated from other fuels by an on-board reformer. Reformers can be used with methanol or natural gas; it may also be possible to use diesel or gasoline. Utilizing reformers increases the cost and complexity of the fuel cell system. Vehicles that do not use reformers are fueled using hydrogen directly. The hydrogen is stored as a liquid, vaporized to a gas, and dispensed into on-board storage tanks on the vehicles. Depending on whether a vehicle uses an on-board reformer or hydrogen directly, the fueling facilities for fuel cell vehicles will differ considerably.[106]

3.2.4 Fuel Emissions

Fuel cells effectively emit zero emissions with the use of hydrogen.[107]

3.2.5 Incentives and Disincentives

The primary benefit and incentive for utilization of fuel cells is zero emissions. Other advantages include high operating efficiency, quick start-up, and operation over a wide range of temperatures. Currently, fuel cells are in the very early stages of development for heavy-duty vehicles. There are currently issues and problems with hydrogen fueling that have to be addressed and resolved. These include high costs, poorly developed hydrogen fuel supply infrastructure, very large storage volume, and safety concerns associated with compressed hydrogen, especially when stored on a vehicle -- compressed hydrogen systems have a tendency to leak and present fire safety hazards.[108]

If hydrogen fuel is produced off board the vehicle, electrical power is required. However, there are transmission costs associated with off-board production and the use of electrical power, as well as production inefficiencies (compared to on-board production).

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[106] National Conference of State Legislatures *Ground Transportation for the 21st Century*, August, 1999.
[107] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, General, 1999.
[108] *Ibid.*

There are tradeoffs between on-board and off-board hydrogen production. With on-board production, the technology used to produce the hydrogen is complex, whereas with off-board production, the technology is simple but to generate the hydrogen there are transmission costs and larger electrical production inefficiencies.

3.3 Battery Electric

Vehicles that operate on electricity alone utilize batteries to store the electricity, which then transfer the power to an electric motor. These vehicles do not produce any emissions. However, the production of the electricity used to power these vehicles does produce remote-source emissions, which are emissions from power plants.[109]

The widespread use of battery electric in refuse vehicles requires the advancement of battery electric propulsion systems, which are needed for the battery electric engines to be able to deliver the power that garbage trucks require.[110]

3.3.1 Fuel Characteristics

Electricity is an alternative source of propulsion. The majority of the electricity used in battery electric vehicles comes from the nation's electric power distribution infrastructure, with batteries used as the electricity storage medium. Battery electric vehicles have characteristics, such as low energy density and weight, which usually limit vehicle performance and driving range. Electric vehicles are recharged overnight, with typical battery recharging time taking six to eight hours.[111]

Battery electric vehicles are operationally much simpler than vehicles powered by internal combustion engines (which can have hundreds of moving parts). The three main mechanisms that power a battery electric vehicle are the battery pack, the inverter and rotor, and the regenerative braking system. Regenerative braking allows the vehicle to reclaim a portion of the

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[109] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*
[110] *Ibid.*
[111] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.

energy that is usually lost in conventional friction braking (which is used in diesel vehicles). Battery electric vehicles, as well as HEVs (discussed in Section 3.7), use both braking systems. The braking systems are controlled electronically in order to maximize stopping ability and make the dual system transparent to the driver.[112]

3.3.2 Use and Development

At the turn of the 20th century, electric vehicles outnumbered gasoline vehicles, with approximately 50,000 electric vehicles operating in the United States. Use decreased when less-expensive methods of producing gasoline were introduced and the electric starter replaced the crank in gasoline vehicles. The current research focus for electric propulsion vehicles is in the area of battery development, with the goal of developing batteries that have low initial cost, high specific energy and high power density. Further advancement of battery electric propulsion systems is needed before the power that garbage trucks need is delivered.[113]

3.3.3 Costs

The vehicle costs of battery electric vehicles are significantly higher than those of diesel vehicles of comparable size. (Because no cost data was available for heavy-duty vehicles, transit bus comparisons will be made.) When a lead-acid battery pack is used, a battery electric shuttle bus is slightly more than twice as costly as a comparable diesel model. For larger transit buses, the cost differential is approximately 33% higher for battery electric vehicles than comparable diesel models. A nickel cadmium battery option will add roughly $40,000 to $50,000 dollars to the cost of a battery electric bus. However, nickel cadmium batteries yield greater range per battery charge and provide an increased battery life of three to seven years more than a typical lead-acid battery.[114]

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[112] National Conference of State Legislatures, *Ground Transportation for the 21st Century*, August, 1999.
[113] *Ibid.*
[114] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.

