APPENDIX A: COST MODEL ASSUMPTIONS

This Appendix describes the assumptions, method, and sources used in the cost model. Additional summary tables are also included.

Curbside Collection Cost Assumptions

Current refuse collection costs per ton and per household

Citywide cost figures come from a DSNY analysis for fiscal year 2014. The estimate for collection costs aims to capture direct costs and exclude indirect and fixed costs. Collection costs include all refuse management expenses at DSNY's Bureau of Collection and Cleaning, motor equipment expenses for refuse management, and 50 percent of refuse collection field support. It is assumed some field support costs are directly linked to the number of routes and workers, but other support costs are fixed. These total $619 million.

The analysis assumes 90 percent of these costs, $549 million, are for residential collections; the rest is for government agencies, schools, and street waste. Collection costs were apportioned to each borough based on their share of worker collection hours in fiscal year 2012 and then divided by curbside household refuse tonnage. This data was provided by DSNY. The per-household figures are based on the number of occupied households reported in the U.S. Census, 2013 American Community Survey (ACS). (See Table A1.)

Variable export cost per ton of refuse

DSNY pays fees to private companies to transport and dispose of city trash. The analysis uses export contract prices from fiscal year 2014 and considers only the variable portion. Data was provided by the New York City Office of Management and Budget (OMB).

Organic waste per household

In 2004 DSNY conducted an extensive survey of household waste composition by borough. This analysis uses those findings and applies the compostable share of household refuse

Table A1: Organic Waste Cost Model Assumptions by Borough

	Collection Cost per Ton of Refuse	Variable Export Cost per Ton of Refuse	Refuse Collection Cost per Household	Average Weekly Organic Waste per Household (Pounds)	Recycling Capture Rate
Bronx	$163	$82	$152	12.0	33%
Brooklyn	$217	$91	$192	11.6	42%
Manhattan	$174	$68	$108	7.7	45%
Queens	$233	$95	$216	12.4	48%
Staten Island	$261	$65	$295	15.3	57%
Citywide	$208	$85	$178	11.2	43%

to fiscal year 2015 DSNY statistics for refuse tonnage by borough. It assumes 90 percent of DSNY refuse is residential. The number of occupied households comes from the U.S. Census, 2013 ACS.

Recycling capture rate

The capture rate measures the share of covered material properly separated. The analysis uses the capture rates for paper, metal, glass, and plastic by sanitation district. The data is available for fiscal year 2010 on New York City Open Data.

Impact on Collections

The analysis considers how many sanitation districts may be able to reduce refuse collections. For each district it was determined how much organic waste would be diverted under two scenarios: a 20 percent capture rate and a capture rate equal to each district's capture rate for recycling. The amount of total organic waste in each district was calculated based on curbside household refuse collections in fiscal year 2012 and the assumed share of organic material in the waste stream by borough, according to the 2004-2005 DSNY waste characterization study.

The number of refuse truck-shifts was reduced by one per week in each district. For districts with three times per week collection, the reduction was 33 percent; for districts with two times per week collection, the reduction was 50 percent. Some districts have a mix of two and three times per week refuse collection; for those districts, the number of shifts was reduced 40 percent. The number of truckloads per district was calculated by multiplying the number of reduced truck-shifts by the average number of truck dumps per shift. Then, the remaining amount of refuse (net of organics diversion) was divided by the number of truckloads. It was assumed that DSNY trucks can hold 12.5 tons of refuse, based on guidance provided in the City's Environmental and Quality Review Technical Manual for Solid Waste and Sanitation Services.

