



January 10, 2023

The Honorable Dominick J. Ruggiero
President of the Senate
State House, Room 318
82 Smith Street
Providence, Rhode Island 02903

Dear President Ruggiero,

On behalf of the Rhode Island Department of Environmental Management (RIDEM) and Rhode Island Resource Recovery Corporation (RIRRC), we are writing to provide you with our findings and recommendations pursuant to Senate Resolution 2582 Substitute A. The thirteen points outlined in that resolution were answered with RIRRC covering items #1 - #5 and RIDEM covering items #6 - #13. Currently, Rhode Island has strong recycling laws in place and operates a meaningful Statewide Mixed Recycling Program that returns tens of thousands of tons of plastics and other materials to the circular economy each year. However, lack of participation and contamination at the curb continue to result in even larger volumes of mixed recycling eligible materials being landfilled.


Recycling markets generally exist for fibers, metals and plastics type 1, 2 and 5 but these are highly volatile and oftentimes cost prohibitive. Markets typically do not exist however for moving Rhode Island's glass and plastics numbered 3, 4, 6 and 7 back into the circular economy. Implementation of modern mixed waste processing technologies have the potential to increase the number of recyclables recovered from the waste stream as does increasing the State's commitment to enforcing its current recycling laws.

Initiatives are underway internationally to address the impact of plastic waste and improve recycling efforts. At the national level laws have been enacted to address plastic pollution and improve recycling and at the regional level there are omnibus legislation and single item legislation that are either active or planned for the next legislative session to address plastics waste and improved recycling. Within these legislative efforts are advancements for Circular Economy Initiatives (CEI), Extended Producer Responsibility (EPR), and Bottle Bill and Container Deposit Programs. The current operations of recycling in Rhode Island, combined with advancements in regulatory programs are promising for reducing waste and returning recyclable materials within a circular economy and will have positive results to address the Act on Climate.

As we enter 2023 it is commonly known that societal health and environmental health are inseparable. Actions are underway at all levels to use the finite resources of the planet in a responsible way, making sure that individual freedoms are maintained and that no group of people are harmed or treated unfairly in the production, distribution, storage or management of materials.

Both agencies look forward to continuing to work with the legislature on approaches to eliminate plastics pollution in Rhode Island and move the state to a more circular economy. We stand ready to answer any questions that you or your staff have about the contents of this report.

Sincerely,

A handwritten signature in blue ink that reads "Terrence Gray". The signature is fluid and cursive.

Terrence Gray, P.E.
Director
Rhode Island Department of
Environmental Management

A handwritten signature in blue ink that reads "Joseph Reposa". The signature is fluid and cursive.

Joseph Reposa
Executive Director
Rhode Island Resource
Recovery Corporation

Cc: The Honorable Dawn Euer
The Honorable Alana DiMario
Joseph Masino, Director of Policy

Below you will find the 13 items requested for study listed by agreed upon responsible party. Following that is RIRRC's response to items 1 through 5. Please note however that these items are presented in a different order that is felt to better tell the larger story. This order is 1, 4, 2, 5, 3.

RIRRC Study Items

1. A summary of Rhode Island's current requirements for plastics, glass, fibers, metals and aluminum recycling;
2. Estimates of the proportionate volume of plastics, glass, fibers, metals and aluminum recycled versus disposed of in landfills in Rhode Island;
3. Available information on the fate of plastics, glass, fibers, metals and aluminum collected for recycling in Rhode Island;
4. An analysis of plastics, glass, fibers, metals and aluminum generation by type and current method of disposal;
5. Information regarding recycling markets including in-state recycling, and national and international markets;