The operating costs that are used to compare diesel vehicles with battery electric are energy costs and maintenance costs (which includes replacement of the battery packs and the individual battery units used in the pack). The energy costs per mile are similar for diesel vehicles and battery electric. General maintenance for battery electric vehicles includes checking the condition of the motor, brakes, batteries and electrical connections, battery pack integrity and battery pack mounting.[115] Battery packs may need to be replaced every 25,000 miles and individual units every 10,000 miles. No data could be found comparing the maintenance costs for battery electric and diesel vehicles.

3.3.4 Fuel Emissions

Battery electric vehicles did not produce any emissions, smoke or exhaust odor.[116]

3.3.5 Incentives and Disincentives

The main benefit and incentive for using battery electric systems is emissions reductions. Battery electric vehicles have no tailpipe emissions, low noise levels and effortless cold starts.[117] The main disincentives associated with battery electric vehicles include the reduced range and performance and the substantially higher purchase price. Also, batteries tend to diminish in power output in cold weather.

The main safety issue with battery electric is the exposure of personnel to electrical hazards when using the recharging system and when connecting vehicles to the recharging system. However, this is not a major concern as safeguards can be put in place to ensure personnel are protected from direct exposure to electrical hazards. In addition, there are no specific health or environmental hazards associated with the transmission and use of electricity at a fleet facility.[118]

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[115] U.S. Department of Energy*, Taking an Alternative Route: A Guide for Fleet Operators and Individual Owners Using Alternative Fuels in Cars and Trucks*, April 2001; National Conference of State Legislatures *Ground Transportation for the 21st Century*, August, 1999.
[116] U.S. Department of Energy, *Taking an Alternative Route: A Guide for Fleet Operators and Individual Owners Using Alternative Fuels in Cars and Trucks*, April 2001.
[117] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air*; U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.
[118] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.

3.4 Propane

Propane, also known as liquefied petroleum gas, is the most commonly used alternative fuel in the U.S., with an estimated 350,000 propane vehicles currently in operation.[119] However, it is not widely used in the private or public refuse hauling sector. The main obstacle associated with the use of propane with refuse fleets is that major garbage truck manufacturers do not make or offer models that burn propane; the development of heavy-duty propane engines is needed for propane to expand in use as an alternative fuel in the refuse hauling vehicle sector.[120]

3.4.1 Fuel Characteristics

Propane is a by-product of both natural gas processing and petroleum refining. At room temperature, propane is a gas, and liquifies at relatively low pressures (about 200 pounds per square inch [psi]). Liquefied petroleum is a liquid mixture containing 90% propane and 2.5% butane (and other higher hydrocarbons), as well as ethane and propylene. Special tanks are utilized to force propane to remain under pressure and in a liquid state. Propane is stored on board vehicles as a liquid. Before being burned in engines, propane is easily converted to a gas before combustion takes place.[121]

3.4.2 Use and Development

Propane was first experimented with as a motor fuel as early as 1910. During the 1950s, it became more widespread and popular. Currently, most of the propane produced in North America is generated from natural gas processing.

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[119] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air*; National Conference of State Legislatures, *Ground Transportation for the 21st Century*, August, 1999.
[120] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air*; U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.
[121] U.S. Department of Energy, *Taking an Alternative Route: A Guide for Fleet Operators and Individual Owners Using Alternative Fuels in Cars and Trucks*, April 2001.

Propane can be purchased in two ways: wholesale from distribution centers, which may be the best option for fleet managers and operators that have their own refueling stations; or at public-access stations, where low and discounted prices may be available for large purchases.[122]

Propane has the largest use among all alternative fuel types in the United States. Nevertheless, vehicles that utilize propane experienced the slowest growth during the 1990s. Propane vehicles are most prevalent in the South, where large numbers are operated in Texas and Oklahoma, two large oil-producing states.[123]