The analysis found 10 districts could reduce a weekly refuse pickup if organic waste were diverted at the same rate as recycling in the district. (See Table A2.) A similar analysis was conducted to test the viability of dual-bin trucks. It was assumed each compartment

Table A2: Sanitation Districts that Could Reduce Refuse Pickup, if Organics Capture Rate Same as Recycling Capture Rate

	Curbside Refuse Tons per Truck-Shift	Curbside Refuse Truck-Shifts	Dumps per Shift	Refuse Pickups per Week	Refuse Truck-shift Reduction	Potential Organics Diverted	New Refuse Tons per Load
Astoria & Long Island City*	8.2	6,055	1.1	2.0	3,027	9,917	12.3
Bayside, Douglaston & Little Neck*	7.1	5,244	1.0	2.0	2,622	8,787	10.7
Bedford-Stuyvesant	9.3	5,312	1.0	3.0	1,771	4,636	12.4
Concourse, Highbridge & Mount Eden	15.9	3,416	1.9	3.0	1,139	4,645	11.6
Crown Heights North & Prospect Heights	9.7	3,403	1.0	3.0	1,134	4,536	12.3
East Flatbush, Farragut & Rugby	8.4	6,196	1.0	2.5	2,478	6,649	12.1
New Springville & South Beach*	8.1	6,503	1.0	2.0	3,252	11,522	12.4
Park Slope, Carroll Gardens & Red Hook*	8.0	3,437	1.0	2.0	1,719	5,241	12.5
Queens Village, Cambria Heights & Rosedale*	6.8	9,393	1.0	2.0	4,696	11,686	11.2
Tottenville, Great Kills & Annadale*	7.6	9,263	1.0	2.0	4,632	16,193	11.5
Average/Total	**8.9**	**58,222**	**1.0**	**2.1**	**26,470**	**83,812**	**11.9**

Note: District with "2.5" weekly pickups has 2 weekly refuse collections in some parts and 3 in others.

*District could also switch to dual-bin trucks for organics and refuse.

could hold 6.25 tons of refuse. The analysis found six districts could switch to dual-bins; each of these could also drop a weekly refuse collection.

In fiscal year 2012, DSNY operated 259,327 curbside refuse truck-shifts. For this analysis, it is assumed organics collection routes mirror refuse routes, and it is assumed each district adds a weekly organics waste pickup. If this were to happen citywide, collection costs would increase 44 percent, and the number of curbside household truck-shifts would increase by 114,396. If refuse collections were reduced in the 10 districts identified above, the number of truck-shifts would be reduced by 26,470, bringing the net increase to 87,926. For the scenario in which organics diversion is the same as district recycling, it is assumed that collection costs increase 34 percent citywide.

Organic waste bins

The assumptions for organic waste bins are based on DSNY's Request for Proposals (RFP) in October 2014. The RFP specifies different sized kitchen and curbside bins depending on building size. Contractors are to provide all households with one 2-gallon kitchen collector and one- to two-unit buildings with one 10- to 16-gallon curbside bin; three- to four-unit buildings with one 20- to 25-gallon curbside bin; and five- to nine-unit buildings with two 20- to 25-gallon curbside bins. The RFP specifies the bins must have a minimum service life of 10 years and a DSNY label. According to DSNY, bin prices for the residential pilot have been $3 for 2-gallon kitchen collectors, $20 for 13-gallon bins, and $36 for 21-gallon bins.

The RFP also includes data on the number of bins allocated per household in the organics pilot to date. The data shows an average of 1.1 kitchen collectors per household, 0.7 13-gallon bins per household, and 0.1 21-gallon bins per household. Using these averages, it is assumed the kitchen bin costs $3 per household and the curbside bin costs $18 per household.

Transportation to processing facility

The analysis assumes composting and anaerobic digestion facilities are located 75 miles from the city. Actual facilities may be closer or farther. The largest composting facility in the region that accepts food waste, New Milford Farms in Connecticut, is 80 miles from midtown Manhattan.

The assumptions for transportation costs are largely based on a study from the Water Environment Research Foundation. It is assumed truck maintenance costs $0.45 per mile; trucks get 5.8 miles per gallon; the price of diesel is $4 per gallon; annual labor costs are $36 per hour; average truck speed is 45 miles per hour; and the number of tons per truck is 15. Long-haul garbage trucks can typically fit 20 tons, but the quantity is likely to be less for New York City until participation expands significantly.

