

Boston Zero Waste Plan



This document includes the proposed Zero Waste Plan outline and the Zero Waste Plan elements (sections 7 and 8) to be discussed at Meeting #3 of the Zero Waste Advisory Committee.

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Proposed Zero Waste Plan Outline

Summary (2-3 pages, in a separate document)

1. Letter of Transmittal
2. Advisory Committee
3. Acknowledgements
4. Table of Contents
5. Project Overview
 - a. Planning Process
 - b. Guiding Principles
 - c. Evaluation Criteria
6. Existing System
7. Services, Rules, and Outreach & Education – included for Meeting #3
8. Impact Analysis – included for Meeting #3
 - a. Cost/Benefit Analysis
 - b. GHG and Job Impacts
9. Implementation
 - a. Goals and Milestones
 - b. Funding Options
 - c. Data and Reporting
 - d. Timeline
 - I. Short-term (2019-2024)
 - II. Medium-term (2025-2030)
 - III. Long-term (2031-2040)

Appendices:

- A: Zero Waste Initiative Details
- B. Economic Development Recommendations

Boston Zero Waste Plan



7. Recommended Services, Rules, Outreach & Education

Nineteen Zero Waste options are recommended for implementation in the short-, medium- and long-term. Each of these options has sub-tasks that are included as initial steps, and more will be added by City staff over time; a brief description of each is provided. For more details on each option, see Appendix A. For each option, the potential diversion from landfills and waste-to-energy in tons per year (TPY) and the potential diversion rate increase is estimated based on full implementation of the option. Those diversion estimates are compiled for all the options on Table 8.1 in the Impact Analysis that follows this section. The total estimated costs at full implementation and the amount of greenhouse gases (GHGs) reduced are also provided for each option.

Recommended Options

Services

A1. Residential and Commercial Organics Diversion

Phase in food and food-soiled paper collection with efficient collection containers for residents and industrial, commercial and institutional generators (ICI). Phase in by neighborhoods as processing capacity expands.

Waste Diversion Impact: 186,000 TPY	Diversion Rate Increase 16%
Total New Costs: \$4,750,000	GHGs reduced: 188,000

A2. Reuse Collection and Facilities

Pickup reusable items by appointment and on a regular basis (e.g., by reuse organizations ahead of recycling and trash pickup). Explore whether a reuse center for durable goods for resale, repair and recycling would be helpful to existing reuse businesses, and, if so, help establish one. This will help reinvest resources where they are needed.

Waste Diversion Impact: 22,000 TPY	Diversion Rate Increase 2%
Total New Costs: \$240,000	GHGs reduced: 117,000

A3. Residential Collection System

Move, in phases, from a tax-based system to a more equitable fee-for-service, cart-based system that incentivizes reduction, reuse, recycling and composting. Charge *Save Money And Reduce Trash* (SMART) rates to households for materials discarded above a base amount covered by property taxes and show a separate line item on property taxes for trash costs. Only continue to provide City-sponsored collection service to multi-family and mixed-use buildings that meet efficiency and diversion standards. Select best qualified lowest priced vendor.

Waste Diversion Impact: 28,000 TPY	Diversion Rate Increase 2%
Total New Costs: \$380,000	GHGs reduced: 97,000

A4. Neighborhood Drop-off Centers

Phase in drop-off centers for recyclables and hard-to-reuse, -recycle or -compost materials neighborhood by neighborhood to make the new system more accessible, particularly to those who live in apartments and small businesses.

Waste Diversion Impact: 4,000 TPY	Diversion Rate Increase <1%
Total New Costs: \$560,000	GHGs reduced: 14,000

A5. Zero Waste Research Option

Promote/start/encourage a Zero Waste research and development (R&D) network to share best practices, organize workshops and webinars, and expand R&D to innovate and find solutions for hard-to-reuse, -recycle or -compost materials and products and identify new business opportunities and priorities of products to ban.