DEM Study Items

6. A review of current initiatives in neighboring states and nationally to reduce plastics, glass, fibers, metals and aluminum and additional financial and market tools that may be employed;
7. A comparison of container deposit programs, including their methods and administration, that rely on state administration with those that utilize third-party nonprofit entity administration subject to state regulation;
8. An analysis of the ways and means to enhance the development and expansion of markets for post-consumer recycled plastic, glass, fibers, metals and aluminum, including state and local purchasing and procurement practices;
9. A study of the costs and practicality of new recycled content technologies, including successful approaches to recycled plastic, glass, fibers, metals and aluminum materials development employed by other states;
10. An analysis of the trends in new plastics, glass, fibers, metals and aluminum being developed, opportunities for reduction and recycling, and market development;
11. Recommendations for market-based recycling opportunities for plastics, glass, fibers, metals and aluminum;
12. Recommendations for incentives for expanded in-state end uses for plastics, glass, fibers, metals and aluminum; and
13. A detailed plan regarding what would be necessary to implement a bottle redemption program based on best practices as identified in the study in Rhode Island within two (2) years;

1 - SUMMARY OF PLASTICS, GLASS, FIBERS, AND METALS RECYCLING REQUIREMENTS

State Law – Rhode Island holds the distinction of being the first state in the nation to enact mandatory statewide recycling requirements. This occurred in 1986 with the adoption of the *Rhode Island Recycling Act* ([RIGL 23-18.8](#)¹) which requires all solid waste whether from cities and towns or from commercial establishments to be separated into recyclable and nonrecyclable components. The *Rhode Island Recycling Act* is backstopped by [RIGL 23-18.9](#)² – *Refuse Disposal* which in turn tasks the Department of Environmental Management (DEM) with defining what materials are to be considered recyclable and with promulgating regulations for the implementation of the mandatory recycling requirement. [RIGL 23-19](#)³ – *Rhode Island Resource Recovery Corporation Act* then closes the loop on the State’s recycling requirement by requiring the corporation to construct a facility for the receipt and marketing of the separated recyclables.

DEM Recycling Regulations – DEM is the State’s lead environmental regulatory and enforcement agency. In this capacity it has enacted two separate sets of rules and regulations relative to the State’s mandatory recycling requirement. One for municipal material ([250-RICR-140-20-2](#)⁴). The other for commercial ([250-RICR-140-20-1](#)⁵). Each of these is very similar to the other in their purpose, findings, applicability and enforcement provisions and both include those items discussed in detail below under “Resource Recovery Mixed Recycling Acceptance Criteria” as the core of what is required to be recycled statewide. As with most single stream mixed recycling programs this generally includes 1) paper, cardboard and cartons; 2) metal cans, lids and foil; 3) glass bottles and jars; and 4) plastic containers. In addition, both sets of regulations include scrap metal, white goods and leaf and yard waste in their definitions of recyclable materials. Textiles are also included in the municipal but excluded in the commercial definitions, and automobiles, laser toner cartridges, used lubricating oils and vehicle batteries are included in the commercial but excluded in the municipal definitions.

Resource Recovery Mixed Recycling Acceptance Criteria - The Rhode Island Resource Recovery Corporation is a quasi-governmental waste management entity that facilitates the implementation of the State’s recycling laws and DEM’s recycling regulations through the operation of its [Material Recycling Facility](#)⁶ or MRF. The MRF is a physical plant that sorts mixed recyclables collected from individual households, businesses and institutions into marketable commodities. Although Resource Recovery is not an environmental regulatory or enforcement agency, it does maintain a set of [Material Acceptance Criteria](#)⁷ that specify the conditions under which it will accept loads of mixed recyclables for processing. These are as follows:

Delivery – Mixed recyclables must be delivered to the Materials Recycling Facility (municipal and commercial loads) or Small Vehicle Area (individual residents and small contractors). All acceptable Mixed Recycling materials can arrive mixed together. Mixed Recycling delivered in mixed waste loads with other materials, and not segregated by the customer, is managed as solid waste.

Preparation - Resource Recovery expects its customers to treat unprocessed comingled recyclables as a commodity during collection and delivery to the MRF to allow for proper sortation when processed through the MRF facility. Materials received in a condition inconsistent with the moisture and compaction standards below, or otherwise found objectionable by Resource Recovery staff, may be rejected as these issues contribute to cross-contamination, loss of quality recyclables, processing inefficiencies and higher residue rates. Rejected loads are recoded as solid waste and customers are subject to applicable fees and surcharges including equipment usage fees.