The propane industry has been criticized for not promoting and generating interest for its use as an alternative transportation fuel. Comparisons have been made with the natural gas industry, which actively promotes the use of its fuel for vehicle use. The propane industry is dominated by small-scale suppliers who primarily serve residential consumers. Possible reasons for little promotion include the lack of internal cohesion within the industry, concern among propane customers that the increase in propane use as a vehicle fuel will cause an increase in price, and fear that the many small propane suppliers would see their businesses suffer if propane was used as a vehicle fuel in large transportation fleets.[124]

The major problem associated with using propane as an alternative fuel in refuse vehicles is that propane engine technology has not been used in large engines that can power and are suitable for refuse vehicles. Major garbage truck manufacturers currently do not offer models capable of burning propane.[125] However, propane does have extensive use in vehicles such as school buses, small transit buses, light- and medium-duty vehicles and heavy-duty trucks and buses.

Another problem associated with propane is the special handling it requires. For propane use, new facilities need to be constructed or old facilities redesigned. Various design specifications for a propane maintenance facility include explosion-proof wiring and flammable gas detectors. In addition, propane storage and dispensing areas must be located at a certain minimum distance from buildings, adjacent property, underground tanks and adjacent streets due to flammability concerns.

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[122] Energy Information Administration, *Developments in U.S. Alternative Fuel Markets,* 1999.
[123] *Ibid.*
[124] *Ibid.*
[125] *Ibid.*

3.4.3 Costs

It is presently hard to determine the incremental cost of a propane garbage truck with a comparable diesel refuse vehicle due to a lack of data and a lack of propane-powered refuse vehicles being produced. With transit vehicles, the incremental vehicle cost of a propane bus over a standard diesel bus was $35,000 to $45,000 in 1998.[126]

As noted in Section 3.4.2, the use of propane brings increased capital costs associated with the design of propane maintenance, storage and fueling facilities. It is assumed that most sanitation fleets are currently already utilizing diesel refuse vehicles and diesel refueling and maintenance facilities. For propane use, new facilities need to be constructed or old facilities redesigned, resulting in additional, higher capital costs.

The increased operating costs (higher than comparable diesel operating costs) associated with propane use are attributed to two main factors: high propane fuel cost and lower fuel efficiency. More propane is needed than an equivalent amount of diesel, which contributes to higher operating costs.

Since the early 1990s, propane prices have been increasing relative to gasoline and diesel fuel. It is difficult to quantify the price of propane because its purchase price depends on a number of factors, including the quantity being purchased, the location of purchase in the United States, the particular state's tax on propane and the season the fuel was purchased. It should be noted that experience with propane vehicles indicates that although initial capital costs are high, significant savings in lower maintenance costs may outweigh the short-term, higher capital costs. This is due to the fact that propane engines are reported to last two to three times longer than gasoline or diesel engines.

[126] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.

3.4.3 Fuel Emissions

Propane buses have lower emissions than diesel engines, but not as low as natural gas or methanol engines. Low levels of NO_X and PM emissions are a characteristic of propane combustion.[127]

3.4.4 Incentives and Disincentives

The main benefit or incentive realized with the use of propane is the emissions benefits. Disincentives include the lack of suitable heavy-duty engines and increased capital costs. Further, there are safety concerns associated with use of propane, including the potential fire hazards associated with its transport, and storage concerns when the fuel is stored as a pressurized liquid. Finally, propane supply is limited by the supply of liquid and gaseous fossil fuels from which propane is produced.[128]

3.5 Ethanol

Ethanol, despite having similar physical and combustion properties to diesel fuel, is not a satisfactory alternative fuel for use with medium- and heavy-duty vehicles, as previous ethanol experience has resulted in high rates of engine failure and low rates of engine reliability. Ethanol is generally not used for heavy-duty vehicles such as refuse trucks; there are few if any OEMs producing ethanol garbage trucks and few if any ethanol-powered refuse vehicles currently in operation.[129]

3.5.1 Fuel Characteristics

Ethanol is produced by the fermentation of plant sugars derived from corn or sugar cane. When used for commercial or industrial applications, ethanol is denatured -- denaturing the fuel involves the addition of a small amount of a toxic substance (typically gasoline) in order for producers to avoid the federal alcoholic beverage tax.

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[127] *Ibid.*
[128] National Conference of State Legislatures, *Ground Transportation for the 21st Century*, August, 1999; U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.
[129] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air.*

Ethanol, when used as an alternative fuel, is most commonly used as a blend of 85% ethanol and 15% gasoline (E85), or a blend composed of 95% ethanol and 5% gasoline (E95). These are the only ethanol forms that are considered to be alternative fuels, and are mainly used with light-duty vehicles. However, the most common application of ethanol is as a blend with gasoline that contains 10% ethanol and 90% gasoline. This fuel, known as gasohol or E10, is not considered an alternative fuel.