Waste Diversion Impact: 6,000 TPY	Diversion Rate Increase 1%
Total New Costs: \$110,000	GHGs reduced: 13,000

A6. City Leads by Example

Pair trash containers at public facilities (e.g. City buildings, airport, parks) with recycling containers, and with composting containers if food is served nearby. Set Zero Waste goals and metrics; monitor and annually report diversion, waste reduction, and Environmentally Preferable Purchasing (EPP, see B4) progress by department or building. Use locally-made compost. Include sustainability practices in employee performance reviews. Support development of domestic markets through residential recycling and composting processing contracts by providing a premium revenue share to the processor for using local or higher quality markets; allowing the City to redirect materials to a local market and for the City to contract directly with a local market and to pay the processor to sort to that specification, providing a higher revenue share if they do so. This will help demonstrate the City’s commitment to Zero Waste and the culture change that will be required.

Waste Diversion Impact: 7,000 TPY	Diversion Rate Increase 1%
Total New Costs: \$130,000	GHGs reduced: 14,000

A7. City-Owned Transfer and Processing Facilities

Identify potential sites for a City-owned transfer and processing facility or existing facilities that could be purchased, then conduct study to evaluate feasibility. This will help decrease truck mileage and associated greenhouse gases, and provide a more cost competitive collection system. Waste Diversion Impact: N/A

Total New Costs: \$2,500,000	GHGs reduced: N/A
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B1. Rules

Waste Reduction and Recycling Requirements

Enforce state and local recycling ordinances for residents and businesses to divert more and meet higher quality standards. Require residents and businesses to separate their recyclable and compostable materials from trash. Require ICI generators to subscribe to recycling and composting services. Require and enforce recycling plans from ICI generators.

Waste Diversion Impact: 161,000 TPY	Diversion Rate Increase 14%
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Total New Costs: \$1,760,000

GHGs reduced: 377,000

B2. ICI Hauler and Generator Requirements and Incentives

Require haulers to provide City-established minimum levels of recycling and compost collection services to all their customers, and require that they not pick up contaminated loads. Require haulers to collect food and food-soiled paper from ICI customers when sufficient processing capacity exists in the region for food scraps and food-soiled paper. Require haulers to offer incentive-based pricing of trash and recycling services for ICI customers. Increase permit fees for ICI sector to cover new program costs, such as increased inspections and technical assistance. Require haulers to report to the City by service category the performance of their trash, recycling and composting services; public set-out rates; and diversion amounts by targeted materials for all containers serviced in the City.

Waste Diversion Impact: 110,000 TPY
Total New Costs: \$1,250,000

Diversion Rate Increase 10%
GHGs reduced: 356,000

B3. Products and Packaging Waste Reduction

Ban or place fees on food-ware or packaging and adopt point-of-sale fees for products that are toxic or hard-to-reuse, -recycle or -compost (e.g. expanded polystyrene aka Styrofoam). Advocate for redesign of products that are not reusable, recyclable or compostable. Participate in the Massachusetts Product Stewardship Council and Product Stewardship Institute. Support [Right to Repair](#) and other products and packaging waste reduction legislation. This will help eliminate problem materials that cause contamination and lower value to materials collected.

Waste Diversion Impact: 19,000 TPY
Total New Costs: \$210,000

Diversion Rate Increase 2%
GHGs reduced: 33,000

B4. Environmentally Preferable Purchasing (EPP)

Update 2008 Executive Order on sustainable food, waste reduction, and EPP. Train and support staff in waste reduction and EPP. Expand EPP through use of state contracts and vendors for sustainable products. This will help create the demand for manufacturers to use reusables, recyclables and compostables.

Waste Diversion Impact: 10,000 TPY
Total New Costs: \$120,000

Diversion Rate Increase 1%
GHGs reduced: 19,000

B5. Zero Waste Venues & Events

Require managers of large venues and organizers of all events that are already required to obtain a City permit to collect three streams (recycling, compost, trash) and adopt Zero Waste best practices to reduce waste generated and implement reuse, recycling and composting. Phase in requirements based on size or complexity of venue or event. Provide venues and events with waste-reduction training and technical assistance. This will be one of the ways the City can demonstrate its commitment to Zero Waste and the culture change that is needed to achieve that. It will help train residents and businesses on how to reuse, recycle and compost right.

Waste Diversion Impact: 5,000 TPY
Total New Costs: \$160,000

Diversion Rate Increase <1%
GHGs reduced: 9,000

B6. Reusables Disposal Ban

Ban, in phases, specific types of reusable, repairable and dismantlable products from

the trash based on demonstrated viable end-use markets. Require transfer/processing/disposal facilities to charge an extra fee to accept reusables that are documented in good working condition and for those facilities to arrange for those products to be reused. This will help reinvest resources where they are needed.