Compost tipping fees

Composting costs depend on the type of technology used. In order of least expensive to most expensive, the three technologies considered are turned windrows, aerated windrows, and enclosed vessel. A 2012 study by the U.S. Environmental Protection Agency (EPA), *Food Scrap Recycling: A Primer for Understanding Large-Scale Food Scrap Recycling Technologies for Urban Areas*, surveyed capital and operational costs at composting facilities. The study found total operating and capital costs ranged from $15 to $40 per ton for turned windrows; $25 to $60 per ton for aerated windrows; and $80 to $110 per ton for in-vessel. The analysis uses the average of these costs for turned windrows and in-vessel. The assumed tipping fee for aerated windrows is based on actual fees of $45 per ton at Ag Choice in New Jersey and the former Wilmington Organics Recycling Center in Delaware.

Anaerobic digestion

The costs for anaerobic digestion are based on a survey of facilities conducted by the City of Vancouver in 2014. The study found optimal economics are achieved with a 44,000-ton plant (40,000-tonne). This sized plant would cost $18 million to construct (CAD$20 million).

Table A3: Summary of Curbside Organics Collection Savings/(Costs) Per Ton Based on 20 Percent Capture Rate

	Bronx	Brooklyn	Manhattan	Queens	Staten Island	Citywide
Kitchen and Curbside Bins	($33)	($35)	($52)	($32)	($26)	($36)
Transportation (75 miles)	($18)	($18)	($18)	($18)	($18)	($18)
Avoided Export	$82	$91	$68	$95	$65	$85
Processing						
Turned Windrow Composting	($28)	($28)	($28)	($28)	($28)	($28)
Aerated Windrow Composting	($45)	($45)	($45)	($45)	($45)	($45)
In-vessel Composting	($95)	($95)	($95)	($95)	($95)	($95)
Anaerobic Digestion	($62)	($62)	($62)	($62)	($62)	($62)
NYC Wastewater Treatment Plant	($69)	($69)	($69)	($69)	($69)	($69)
Collection	($899)	($1,376)	($900)	($1,677)	($1,854)	($1,339)
Organics Net Added Savings/(Costs)						
Low Cost	($895)	($1,365)	($929)	($1,660)	($1,861)	($1,336)
High Cost	($963)	($1,432)	($996)	($1,728)	($1,928)	($1,403)
Potential Organic Tons Diverted	**30,105**	**55,891**	**28,999**	**50,570**	**13,336**	**178,900**

The analysis assumes a 6 percent interest rate and a 20-year amortization period, resulting in annual debt service of $36 per ton. It is assumed the plant would cost $70 per ton to operate based on the experience of the 40,000-ton Dufferin Organic Processing Facility in Toronto.

Costs would be offset by revenues from the sale of biogas. Based on a presentation from DEP, the analysis assumes one ton of food scraps produces 241 cubic meters of biogas, equivalent to 8,508 cubic feet. The average wholesale price for natural gas (called the citygate price) in New York from August 2014 to July 2015 was $5.12 per thousand cubic feet. Based on these inputs, it is assumed biogas generates $44 per ton of food waste, and the net cost of anaerobic digestion is $62 per ton.

Co-digestion at wastewater treatment plant

The assumed costs for co-digestion are based on estimated capital upgrades, biosolids handling, and biogas revenues. For the Newtown Creek pilot, DSNY pays Waste Management $116 per ton to pre-process and transport food waste to the wastewater treatment plant. Waste Management was also responsible for financing a receiving station at Newtown Creek. The analysis assumes this fee would remain the same. It also assumes the wastewater treatment plant would invest in biogas conversion upgrades. National Grid is investing $14.4 million in such equipment at the Newtown Creek plant. Based on initial processing plans of 50 tons of food waste per day, or 15,600 tons per year assuming operations six days per week, the annual debt service for this infrastructure is $60 per ton. The analysis assumes DEP finances infrastructure over a 30-year period at a 5 percent interest rate.