Ethanol can be blended with gasoline at lower concentrations to produce oxygenated gasoline. Ethanol is also a chemical component of ethyl tertiary butyl ether (ETBE), a type of oxygenate. Oxygenated gasoline (containing ethanol or ETBE) is also not considered an alternative fuel, but is mandated in certain CO non-attainment areas to reduce exhaust CO emissions.[130]

3.5.2 Use and Development

Alcohols were used as fuel in several of the earliest vehicles ever designed. In fact, Henry Ford's very first car used an alcohol-based fuel. During the oil crisis of the 1970s, ethanol use increased.

Since the largest supply of corn is grown in the Midwest, most ethanol production facilities in the United States are located there. It follows that use of ethanol (E85 and E95) has also been mostly limited to this section of the country. There are roughly only 50 E85 refueling sites currently operating in the United States.[131] The lack of an adequate refueling infrastructure is a barrier that impedes more widespread use of ethanol.

There are no ethanol garbage trucks in operation and no ethanol refuse vehicles available from OEMs. In addition, experience with ethanol transit buses in the mid- and late-1990s has shown that ethanol engines failed at a much higher rate than methanol-fueled engines, and their operational life was only half that. The use of ethanol is more successful with light-duty

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[130] U.S. Department if Energy, T*aking an Alternative Route: A Guide for Fleet Operators and Individual Owners Using Alternative Fuels in Cars and Trucks*, April 2001.
[131] Energy Information Administration, *Developments in U.S. Alternative Fuel Markets*, U.S. Department of Energy, 1999.

vehicles. DSNY uses approximately 350 light-duty vehicles that run on E85 in the non-collection operations. These vehicles are well suited for DSNY's non-collection operational needs and the agency is in the process of developing seven ethanol filling stations.[132]

3.5.3 Costs

Data suggests that ethanol-powered vehicles are characterized by higher operating and capital costs than diesel-powered vehicles. A 1999 DOE study states that the maintenance costs associated with ethanol-powered vehicles were significantly higher than for those vehicles with diesel engines.[133] Ethanol also suffers a fuel economy penalty compared to vehicles using diesel fuel, which may result in higher operating costs. More ethanol is needed than an equivalent amount of diesel fuel used in diesel-powered engines.

Capital costs are also likely to be greater if heavy-duty ethanol vehicles were used and produced. These costs include a higher purchase price for vehicles and modifications to maintenance and fueling facilities. For example, in the late 1990s, if a 200-bus transit fleet is considered, modifications to one maintenance garage would be between $300,000 and $400,000. In addition, the incremental cost for a standard ethanol bus, if available, is higher than the purchase of an equivalent diesel bus. An ethanol bus would likely cost $25,000 to $35,000 more than an equivalent diesel bus.[134]

3.5.4 Fuel Emissions

The main emissions advantage of ethanol and ethanol blends is that the oxygen content present in the ethanol lowers emissions of CO. When combusted, alcohol fuels do not produce any soot or PM and their emissions are less reactive in the atmosphere, thus producing smaller amounts of O_3, the harmful component of smog. However, ethanol usually produces slightly higher NO_X emissions.[135]

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[132] Based on meeting with Spiro Kattan, Supervisor of Mechanics, Bureau of Motor Equipment, DSNY, July 9, 2003.

[133] Energy Information Administration, *Developments in U.S. Alternative Fuel Markets*, U.S. Department of Energy, 1999.

[134] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.

[135] *Ibid.*

3.5.5 Incentives and Disincentives

The primary benefit of using ethanol and alcohol fuels is lower emissions of CO. However, emissions of NO_X and HC can increase somewhat with ethanol use.[136]

The main disincentive is that heavy-duty engine manufacturers do not currently produce alcohol fueled engines. Two main reasons for this are the high rate of engine failure and low engine reliability.