Waste Diversion Impact: 6,000 TPY	Diversion Rate Increase 1%
Total New Costs: \$70,000	GHGs reduced: 36,000

B7. Deconstruction, Construction and Demolition Requirements

Require deconstruction, recycling and source separation at construction and demolition sites. Require that C&D recycling facilities divert 75% of materials they receive, certified by the Recycling Certification Institute. Require collection of three streams (recycling, compost, trash) on every construction site over a minimum size. Separate clean wallboard for reuse and composting and separate painted wallboard to minimize hazards at C&D facilities. Require C&D waste recycling plans phased in by type and size of project.

Waste Diversion Impact: 6,000 TPY	Diversion Rate Increase 1%
Total New Costs: \$160,000	GHGs reduced: 22,000

C1. Outreach & Education

Outreach and Technical Assistance

Inform residents, businesses and institutions of waste-reduction services and rules (integrate into Greenovate Boston, promotional campaigns in multiple languages, advertisements, Public Service Announcements, how-to guides, uniform messages, universal recycling and trash signs, website resources, and mobile apps). Periodically audit residential and commercial customer containers; provide targeted outreach and technical assistance (tools, training, door-to-door outreach, and classroom presentations) to generators (including their janitorial and food service vendors) who require more assistance as indicated by audits. Recycling Works is immediately available to assist on that. This will be one of the most important ways the City can demonstrate its commitment to Zero Waste and the culture change that is needed to achieve that. It will help train residents and businesses on how to reuse, recycle and compost right.

Waste Diversion Impact: 17,000 TPY	Diversion Rate Increase 1%
Total New Costs: \$1,170,000	GHGs reduced: 36,000

C2. Behavior Change Marketing

Plan and conduct waste-reduction behavior-change marketing campaigns to increase adoption of Zero Waste behaviors. Implement the MassDEP Recycling IQ kit to reduce recycling contamination. This will be a methodical way for the City to determine Zero Waste best practices by documenting how residents and businesses successfully respond to more precise information to reuse, recycle and compost right.

Waste Diversion Impact: 26,000 TPY	Diversion Rate Increase 2%
Total New Costs: \$1,260,000	GHGs reduced: 54,000

C3. Awards and Certifications

Promote Mayor’s Greenovate [Waste Reduction Awards and](#) develop a subcategory as a Zero Waste Challenge. Provide a Zero Waste window sticker for businesses meeting the Zero Waste Challenge. Promote TRUE Zero Waste certification of public and private facilities. This will be a way for the City to inspire residents and businesses to reduce, reuse, recycle and compost right.

Waste Diversion Impact: 3,000 TPY	Diversion Rate Increase <1%
Total New Costs: \$60,000	GHGs reduced: 7,000

C4. Community Waste Prevention and Recycling Grants

Provide grants for waste reduction, reuse, repair, recycling and composting outreach and business development. This will be a way for the City to innovate and demonstrate how residents and businesses can more easily reduce, reuse, recycle and compost right.

Waste Diversion Impact: 9,000 TPY	Diversion Rate Increase 1%
Total New Costs: \$120,000	GHGs reduced: 18,000

C5. Zero Waste Economic Development

Support development of new reuse, recycling and composting processing, manufacturing and retail businesses and robust markets (including collection, repair, resale, and manufacturing) for reusables, recyclables and compostables. Develop job recruitment and training programs for skills needed by Zero Waste service providers (e.g. drivers, repair and marketing of reusables). Support measures to improve the safety, health, and jobs of workers in waste-reduction activities. This will help the City to create a Zero Waste Economy that demonstrates its leadership in innovation and creating and retaining jobs in the region.

Waste Diversion Impact: 13,000 TPY	Diversion Rate Increase 1%
Total New Costs: \$255,000	GHGs reduced: 22,000

8. Impact Analysis

Estimating Diversion Potential and Greenhouse Gas Emissions

Data from the MassDEP 2016 Waste Characterization Study were used to estimate the diversion potential for each initiative. This diversion potential is diversion from disposal, in addition to what the City already diverts in its recycling programs. This study evaluated samples from the residential and commercial sectors. The samples were characterized by material type. The percentages of each material type and the total tons by material type were estimated for each generator sector.