¹ <http://webserver.rilegislature.gov/Statutes/TITLE23/23-18.8/INDEX.htm>

² <http://webserver.rilegislature.gov/Statutes/TITLE23/23-18.9/INDEX.htm>

³ <http://webserver.rilegislature.gov/Statutes/TITLE23/23-19/INDEX.htm>

⁴ <https://rules.sos.ri.gov/regulations/part/250-140-20-2>

⁵ <https://rules.sos.ri.gov/regulations/part/250-140-20-1>

⁶ https://www.youtube.com/watch?v=Jda_9_30-WU&t=4s

⁷ <http://www.rirrc.org/about/accepted-materials-pricing>

Figure 1 - Rhode Island Resource Recovery Materials Recycling Facility



Excessive Moisture: Customers shall ensure that recyclables are delivered to the MRF free of excess moisture. Loads that are determined to be too wet or contain an excessive amount of snow, ice or frozen material to process are subject to rejection. Such determination is made by Resource Recovery and is binding.

Excessive Compaction: While balancing the utilization of the hauling vehicle’s maximum load capacity, customers must prevent the excessive compaction of material to be delivered to the MRF. Loads that have been subject to excessive compaction cannot be sorted properly causing excess residue and/or contamination. Resource Recovery recommends a 2.5:1 maximum compaction ratio to reduce MRF residue and preserve commodity values. Using data from the 2016 EPA Volume to Weight conversion table, single family commingled recyclables average 126 pounds per cubic yard (e.g. a vehicle with 30 yards capacity should not exceed 5 tons of residential single stream material). Loads that are found to be excessively compacted and unsuitable for processing may be subject to rejection. Such determination is made by Resource Recovery and is binding.

No Bagging/Bundling: All materials must arrive loose (i.e. not be in plastic bags, leaf and lawn bags, cardboard boxes or bundled together). Materials received in bags are treated as solid waste and disposed of as residue regardless of the recyclability of the items within the bags.

Acceptable – Materials must be (1) commingled plastic, glass, metal, and paper/cardboard items that follow the acceptance criteria outlined below, by material type, (2) dedicated loads of acceptable material types, (dedicated loads of glass may be accepted with advance notice and permission from RIRRC), (3) no more than 50% glass by weight in any mixed load, (4) free from excessive moisture, (5) loose, and (6) free from excessive compaction.

Contaminants - These items either (1) do not fit the general acceptance criteria or (2) fit it, but are not accepted by our buyer(s). No more than 10% of these are allowed in any load:

Figure 2 - Mixed Recycling Contaminants

	Acceptable	Contaminants
Plastic	Plastic items must be empty containers that never held flammable liquid, 5 gallons in size or smaller. Examples of items that fit the criteria, and are accepted, include:	<ul style="list-style-type: none"> Any plastic item that is not a container (e.g. hangers, toys, VHS tapes, shelving) (Any plastic container that held hazardous liquid - see Prohibitives below.)