3.6 Methanol

Methyl alcohol, or methanol, is a liquid fuel that, like ethanol, displays similar physical and combustion properties to diesel fuel. Basic engine and fuel system technologies can be used both with methanol and diesel fuel. However, similar to ethanol, methanol use has shown high engine unreliability. There appears to be no heavy-duty engine manufacturer currently producing methanol engines for refuse vehicles.[137]

3.6.1 Fuel Characteristics

Methanol is produced in a variety of ways. The most common method is via the reformation of natural gas, but it can also be produced from coal and municipal waste. Methanol is primarily produced in the Gulf Coast states.

When used as an alternative transportation fuel, methanol is typically blended with gasoline -- 85% methanol and 15% gasoline (M85) -- or left unblended, which is pure methanol (M100). Methanol is also being tested as a source of hydrogen to power fuel cells for use in vehicles.[138] In addition to use as an alternative fuel, methanol is used as a solvent and in a variety of ways in many industrial manufacturing processes.

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[136] Living Without Oil, *U.S. News & World Report*, February 17, 2003.
[137] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air*; U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.
[138] U.S. Department of Agriculture, *Life-Cycle Costs of Alternative Fuels: Is Biodiesel Cost Competitive For Urban Buses*, 1995.

3.6.2 Use and Development

Because of poor engine reliability and high engine failure, there is currently very little effort to develop heavy-duty methanol engines.[139]

Currently, methanol is principally used in light-duty flexible fuel vehicles that operate on methanol, gasoline, or a combination of the two. Seventy-five percent (75%) of all methanol vehicles in the United States are operated in California; only around 15 methanol refueling sties are located outside of California.[140]

3.6.3 Costs

Methanol has a similar capital cost structure to ethanol, with higher capital costs than diesel-powered vehicles. These higher costs include higher purchase prices for vehicles and modifications to maintenance and fueling facilities. The modifications consist of alcohol-compatible fuel tanks, new fuel dispensers and special safety equipment. Because they have a higher fuel consumption rate than diesel-powered engines, methanol vehicles need more on-board fuel than diesel vehicles and require additional fuel storage capacity. For example, methanol buses require on average 2.5 times as much fuel as diesel buses. A United States Department of Agriculture (USDA) 1995 study titled "Life-Cycle Costs of Alternative Fuels" found that for urban buses, total infrastructure cost per bus is $10,000 for methanol vs. only $1,646 for diesel- and biodiesel-powered buses.[141]

Operating costs associated with methanol are higher than those for diesel. Fuel costs are substantially higher because of higher methanol fuel prices and lower fuel economy mileage. Higher maintenance costs are present as well because of the need for frequent engine rebuilds.[142]

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[139] U.S. Department of Energy, *Taking an Alternative Route: A Guide for Fleet Operators and Individual Owners Using Alternative Fuels in Cars and Trucks*, April 2001; U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.
[140] Energy Information Administration, *Developments in U.S. Alternative Fuel Markets,* 1999.
[141] U.S. Department of Agriculture, *Life-Cycle Costs of Alternative Fuels: Is Biodiesel Cost Competitive For Urban Buses*, 1995.
[142] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.

The 1995 USDA study referenced above indicates that annual refueling costs are $21,102 per methanol-fueled bus -- twice the amount of the cost for diesel buses. The higher refueling labor costs are due to the 2.5-times higher fuel consumption rate present in methanol buses over those fueled with diesel, requiring 4.5 times more labor for refueling purposes. This study also indicates that methanol buses have higher maintenance costs than diesel buses, including engine rebuilds ($9,500 per engine for methanol vs. $6,500 for diesel) and general maintenance and repair. Overall, the maintenance cost per month per bus for diesel is $4.34, compared with the $31.84 for methanol buses.[143]

3.6.4 Fuel Emissions

Methanol combustion produces negligible amounts of PM and low levels of NO_X. Since methanol emissions are less reactive in the atmosphere than diesel fuel, smaller amounts of O_3 are produced.

3.6.5 Incentives and Disincentives

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The main benefit of using methanol is a reduction in PM, NO_X and O_3 emissions.