To estimate the diversion potential of each initiative in this plan, a “capture rate” by material type was determined. For example, waste reduction and recycling requirements for residential generators was estimated to divert 25% of the clean cardboard from residential garbage to residential recycling. This would result in an additional 2,400 tons of material diverted from disposal annually. It is possible that implementation of this program will result in much higher capture rates. However, conservative assumptions were used for these calculations. The City will be able to refine this analysis once it has fully implemented each program.

The U.S. EPA Waste Assessment Model (WARM) was used to estimate the potential reduction in greenhouse gas emissions anticipated to be achieved through implementation of each initiative. WARM identifies the metric tons of carbon dioxide equivalent (MTCO_{2e}) reduced by material type for each ton diverted from disposal. For example, the 2,400 tons of clean cardboard from residential generators that is diverted from disposal annually through waste reduction and recycling requirements is estimated to reduce greenhouse gas emissions by 3.4498 MTCO_{2e} per ton or 8,400 MTCO_{2e} per year. Table 8.1 lists the estimated diversion tons, greenhouse gas emissions reduction in MTCO_{2e}, and the percentage increase in diversion for each initiative.

Table 8.1 Estimated Diversion and Greenhouse Gas Reduction

Services		Diversion Tons	GHG Reduction MTCO _{2e}	Diversion Increase
A1.	Residential and Commercial Organics Diversion	186,000	188,000	16%
A2.	Reuse Collection and Facilities	22,000	117,000	2%
A3.	Residential Collection System	28,000	97,000	2%
A4.	Neighborhood Drop-off Centers	4,000	14,000	0%
A5.	Zero Waste Research Initiative	6,000	13,000	1%
A6.	City Leads by Example	7,000	14,000	1%
A7.	City-Owned Transfer and Processing Facilities	NA	NA	NA
Rules		Diversion Tons	GHG Reduction MTCO _{2e}	Percentage Increase in Diversion
B1.	Waste Reduction and Recycling Requirements	161,000	377,000	14%

B2.	Commercial Hauler and Generator Requirements	110,000	356,000	10%
B3.	Product and Packaging Waste Reduction	19,000	33,000	2%
B4.	Environmentally Preferable Purchasing	10,000	19,000	1%
B5.	Zero Waste Venues & Events	5,000	9,000	0%
B6.	Reusables Disposal Ban	6,000	36,000	1%
B7.	Deconstruction, Construction and Demolition Requirements	6,000	22,000	1%
Outreach & Education		Diversion Tons	GHG Reduction MTCO₂e	Percentage Increase in Diversion
C1.	Outreach and Technical Assistance	17,000	36,000	1%
C2.	Behavior Change Marketing	26,000	54,000	2%
C3.	Awards and Certifications	3,000	7,000	0%
C4.	Community Waste Prevention and Recycling Grants	9,000	18,000	1%
C5.	Zero Waste Market Development	13,000	22,000	1%
Total		638,000	1,435,000	55%

Fully implementing each of the options is anticipated to increase diversion by 55%. This would increase the City's overall diversion rate from approximately 25% to 80%. This is consistent with the current reported recycling rates of other Zero Waste cities, including San Francisco (83%) and Los Angeles (76%) and higher than other Zero Waste cities, including Seattle (59%) and Austin (42%) (though it should be noted that each city calculates its diversion differently). Table 8.2 lists the current estimated disposal and diversion and the potential increase in diversion for the residential and commercial generator sectors.

Table 8.2 Diversion by Generator Sector

	Current Disposal Tons	Current Diversion Ton	Current Diversion Rate	New Zero Waste Option Diversion Tons	Total Diversion Tons	New Diversion Rate	GHG Emissions Reduction Potential
Residential	190,000	50,000	21%	136,000	186,000	78%	325,000
Commercial	684,000	232,000	25%	502,000	734,000	80%	1,111,000
Total	874,000	282,000	25%	638,000	921,000	80%	1,435,000