It is assumed biosolids equal 28 percent of food waste input by weight, and the cost of DEP biosolids handling is $136 per ton. For a 2008 report on commercial food waste grinders, DEP estimated operational costs of $23.3 million for handling 519 tons per day, or 189,435 tons per year. The estimated 2008 cost was adjusted for inflation. Thus, the cost of biosolids handling is $38 per ton of food waste input.

Table A4: Summary of Curbside Organics Collection Savings/(Costs) Per Ton Based on Organics Capture Rate Equal to District Recycling Rate

	Bronx	Brooklyn	Manhattan	Queens	Staten Island	Citywide
Kitchen and Curbside Bins	($20)	($16)	($23)	($13)	($9)	($17)
Transportation (75 miles)	($18)	($18)	($18)	($18)	($18)	($18)
Avoided Export	$82	$91	$68	$95	$65	$85
Processing						
Turned Windrow Composting	($28)	($28)	($28)	($28)	($28)	($28)
Aerated Windrow Composting	($45)	($45)	($45)	($45)	($45)	($45)
In-vessel Composting	($95)	($95)	($95)	($95)	($95)	($95)
Anaerobic Digestion	($62)	($62)	($62)	($62)	($62)	($62)
NYC Wastewater Treatment Plant	($69)	($69)	($69)	($69)	($69)	($69)
Collection	($540)	($522)	($397)	($519)	($211)	($481)
Organics Net Added Savings/(Costs)						
Low Cost	($522)	($493)	($397)	($483)	($201)	($459)
High Cost	($590)	($560)	($464)	($551)	($268)	($526)
Potential Organic Tons Diverted	**50,176**	**118,477**	**65,733**	**121,189**	**38,103**	**386,544**

Based on the assumptions described above for biogas revenue at anaerobic digestion plants, it is assumed biogas produces revenue of $44 per ton of food waste. Based on the analysis below of physical constraints at DEP plants, Newtown Creek digested 49,698 tons of total suspended solids in 2014. Assuming the energy output of sewage is 10,000 cubic feet of biogas per ton of dry sewage, as reported by the East Bay Municipal Utility District, and 62 percent is currently flared, new revenue from sewage would be $1.6 million, or $101 per ton of food waste based on 50 tons per day. Total net costs are assumed to be $69 per ton.

Because the cost of biogas equipment upgrades do not depend on the amount of food waste digested, the per-ton cost of co-digestion would change if a greater quantity of food waste were digested. For example, if the amount of food waste increased to 250 tons per day, as planned over the next few years at Newtown Creek, revenues per ton from sewage biogas would fall from $101 to $20 per ton and debt service would fall from $60 to $12 per ton, resulting in a net cost of $102 per ton.

Curbside Organic Waste Collection Results

Table A3 summarizes the per-ton costs of curbside organics collection by borough if the organics capture rate is 20 percent.

Table A4 summarizes the per-ton costs of curbside organics collection by borough if the organics capture rate is the same as district-level paper, metal, glass, and plastic recycling capture rates.

Food Waste Disposers

Device purchase and installation

It is assumed households purchase the simplest available model of in-sink food waste disposer for $50 per device. Installation is assumed to require one hour of work for both a plumber and an electrician. The prevailing wage rate for a plumber in New York City is $93.65 per hour, including benefits, and $48.32 per hour for an electrician. The amount of material processed through disposers is assumed to be 50 percent of household food waste; average household food waste is based on DSNY's waste characterization study. Assuming the devices have a useful life of 10 years, the annualized cost of purchase and installation is $156 per ton and $14 per household.