Major disincentives of using methanol are the lack of heavy-duty engine production, high rate of engine failure and poor engine durability. The poor durability is due to mechanical wear and accumulation of combustion deposits in the injector tips, which cause fuel injectors to leak. In addition, methanol vehicles experience lower fuel economy compared to diesel vehicles, likely due to the additional fuel storage weight carried by methanol buses. There are also higher operating and capital costs associated with methanol, and special safety concerns -- it can cause toxic effects through skin contact, ingestion or inhalation. Special training programs are needed for those personnel who work with methanol. Finally, due to its inhalation toxicity, methanol is regulated as a hazardous air pollutant (HAP) under 1990 CAA Amendments.[144]

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[143] U.S. Department of Agriculture, *Life-Cycle Costs of Alternative Fuels: Is Biodiesel Cost Competitive For Urban Buses*, 1995.
[144] National Conference of State Legislatures, *Ground Transportation for the 21st Century*, August 1999.

3.7 Hybrid Electric Vehicles

Hybrid electric vehicles (HEVs) are powered by two energy sources: an energy conversion unit such as an internal combustion engine or fuel cell, and an energy storage device such as a battery. Fuels used in HEVs to power the energy conversion unit include gasoline, diesel, methanol, CNG and hydrogen. The main benefits of HEV use are reduction in emissions and increased fuel economy and efficiency. Nevertheless, there is currently a lack of commercially manufactured hybrid engines that can be used with heavy-duty vehicles such as refuse trucks.[145]

3.7.1 Fuel Characteristics

HEVs can be configured in a parallel or series design. In a parallel design, the HEV is powered by the power generation unit (such as an internal combustion engine) and the electric motor, either at the same time or separately. In a series design, the power generation unit is used to generate electricity, which recharges the HEV's battery pack and powers the vehicle with use of an electric motor. Both designs enable the battery pack and internal combustion engine to be smaller than those found in a battery electric vehicle or diesel engine.[146]

In a parallel design, the power generation unit and electric propulsion system are connected directly to the vehicle's mechanical drive train. The primary engine is typically used for highway driving, while the electric motor provides added power during hill climbs, acceleration and other periods of high demand.

In a series design, the primary engine (internal combustion engine) or power generation unit is connected to a generator that produces electricity. The electricity charges the batteries that are then used as a power source for the electric motor that drives the vehicle. Series configuration is thought to be more suited for city and stop-and-go driving. However, the need for a larger battery pack (relative to parallel design) associated with series design increases the costs of these vehicles.[147]

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[145] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air*. U.S. Department of Energy, *Taking an Alternative Route: A Guide for Fleet Operators and Individual Owners Using Alternative Fuels in Cars and Trucks*, April 2001.
[146] National Conference of State Legislatures, *Ground Transportation for the 21st Century*, August 1999.
[147] *Ibid.*

3.7.2 Use and Development

Currently, HEVs are not in widespread use in the refuse vehicle sector. However, refuse vehicles operate under conditions that would make the development of hybrid refuse vehicles feasible and practical; refuse vehicles demonstrate intense stop-and-go driving cycles, a characteristic well-suited for hybrid electric technology.

DSNY is exploring the future use of HEVs in their refuse collection fleet. However, before the widespread commercialization of hybrid heavy-duty refuse vehicles takes place, the cost of batteries will have to be addressed with new engineering and technology. DSNY, in their non-collection operations, is currently using some HEVs.[148]

Hybrid electric technology is being developed and experimented with for use with transit buses, as most major bus manufacturers are currently producing or involved with hybrid-electric demonstration projects.[149]

3.7.3 Costs

Heavy-duty HEVs are still in the developmental stage, so it is difficult to project and estimate the capital and operating costs. With transit buses, HEVs are currently more expensive than regular diesel vehicles. For example, in 1997 New York City Transit (NYCT) purchased diesel hybrid electric buses at an average price per bus of $465,000, compared to the cost of a comparable diesel bus at $290,000.[150] It is anticipated that commercialized diesel hybrid electric buses will eventually have prices similarly to CNG motor buses.[151]

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[148] Based on meeting with Spiro Kattan, Supervisor of Mechanics, Bureau of Motor Equipment, DSNY, July 9, 2003.
[149] INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air;* U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.
[150] Jason Penshorn, Lessons Learned from NYCT's Hybrid-Electric Fleet, *Mass Transit,* July/August 2003.
[151] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.