Based on the assumptions in the U.S. EPA WARM, reducing greenhouse gas emissions by 1.4 MTCO₂e is the equivalent of reducing the number of passenger cars citywide by 261,000 (which is approximately the current number of cars in Boston). For comparison, in 2015, the Boston community emitted 6.4 million metric tons of greenhouse gases from energy use in buildings and other facilities, and for transportation.¹

¹ City of Boston Greenhouse Gas Emissions Inventory 2005-2015
https://www.boston.gov/sites/default/files/boston_ghg_inventory_2005-2015.pdf

Estimating Costs for Implementing Zero Waste Options

Costs for implementing each option include both staffing costs for full-time equivalent (FTE) staff or contractors, annual outreach costs for materials and promotion, annualized capital costs (including facilities - amortized over 20 years), annualized equipment costs (including carts - amortized over 10 years), other annual costs (including grants, awards, and market development projects), processing costs, and collection costs. These costs can be offset by potential reductions in disposal costs and receipt of grants from the state or other sources.

Table 8.3 Estimated Costs for Implementing Each Option

Services		FTE	Annual Staff Costs	Other Annual Costs	Processing Costs	Collection Costs	Disposal Cost Reduction	Total Net Annual Cost
A1.	Residential and Commercial Organics Diversion	1	\$100,000		\$7,440,000	\$9,300,000	(\$12,090,000)	\$4,750,000
A2.	Reuse Collection and Facilities	0.2	\$20,000		\$550,000	\$1,100,000	(\$1,430,000)	\$240,000
A3.	Residential Collection System	1	\$100,000		\$700,000	\$1,400,000	(\$1,820,000)	\$380,000
A4.	Neighborhood Drop-off Centers	0.2	\$20,000	\$500,000	\$100,000	\$200,000	(\$260,000)	\$560,000
A5.	Zero Waste Research Option	0.5	\$50,000		\$150,000	\$300,000	(\$390,000)	\$110,000
A6.	City Leads by Example	0.5	\$50,000	\$10,000	\$175,000	\$350,000	(\$455,000)	\$130,000
A7.	City-Owned Transfer and Processing Facilities	NA	NA	\$2,500,000	NA			\$2,500,000
Rules		FTE	Annual Staff Costs	Other Annual Costs	Processing Costs	Collection Costs	Disposal Cost Reduction	Total Net Annual Cost
B1.	Waste Reduction and Recycling Requirements	1.5	\$150,000		\$4,025,000	\$8,050,000	(\$10,465,000)	\$1,760,000
B2.	Commercial Hauler and Generator Requirements	1.5	\$150,000		\$2,750,000	\$5,500,000	(\$7,150,000)	\$1,250,000
B3.	Product and Packaging Waste Reduction	0.2	\$20,000		\$475,000	\$950,000	(\$1,235,000)	\$210,000
B4.	Environmentally Preferable Purchasing	0.2	\$20,000		\$250,000	\$500,000	(\$650,000)	\$120,000
B5.	Zero Waste Venues & Events	1	\$100,000	\$10,000	\$125,000	\$250,000	(\$325,000)	\$160,000
B6.	Reusables Disposal Ban	0.1	\$10,000		\$150,000	\$300,000	(\$390,000)	\$70,000
B7.	Deconstruction, Construction and Demolition Requirements	1	\$100,000		\$150,000	\$300,000	(\$390,000)	\$160,000

Outreach & Education		FTE	Annual Staff Costs	Other Annual Costs	Processing Costs	Collection Costs	Disposal Cost Reduction	Total Net Annual Cost
C1.	Outreach and Technical Assistance	5	\$500,000	\$500,000	\$425,000	\$850,000	(\$1,105,000)	\$1,170,000
C2.	Behavior Change Marketing	5	\$500,000	\$500,000	\$650,000	\$1,300,000	(\$1,690,000)	\$1,260,000
C3.	Awards and Certifications	0.05	\$5,000	\$25,000	\$75,000	\$150,000	(\$195,000)	\$60,000
C4.	Community Waste Prevention and Recycling Grants	0.05	\$5,000	\$25,000	\$225,000	\$450,000	(\$585,000)	\$120,000
C5.	Zero Waste Market Development	1	\$100,000	\$25,000	\$325,000	\$650,000	(\$845,000)	\$255,000
Total		20	\$2,000,000	\$4,095,000	\$18,740,000	\$31,900,000	(\$41,470,000)	\$15,265,000

Assumptions:

Staff costs are \$50 per hour

Capital costs are amortized over 20 years

Equipment costs are amortized over 10 years

Processing costs are \$25 per ton for recyclables

Processing costs are \$40 per ton for organics

Collection costs are \$50 per ton

Disposal costs are \$65 per ton

These assumptions are based on average, industry standard, costs for future implementation of programs for all City generators, including commercial businesses and construction projects. The City's current costs for residential collection vary based on contracts provisions and bid specifications.