Household water and electricity usage

The amount of water and electricity required to operate the devices is based on a review of case studies. It is assumed devices use 4 kilowatt-hours per year at a price of $0.045 per kilowatt-hour, based on New York City electricity prices for January to September 2015. The per-ton cost of electricity is $2 and the annual household cost is $0.18. Numerous studies have found household water usage for disposers to be 1 gallon per capita. Based on this assumption and DEP water and sewer rates of $0.01 per gallon for fiscal year 2016, the annual cost of water usage is $145 per ton and $13 per household.

Wastewater treatment plant processing

The cost of wastewater treatment plant processing is based on a comprehensive 2012 study by the Water Environment Research Foundation (WERF). The study evaluated alternatives to handle food waste based on existing facility costs. For in-sink disposers, the study assumed operating and maintenance costs of $76 per ton. The WERF study also assumed new capital costs of $692 per ton, including a combined heat and power system. Based on a 5 percent interest rate and a 30-year amortization period, annual debt service costs would be $45 per ton. Since the WERF study used 2009 numbers, this analysis adjusted their findings to 2014 terms, producing assumed operating costs of $83 per ton and annual debt service of $49 per ton.

In 1997 DEP evaluated the cost of residential food waste disposers in the city. The study produced a wide range of estimates depending on the type of pollution controls installed. Using the figures in that report and adjusting for inflation would produce estimates of $47 to $182 per ton for annual operating costs and $10 to $111 per ton for annual debt service. The assumptions used in this analysis fall in the middle of these DEP estimates.

For revenues from food waste conveyed by sewers, it is assumed biogas is converted into electricity, which lowers the assumption for revenues per ton compared to anaerobic digestion plants or wastewater digesters. Based on the experience of a Toronto anaerobic digestion plant, it is assumed one ton of food waste generates 270 kilowatt-hours of electricity, producing revenues of $12 per ton of food waste sent through in-sink disposers.

DSNY collection reductions

For each district, it was determined how much food waste would be diverted if 50 percent went down the sink. The amount of total organic waste in each district was calculated based on curbside household refuse collections in fiscal year 2012 and the assumed share of organic material in the waste stream by borough, according to the 2004-2005 DSNY waste characterization study.

The current number of refuse truck-shifts was reduced by one per week. Some districts have a mix of two and three times per week refuse collection; for those districts, the number of shifts was reduced by 40 percent. The number of truckloads per district was calculated by multiplying the number of reduced truck-shifts by the average number of truck dumps per shift; the remaining amount of refuse was divided by the number of truckloads. It was assumed that DSNY trucks can hold 12.5 tons of refuse, based on guidance provided in the City's Environmental and Quality Review Technical Manual for Solid Waste and Sanitation Services.

The analysis found six districts could reduce refuse pickup if food waste disposers were installed (Bedford-Stuyvesant, Brownsville, and East Flatbush in Brooklyn; Concourse and Mott Haven in the Bronx; and Queens Village in Queens). (See Table A5.) A similar analysis was conducted to test the viability of dual-bin trucks. It was assumed each compartment could hold 6.25 tons of refuse. The analysis found one district could also switch to dual-bin

Table A5: Sanitation Districts that Could Reduce Refuse If Food Waste Disposers Installed

	Curbside Refuse Tons per Truck-Shift	Curbside Refuse Truck-Shifts	Dumps per Shift	Refuse Pickups per Week	Refuse Truck-shift Reduction	Potential Organics Diverted	New Refuse Tons per Load
Bedford-Stuyvesant	9.3	5,312	1.0	3.0	1,771	5,628	12.2
Brownsville & Ocean Hill	9.3	2,489	1.0	3.0	830	2,647	12.3
Concourse, Highbridge & Mount Eden	15.9	3,416	1.9	3.0	1,139	6,334	11.2
East Flatbush, Farragut & Rugby	8.4	6,196	1.0	2.5	2,478	5,906	12.3
Mott Haven & Melrose	15.2	1,584	1.6	3.0	528	2,810	12.4
Queens Village, Cambria Heights & Rosedale*	6.8	9,393	1.0	2.0	4,696	6,375	12.3
Average/Total	**10.8**	**28,390**	**1.3**	**2.8**	**11,442**	**29,700**	**12.1**

Note: District with "2.5" weekly pickups has 2 weekly refuse collections in some parts and 3 in others.