	Acceptable	Contaminants
	<ul style="list-style-type: none"> Jars (e.g. peanut butter, mayo) Jugs (e.g. milk, juice, detergent) Tubs (e.g. ice cream, margarine) Bottles (e.g. soda, shampoo) Cups (e.g. iced coffee) Clamshells (i.e. clear plastic take-out containers) Cartons (i.e. plastic egg cartons) Blister packaging (i.e. containers molded into the shape of the consumer product it holds) 	<ul style="list-style-type: none"> Any plastic container larger than 5 gallons in size (e.g. large plastic storage totes) Containers that aren't empty Hybrid items made up of near equal parts of different materials or 3+ different materials (e.g. foil-plastic juice pouches, snack bags, candy wrappers, yogurt tops) Styrofoam containers (e.g. cups, take-out containers, coolers, etc.) Compostable containers (labeled "compostable," "biodegradable" or "PLA") Containers that crinkle or tear easily (e.g. plant plug trays) Containers that shatter (e.g. CD cases) Plastic film (plastic bags, bubble wrap, shrink wrap)
Metal	<p>Metal items must be empty cans/lids or clean foil. Examples of items that fit the criteria, and are accepted, include:</p> <ul style="list-style-type: none"> Aluminum beverage cans/bottles Aluminum cat food cans Steel/tin food cans Aerosol cans (depressed nozzle results in no product/air/noise) Aluminum foil Aluminum pie plates and serving dishes 	<ul style="list-style-type: none"> Any metal items that aren't cans/lids or foil (e.g. wire hangers, pots, pans) Cans that aren't empty Foil that is not clean Hybrid items made up of near equal parts of different materials or 3+ different materials (e.g. juice pouches, snack bags, candy wrappers, yogurt tops)
Glass	<p>Glass items must be empty bottles or jars. Examples of items that fit the criteria, and are accepted, include:</p> <ul style="list-style-type: none"> Drink bottles (e.g. soda, juice, tea, beer, wine) Food jars (e.g. sauce, jam/jelly, condiments, baby food) 	<ul style="list-style-type: none"> Any glass items that aren't bottles or jars (e.g. lightbulbs, windows, drinking glasses, bowls, ceramics) Glass bottles and jars that aren't empty Hybrid items made up of near equal parts of different materials or 3+ different materials (e.g. ½ glass ½ plastic pepper grinder) <i>Though broken glass bottles and jars are accepted, Resource Recovery continues to advise those cities, towns, businesses, or institutions with manual collection to refrain from putting broken glass bottles or jars in their recycling for the protection of custodial staff and curbside haulers.</i>
Paper/ Cardboard/ Cartons	<p>Paper and cardboard must be (1) reasonably clean, dry, and flat (some grease on cardboard pizza boxes is OK); (2) in pieces no larger than 3' x 5'; Cartons must be (1) empty and (2) not crushed completely flat. Examples of items that fit the criteria, and are accepted, include:</p>	<ul style="list-style-type: none"> Paper/Cardboard that isn't clean (some grease on cardboard pizza boxes OK) Paper/Cardboard that isn't reasonably dry Cardboard pieces larger than 3' x 5' should be cut down to size Hybrid items made up of near equal part of different materials or 3+ different materials (e.g. photographs, cigarette packs, bubble

	Acceptable	Contaminants
	<ul style="list-style-type: none"> • Books (soft-covered or with hard cover removed) • Cartons - Gabletop (e.g. milk, creamer, juice) • Cartons - Aseptic (e.g. soy milk, broth, juice boxes) • Corrugated cardboard (up to 3' x 5', flattened) • Egg cartons • Envelopes • 100% paper gift bags with handles removed • Magazines / catalogs • Newspaper • Notebooks • Office paper • Paperboard boxes (e.g. food boxes, shoe boxes) • Paper towel inner tubes • Wrapping paper 	<ul style="list-style-type: none"> wrap padded envelopes, nut canisters, three ring binders) • Sanitary paper (e.g. napkins, tissues, or paper towels) • Shredded paper • Wet-strength cardboard (e.g. soda boxes, six-pack carriers, frozen food boxes, paper coffee beverage/soup cups, soap or laundry detergent boxes) • Wax coated or wire reinforced cardboard (e.g. boxes used to transport fresh produce)

Other contaminants:

- Textiles: e.g. clothing, towels, blankets, sheets, linens, luggage, backpacks, tote bags and footwear

Prohibitive items - These items (1) clearly do not fit the acceptance criteria and (2) cause major problems for our system, workers, and/or our buyer(s). Loads containing any percentage of these items will be subject to immediate rejection:

- Aren't loose (i.e. any bagged materials, including bagged recycling and bagged municipal or commercial solid waste, any materials that are excessively compacted.)
- Aren't empty (i.e. any container still containing hazardous waste, pressurized contents, or unknown contents)
- Aren't reasonably dry (i.e. material that has been coated by liquids such as paint, petroleum or chemicals)
- Aren't: (1) plastic containers that never carried flammable liquid, (2) metal cans/lids or foil, (3) glass bottles or jars, (3) paper, cardboard, or cartons, for example:
 - Organics: e.g. food waste, cooking oil-soaked materials, pet waste, human waste, deceased animals, and yard waste such as leaves, branches, stones, mulch, dirt / potting soil, grass clippings, flowers, plants and weeds
 - Construction and demolition debris: e.g. windows, siding, tile, gutters, shingles, pipe, drywall concrete, brick, gravel, wood, sawdust, dirt, sand
 - Medical/biological waste: e.g. hypodermic needles, auto-injection pens and lancets, intravenous (IV) tubing and bags, oxygen respiration tubing and masks, soiled diapers/changing pads
 - Explosives/flammables/combustibles: e.g. firearms, ammunition, fireworks, cylinders/tanks including but not limited to propane/acetylene/oxygen/helium, and containers labeled as having one time contained flammable fluids such as automotive fluid containers; chemical containers; gasoline/petroleum product cans or containers; paint product cans or buckets; paint/stripper/thinner/varnish containers; pesticide/herbicide/insecticide containers).
 - Items that wrap / can be tied in a knot: e.g. string, twine, rope, cables, chain, wire, hose, tubing, electrical cords, Christmas tree lights, fishing line and nets
 - Bulky/special waste: e.g. electronic items like printers and laptops, appliances like A/C units and microwaves, furniture, exercise equipment

- Dangerous ferrous and non-ferrous scrap metal: e.g. sheet metal, pipe, auto parts-such as brake rotors/brake drums, wheels, structural steel such as rebar, angle iron, channel steel, tools, knives, razor blades, saw blades, drill bits, nails/screws
- Lithium Batteries/Lithium Ion Batteries: Loose or installed in a device.

4 - PLASTIC, GLASS, FIBER, & METALS GENERATION BY TYPE & DISPOSAL METHOD

Plastic, glass, fiber, and metals are manufactured in many different types. What follows details these as they are most often generated and delivered to Resource Recovery’s MRF under the above referenced mixed recycling acceptance criteria. Some of these are processed by Resource Recovery’s MRF and sold for recycling, others are not. Determining which are and aren’t generally is a function of whether the associated products initial design including its size, shape and sometimes even color allow for effective sorting, whether the materials have been properly prepared and delivered to the MRF, and whether there is a market for the resulting commodity streams.

The figures that follow are based on Resource Recovery Materials Recycling Facility scale data for Fiscal Year 2022. Although quantities are presented separately for specific material types, it is important to remember that these materials arrive co-mingled or mixed in a single stream as opposed to in separate ones. In reviewing the data, please recognize that a 7% shrinkage factor exists between inbound and outbound totals accounting for weights typically lost during processing due to moisture dispersal etc.

Furthermore, please note that the tonnage provided for glass is based on a 21% composition estimate. Whereas all municipal mixed recyclables are required to be delivered to Resource Recovery and all of those are reflected in the quantities provided, commercial recyclables are not required to be delivered to Resource Recovery and although the quantities provided do include some of these, they do not include those that may have been legally delivered elsewhere.

Plastics – Plastics is one of the more complex categories given the variety of material types and differing levels of recyclability that apply to each. Generally speaking, plastics come in seven different types. These include 1) Polyethylene Terephthalate (PET or PETE), 2) High-Density Polyethylene (HDPE), 3) Polyvinyl Chloride (PVC or Vinyl), 4) Low-Density Polyethylene (LDPE), 5) Polypropylene (PP), 6) Polystyrene (PS or Styrofoam), and 7) Other (see Figure 3 below). Resource Recovery estimates that in FY 22 16.81% or 16,172.48 tons of the MRF mixed recycling stream were of one plastic type or another.

Figure 3 – Plastic Resin Identification Codes⁸

1	2	3	4	5	6	7
PETE Polyethylene Terephthalate	HDPE High-Density Polyethylene	PVC Polyvinyl Chloride	LDPE Low-Density Polyethylene	PP Polypropylene	PS Polystyrene	Other
Common Products: • water bottles • soda bottles • peanut butter jars	Common Products: • milk jugs • 5 gal buckets • shampoo bottles • laundry detergent containers	Common Products: • vinyl • tubing/pipe • siding • auto product bottles	Common Products: • laundry baskets • bread bags • squeeze bottles • plastic film	Common Products: • yogurt containers • bread bags • amber-colored pill bottles • coffee cup lids • straws • kitty litter buckets	Common Products: • styrofoam cups • solo cups • egg cartons • to-go containers	Common Products: • toys • sippy cups • cd/dvds • lenses