Cost/Benefit Analysis

The total annual cost for implementing the Zero Waste options can be evaluated based on the cost per ton diverted and the cost per household and business per month. Total net annual costs are divided by the number of tons diverted to get an average of \$24 per ton diverted. Implementing all of the Zero Waste options are estimated to cost each household and each business about \$5 more per month on average over current costs. These cost estimates do not include internal costs for residents and businesses, such as the time undertaken for training and sorting.

Table 8.4 Costs Per Ton and Costs Per Household and Business Per Month

Services		Total Net Annual Cost	\$/Ton Diverted	Cost Per Household/ Business Per Month
A1.	Residential and Commercial Organics Diversion	\$4,750,000	\$26	\$1.49
A2.	Reuse Collection and Facilities	\$240,000	\$11	\$0.08
A3.	Residential Collection System	\$380,000	\$14	\$0.12
A4.	Neighborhood Drop-off Centers	\$560,000	\$140	\$0.18
A5.	Zero Waste Research Option	\$110,000	\$18	\$0.03
A6.	City Leads by Example	\$130,000	\$19	\$0.04
A7.	City-Owned Transfer and Processing Facilities	\$2,500,000	NA	\$0.78
Rules		Total Net Annual Cost	\$/Ton Diverted	Cost Per Household/ Business Per Month
B1.	Waste Reduction and Recycling Requirements	\$1,760,000	\$11	\$0.55
B2.	Commercial Hauler and Generator Requirements	\$1,250,000	\$11	\$0.39
B3.	Product and Packaging Waste Reduction	\$210,000	\$11	\$0.07
B4.	Environmentally Preferable Purchasing	\$120,000	\$12	\$0.04
B5.	Zero Waste Venues & Events	\$160,000	\$32	\$0.05
B6.	Reusables Disposal Ban	\$70,000	\$12	\$0.02
B7.	Deconstruction, Construction and Demolition Requirements	\$160,000	\$27	\$0.05
Outreach & Education		Total Net Annual Cost	\$/Ton Diverted	Cost Per Household/ Business Per Month
C1.	Outreach and Technical Assistance	\$1,170,000	\$69	\$0.37
C2.	Behavior Change Marketing	\$1,260,000	\$48	\$0.39
C3.	Awards and Certifications	\$60,000	\$20	\$0.02
C4.	Community Waste Prevention and Recycling Grants	\$120,000	\$13	\$0.04
C5.	Zero Waste Market Development	\$255,000	\$20	\$0.08
Total		\$15,265,000	\$24	\$4.77

Assumptions:

There are 239,528 households in Boston and approximately 27,000 businesses.

Estimated Potential Jobs Impacts

The Institute for Local Self-Reliance developed a methodology for calculating the number of jobs created through recycling. This approach is based on research published in *Recycling Economic Development through Scrap-Based Manufacturing* (Michael Lewis, 1994) and updated in 2013.

For example, 10,000 tons of clean cardboard recycled per year creates:

- 10.86 processing jobs
- 8.29 intermediate processing jobs
- 17.46 manufacturing jobs

Not all of these jobs would be created locally. Recyclables are world-wide commodities so manufacturing jobs could be created off-shore. However, the City has an opportunity to create more jobs locally by increasing recycling and encouraging local market development. Table 8.5 shows the estimated number of jobs created through full implementation of the Zero Waste options. Nearly 500 local jobs and 700 additional jobs (which may not be local) could be created.

Table 8.5 Jobs from Recycling

	New Zero Waste Option Diversion Tons	Potential Local "Processing" Jobs	Potential Manufacturing Jobs (may not be local)	Total Potential Jobs
Residential	136,000	94	146	240
Commercial	502,000	386	547	933
Total	638,000	480	692	1,172