*District could also switch to dual-bin trucks for organics and refuse.

trucks. Based on the analysis below of physical constraints at DEP plants, it was assumed that in-sink disposers are viable in four of the six districts identified. Disposers are not viable in the neighborhoods of East Flatbush and Queens Village because they are served by the Coney Island and Jamaica plants, respectively.

In fiscal year 2012, DSNY operated 259,327 curbside refuse truck-shifts. It is assumed refuse reductions in these four districts would reduce collection costs 1.6 percent citywide; 4.8 percent in the Bronx; and 3.1 percent in Brooklyn.

Food Waste Disposers Results

Table A6 summarizes the per-ton public and private costs by borough of food waste disposers.

Summary of Cost Analysis

The total cost of curbside residential organics diversion would range from $177 million to $203 million per year if capture rates are the same as sanitation district rates for paper, metal, glass, and plastic recycling. If the capture rate is only 20 percent, citywide costs would range from $239 million to $251 million. In contrast,

Table A6: Summary of Food Waste Disposer Savings/(Costs) Per Ton

	Bronx	Brooklyn	Manhattan	Queens	Staten Island	Citywide
Disposer Installation	($131)	($142)	($216)	($154)	($150)	($156)
Household Electricity	($2)	($2)	($3)	($2)	($2)	($2)
Household Water Consumption	($132)	($136)	($165)	($155)	($144)	($145)
Avoided Export	$82	$91	$68	$95	$65	$85
Treatment Plant Capital and Operations	($133)	($133)	($133)	($133)	($133)	($133)
Biogas Revenues	$12	$12	$12	$12	$12	$12
Collection Avoided	$67	$119	$0	$0	$0	$61
Net Savings/(Costs)	**($235)**	**($190)**	**($435)**	**($336)**	**($351)**	**($278)**
Potential Organic Tons Diverted	**52,332**	**46,377**	**23,920**	**14,458**	**15,880**	**148,667**

Table A7: Summary of Citywide Organic Waste Diversion Cost Analysis

	Bronx	Brooklyn	Manhattan	Queens	Staten Island	Citywide
Potential Organic Tons Diverted						
Curbside, 20% Capture Rate	30,105	55,891	28,999	50,570	13,336	178,900
Curbside, Capture Rate Equals Recycling Rate	50,176	118,477	65,733	121,189	38,103	386,544
Food Waste Disposer	52,332	46,377	23,920	14,458	15,880	148,667
Total Added Savings/(Costs), Low Cost ($ in millions)						
Curbside, 20% Capture Rate	($27)	($76)	($27)	($84)	($25)	($239)
Curbside, Capture Rate Equals Recycling Rate	($26)	($58)	($26)	($59)	($8)	($177)
Food Waste Disposer	($12)	($9)	($10)	($5)	($6)	($41)
Total Added Savings/(Costs), High Cost ($ in millions)						
Curbside, 20% Capture Rate	($29)	($80)	($29)	($87)	($26)	($251)
Curbside, Capture Rate Equals Recycling Rate	($30)	($66)	($31)	($67)	($10)	($203)
Food Waste Disposer	($12)	($9)	($10)	($5)	($6)	($41)

the use of in-sink food waste disposers would cost $41 million annually. (See Table A7.)

Physical Constraints on Wastewater Treatment System

The following analysis is based on 2014 monthly data for DEP wastewater treatment plants available from New York City Open Data.

Water

The analysis assumes food waste disposers add 1 gallon of water per capita per day. Overall, the 14 plants have a permitted capacity of 1.8 billion gallons per day, but only 1.2 billion gallons are processed on an average day. The addition of water from food waste disposers was compared to each plant's excess capacity. Because water flows vary significantly by month, largely due to rainfall, the additional water impact was compared to water flows during each plant's maximum month. The largest impact would be at Oakwood Beach in Staten Island, where food waste disposers would consume 6.3 percent of excess capacity.