The maintenance facilities used for HEVs require new equipment. Space for storing and replacing propulsion batteries will be needed, and, as hybrids usually require less transmission and brake maintenance, the number of service bays and maintenance spares may need to be decreased. It should be noted that diesel HEVs do not require new fueling infrastructure and fueling facilities.[152]

NYCT has seen higher maintenance costs and lower reliability and availability with its diesel hybrid electric buses. The new technology and the learning curve of the mechanics are the likely causes of the lower reliability of the buses. Over time, as mechanics become more experienced with these new vehicles, they will likely approach the reliability of diesel vehicles. Subsequently, the operating costs for HEVs will be lower than diesel vehicles and reliability and durability will likely not be an issue after the initial implementation. Furthermore, the reduction in fuel consumption and the extended repair intervals used to service the brakes (lower wear rates) will likely result in a reduction in operating costs.[153]

3.7.4 Emissions

There appears to be significant emission reductions with the use of HEVs. HEVs use diesel fuel more efficiently than conventional vehicles, resulting in reduced emissions.[154]

NYCT is currently utilizing diesel hybrid electric buses. A report sponsored by the U.S. Defense Department's Defense Advanced Research Projects Agency titled "Hybrid-Electric Drive Heavy-Duty Vehicle Testing Project" (2000) found that PM emissions from diesel hybrid electric NYCT buses are generally found to be 50% to 70% lower than conventional diesel-fueled vehicles. (Note that when tested these hybrid vehicles used low-sulfur diesel fuel as well as after-treatment technologies such as particulate filters.) Several systems are responsible for these PM reductions, such as the after-treatment technologies and the ability of these vehicles to utilize regenerative braking.

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[152] *Ibid.*
[153] Jason Penshorn, Lessons Learned from NYCT's Hybrid-Electric Fleet, *Mass Transit,* July/August 2003.
[154] U.S. General Accounting Office, *Mass Transit: Use of Alternative Fuels in Transit Buses*, 1999.

NO_X emissions from NYCT diesel hybrid electric buses are 30% to 40% less than from conventional diesel buses. Engine operation and performance is a prime reason for this difference. Even when the regenerative braking system is turned off during emissions testing, the hybrid vehicles still exhibit 20% to 30% lower NO_X emissions than conventional diesel buses.

Diesel hybrid electric buses also have lower emission levels of CO_2 and CO than diesel buses. Reductions of CO_2 emissions are 10% to 40% lower than conventional diesel bus engines, and CO is 70% lower.[155]

3.7.5 Incentives and Disincentives

The combination of improved fuel economy and emissions reductions is an extremely attractive combination of benefits. Diesel hybrid buses operated by NYCT demonstrate 10% higher fuel economy over conventional diesel buses.[156] The components of a hybrid vehicle that result in improved fuel performance include regenerative braking, an efficient electric-drive system, and on-board energy storage (battery pack).[157] The concept behind regenerative braking is that the forward inertial energy of the vehicle is captured and stored on board the vehicle for later use. When the driver brakes, the motor becomes a generator and uses the kinetic energy of the vehicle to generate electricity that can be stored in the battery and used at a later time. With friction braking, energy is wasted when the energy of the motion of the vehicle is turned to heat as the brakes are applied.

The main disincentive associated with hybrid electric technology is the current lack of commercially manufactured hybrid engines that can be utilized with heavy-duty trucks such as refuse vehicles. The development of heavy-duty hybrid electric propulsion systems has to advance before hybrid technology is used and available with refuse vehicles. In addition, the high cost of batteries used with heavy-duty HEVs will have to be addressed before the

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[155] Northeast Advanced Vehicle Consortium, *Hybrid-Electric Drive Heavy-Duty Vehicle Testing Project*, 2000.
[156] Jason Penshorn, Lessons Learned from NYCT's Hybrid-Electric Fleet, *Mass Transit*, July/August 2003.
[157] National Conference of State Legislatures, *Ground Transportation for the 21st Century*, August 1999.

large-scale production by major refuse vehicle manufacturers takes place. Other disincentives include high capital costs and necessary modifications to maintenance and storage facilities. In addition, higher maintenance costs and lower reliability (due to the new technology and learning curve of mechanics) are disincentives associated with initial use of these vehicles.

4.0 SUMMARY OF FINDINGS AND OPTIONS

4.1 Need to Promote Clean Fuels

Two main factors currently drive the switch to alternative fuels with refuse vehicles and heavy-duty diesel vehicles.

- Environmental concerns related to heavy-duty diesel truck utilization in the City.
- New stricter government emission standards for heavy-duty vehicles.