Total suspended solids

Total suspended solids (TSS) are materials that are suspended in water. DEP reports on monthly TSS influent and effluent. In 2014 DEP plants processed 273,407 tons of TSS influent. This estimate was calculated based on reported TSS milligrams per liter and reported water flow at each plant. To test the impact of food waste disposers, the analysis assumes 19 percent of food waste is TSS. This would increase TSS influent by 18.4 percent overall and between 11.3 percent at North River in Manhattan and 25.0 percent at Jamaica in Queens.

Under federal regulations, DEP plants are required to remove 85 percent of TSS and keep TSS effluent below 30 milligrams per liter. Based on reported monthly TSS effluent milligrams per liter and reported water flow, in 2014 DEP plants released 21,437 tons of TSS effluent. Using average removal performance, food waste disposers would increase TSS effluent by 3,522 tons, or 16.4 percent. The increase would range from 11.0 percent at North River to 23.4 percent at Jamaica.

Each plant was evaluated based on their worst monthly performance in 2014 to determine if the installation of food waste disposers would

Table A8: Impact of Food Waste Disposers on Total Suspended Solids (TSS) Effluent During Worst Month at New York City Wastewater Treatment Plants, 2014

Plant	Tons of TSS Influent with Disposers, tons	Water Flow with Disposers, MGD	Minimum Monthly TSS Removal	Maximum TSS Effluent with Disposers, mg/L	Excess TSS Capacity During Maximum Month
26th Ward	9,716	47	89%	15	51.4%
Bowery Bay	28,075	110	94%	10	65.3%
Coney Island	26,695	88	81%	38	(28.3%)
Hunts Point	25,376	124	89%	15	50.8%
Jamaica	21,659	81	90%	17	42.4%
Newtown Creek	60,828	220	88%	21	29.5%
North River	32,392	117	79%	39	(29.9%)
Oakwood Beach	10,389	30	91%	21	28.8%
Owls Head	27,666	95	83%	32	(7.8%)
Port Richmond	10,877	31	86%	32	(5.7%)
Red Hook	8,859	28	91%	18	39.7%
Rockaway	3,287	16	86%	19	37.1%
Tallman Island	13,532	58	85%	22	25.6%
Wards Island	44,286	211	85%	21	29.0%
Citywide	**323,639**	**1,255**	**NAP**	**NAP**	**NAP**

MGD = Millions of gallons per day

NAP = Not applicable

cause any plants to exceed their permits for TSS effluent. In 2014, the North River and Owls Head (Brooklyn) plants exceeded their permits in at least one month; thus, they would also exceed permits with food waste disposers. Two other plants would have also exceeded permits in 2014 with food waste disposers: Coney Island in Brooklyn and Port Richmond in Staten Island. (See Table A8.)

Carbonaceous Biochemical Oxygen Demand (cBOD)

Carbonaceous biochemical oxygen demand (cBOD) measures the depletion of oxygen in a body of water from the presence of biological organisms. DEP reports on both cBOD influent and effluent. In 2014 DEP processed 273,407 tons of cBOD influent. This estimate was calculated based on reported cBOD milligrams per liter and reported water flow at each plant. To test the impact of disposers, the analysis assumes 39 percent of food waste is biochemical oxygen demand (BOD) and 86 percent of BOD is cBOD. The installation of disposers would increase cBOD influent by 88,340 tons, or 32.3 percent. The increase would range from 19.8 percent at North River to 43.9 percent at Jamaica.