4.2 Types of Clean Fuels

4.2.1 Clean Diesel

- Can cut certain emissions by 90%.
- Ultra-low-sulfur diesel fuel needs to be utilized in conjunction with after-treatment devices in order to maximize the emissions reductions.
- Diesel oxidation catalysts and particulate filters are two promising after-treatment technologies.
- By 2007, new heavy-duty diesel engines, in conjunction with clean diesel after-treatment technologies, will provide up to 98% reductions (from 1998 model year engines) in PM and NO_X emissions.

4.2.2 Natural Gas

- Drilled from underground supplies in the U.S.
- Two forms -- CNG and LNG.
- The City has a moratorium on establishing LNG facilities.
- More expensive to purchase, maintain and operate than diesel.
- On average cost about 25% more per vehicle.
- Retrofitting diesel vehicle for natural gas use can cost $30,000 to $100,000.
- Incentives from public sector can help offset costs.
- Cleaner and quieter than diesel.
- Loss of torque and power compared to diesel engines.
- CNG can be a transitional fuel used as a hydrogen source for fuel cells.

4.2.3 Biodiesel

- More expensive than regular diesel.
- Does not require mechanical modifications or conversions.
- Works best in diesel engines as B20 (80% petroleum diesel).
- B100 eliminates sulfur emissions and cuts PM by approximately 50%, but NOX emissions increase when biodiesel is used.

4.2.4 Fuel Cells

- Not a viable option for heavy-duty vehicles for at least 10-15 years.
- High energy-efficiency and zero emissions.
- Infrastructure of hydrogen fueling stations needs to be built.

4.2.5 Battery Electric

- Despite advances in power production, battery electric vehicles cannot currently provide the power or torque needed for heavy-duty vehicles such as refuse vehicles.
- Battery needs a long time to recharge and vehicles that use battery power have a limited range.
- Vehicles have zero tailpipe emissions.

4.2.6 Propane

- The most commonly used alternative fuel in the U.S.
- Major garbage truck manufacturers currently do not offer models capable of burning propane.
- Low levels of NO_X and PM emissions are a characteristic of propane combustion.

4.2.7 Ethanol

- High operating and capital costs.
- High rate of engine failure and low engine durability.
- Lack of heavy-duty engine production.
- Like methanol, emission reductions in CO and PM, but higher NO_X emissions than diesel engines.

4.2.8 Methanol

- M85 is primarily an alternative fuel used in light-duty vehicles.
- High operating and capital costs.
- High rate of engine failure and low engine durability.
- Lack of heavy-duty engine production.

4.2.9 Hybrid Electric

- Vehicles are powered by two energy sources: an energy conversion unit such as an internal combustion engine and an energy storage device such as a battery.
- Lack of commercial hybrid engines and propulsion systems that can be used with refuse trucks.
- Combination of improved fuel economy and emissions benefits makes these vehicles an attractive future option.

4.3 Options

4.3.1 New York City Department of Sanitation

- Continue to utilize and experiment with ULSD and clean diesel technology with use in existing vehicles with the goal being that all diesel vehicles currently in operation should utilize clean diesel technology in order to meet the USEPA 2004 and 2007 emissions standards applicable to new diesel vehicle engines.
- Continue to make clean diesel technology the preferred vehicle standard for new heavy-duty refuse vehicle purchases.
- Continue to test and compare alternative fuel exhaust emissions in order to evaluate hybrid electric refuse vehicles.
- Continue to pursue its CNG heavy-duty program, so that DSNY will be able to take advantage of potential advancements in CNG technology and fuel cell technology.
- Continue to develop partnerships with fuel suppliers, OEMs and infrastructure providers in order to help reduce the cost of clean fuel implementation.
- For light-duty vehicles, continue with ethanol purchase and plans for ethanol fueling facilities.
- Utilize government grants and economic incentives to offset the higher costs associated with natural gas, hybrid electric and ethanol vehicles.

4.3.2 Private Waste Haulers

- Retrofit old diesel vehicles with clean diesel technology.
- Begin using ULSD ahead of June 2006 mandate.
- Deploy and purchase clean diesel vehicles now in order to avoid future expenses that will be needed to meet new strict USEPA emission standards.
- Utilize government grants and economic incentives to help offset the incremental capital costs associated with natural gas refuse vehicles.
- In conjunction with infrastructure supplier and engine manufacturers, explore the future option of CNG heavy-duty refuse vehicles