Under federal regulations, DEP plants are required to remove 85 percent of cBOD and keep cBOD effluent below 25 milligrams per liter. Based on reported monthly cBOD effluent milligrams per liter and reported water flow, in 2014 DEP plants released 13,581 tons of cBOD effluent. Using average removal performance, food waste disposers would increase cBOD effluent by 3,991 tons, or 29.4

Table A9: Impact of Food Waste Disposers on Carbonaceous Biochemical Oxygen Demand (cBOD) Effluent During Worst Month at New York City Wastewater Treatment Plants, 2014

Plant	Tons of cBOD Influent with Disposers, tons	Water Flow with Disposers, MGD	Minimum Monthly cBOD Removal	Maximum cBOD Effluent with Disposers, mg/L	Excess cBOD Capacity During Maximum Month
26th Ward	12,778	47	95%	9	64.5%
Bowery Bay	31,761	110	96%	8	69.6%
Coney Island	27,177	88	94%	12	51.1%
Hunts Point	26,625	124	94%	8	66.1%
Jamaica	25,520	81	93%	15	41.9%
Newtown Creek	65,381	220	91%	18	29.8%
North River	30,482	117	79%	36	(44.2%)
Oakwood Beach	10,221	30	95%	11	54.7%
Owls Head	32,921	95	90%	23	8.8%
Port Richmond	15,109	31	95%	16	36.4%
Red Hook	9,502	28	92%	18	29.2%
Rockaway	3,769	16	93%	11	56.9%
Tallman Island	14,940	58	94%	10	59.3%
Wards Island	44,282	211	94%	8	66.9%
Citywide	**350,466**	**1,255**	**NAP**	**NAP**	**NAP**

MGD = Millions of gallons per day

NAP = Not applicable

percent. The increase would range from 17.0 percent at Port Richmond to 42.1 percent at Hunts Point in the Bronx.

Each plant was evaluated based on their worst monthly performance in 2014 to determine if the installation of food waste disposers would cause any plants to exceed their permits for cBOD effluent. In 2014, the North River plant exceeded its permit in at least one month; thus, this plant would also exceed its permit with food waste disposers. No other plants would have exceeded permits in 2014 with food waste disposers. (See Table A9.)

Digester Capacity

For a conference presentation, DEP conducted an analysis of capacity for co-digestion of food waste at its 14 plants. The analysis found excess digester capacity available at all plants except Bowery Bay (Queens), North River, Coney Island, Jamaica, and Owls Head.

Results

The analysis assumes that food waste disposers are not viable in neighborhoods served by Bowery Bay, North River, Coney Island, Jamaica, and Owls Head. Based on the map below, the following sanitation districts are partially or fully served by plants with physical limitations: Queens 1-6, 9-10, 12-13; Manhattan 4, 7, 9, 12; and Brooklyn 7, 9, 10-12, 13-18.

Based on these exclusions and the populations in those areas, it is assumed disposers are viable in 100 percent of the Bronx and Staten Island, 50 percent of Brooklyn and Manhattan, and 20 percent of Queens.

SOURCES OF DATA FOR APPENDICES

Appendix A

Sources for curbside collection analysis

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East Bay Municipal Utility District, *Anaerobic Digestion of Food Waste* (March 2008), http://infohouse.p2ric.org/ref/43/42429.pdf.

City of New York Request for Proposals, *Waste Bins: Organics Collection* (DSNY) (October 10, 2014), https://mspwvw-dcscpfvp.nyc.gov/CROLPublicFacingWeb/Search/GetFile?sectionId=6&requestId=20141010017&requestStatus=Archived&documentId=17056.

Appendix B

Souces

CBC staff analysis of permits and annual reports from the New York State Department of Conservation, the Connecticut Department of Energy and Environment, and the New Jersey Department of Environmental Protection.

"Food Composting Infrastructure Survey" *BioCycle* (August 2008), Vol. 49, No. 8, www.foodscrapsrecovery.com/BioCycle_foodCompostInfrastructure.pdf.

Meghan Van Dyk, "Sussex County Organics

Recycler Taps Food Waste's Potential"
Daily Record (February 20, 2013), http://archive.dailyrecord.com/article/20130221/GRASSROOTS/302210014/Sussex-County-organics-recycler-taps-food-waste-s-potential.