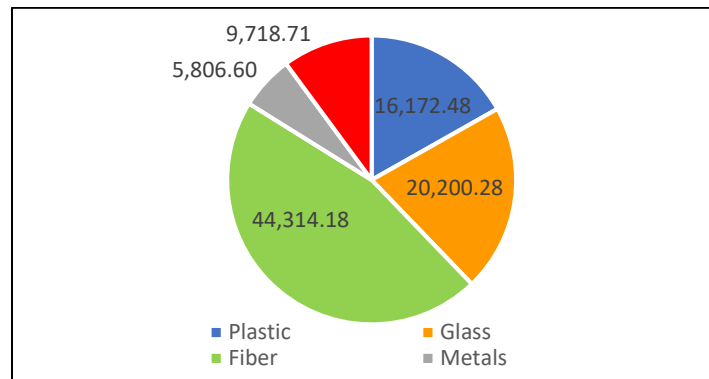
Of the seven plastic types, numbers 1, 2 and 5 are the most readily recyclable meaning that Resource Recovery’s MRF can not only effectively sort them from the mixed recycling stream but that there is generally a market available for the sale of the resulting commodities. These types respectively include products such as food and beverage bottles; milk jugs, detergent and shampoo bottles; and takeout containers, kitchenware, and prescription

⁸ https://media.conwayarkansas.gov/conwayarkansas-media/documents/PlasticResinCodes_Handout.pdf

bottles. Resource Recovery estimates that approximately 80.05% or 12,945.95 tons of the plastics received at the MRF in FY 22 were of these types. More specifically, 38.43% or 6,215.77 tons were estimated to be type 1, 24.34% or 3,936.58 tons type 2, and 17.27% or 2,793.60 tons type 5.

Material types 3, 4, 6, and 7 on the other hand are less readily recyclable and include items like vinyl siding, plastic film and bags, Styrofoam, and other specialty products. Whereas material types 1, 2 and 5 are generally processable for sale into the recycled commodities market by Resource Recovery’s Materials Recycling Facility, types 3, 4, 6 and 7 typically are not. For these materials to be recycled, the public must bring them to special drop off facilities where applicable. Otherwise, quantities that do find their way into the mixed recycling program are disposed of as part of the Materials Recycling Facility residual waste stream. Resource Recovery estimates that approximately 19.95% or 3,226.53 tons of the plastics received at the MRF in FY 22 were of these types. More specifically, 0 tons were estimated to be type 3, 7.98% or 1,290.61 tons type 4, 9.12% or 1,474.99 tons type 6, and 2.85% or 460.93 tons type 7.

Figure 4 - FY 22 RIRRC MRF Mixed Recycling Stream Tonnage



Glass -Like plastics, glass also comes in different types. Some like food and beverage containers are made with lower melting points. Others like cookware, tableware and plate glass are made to be more heat resistant and have higher melting points. Unfortunately, these differing characteristics complicate the recycling process and require the different types be kept separate from one another as much as possible. Unlike plastics however, there is no standardized labeling system displayed on glass products or cost-effective mechanical sorting process that can assist in separating them at the curb or within the MRF. Drop off options for recycling non-food and beverage grade glass are also limited. 21.00% or 20,200.28 tons of the FY 22 inbound MRF mixed recycling stream is estimated to have been glass of one type or the other.

Fiber – Fiber recycling generally refers to the recycling of paper and cardboard based products. As with the above, various types of these materials are generated and some are more recyclable than others. What generally drives the recyclability of these is whether they are soiled or if they are coated or composite products intended for hot or cold food and beverage packaging, preparation, serving or preservation. Whereas clean non coated/composite materials like cardboard and newspaper are readily recyclable, coated composite materials like hot cups and freezer boxes are not. As with glass these subtle differences in material types make it difficult to sort them both at the curb and in the MRF. Given this, Resource Recovery is only able to report on the volumes of the associated commodities that flow out of the MRF. For example, Resource Recovery estimates that in FY 22 fiber products made up 46.06% or 44,314.18 tons of the MRF’s mixed recycling stream. Of this, 53.61% or 23,754.89 tons was estimated to be cardboard and 46.39% or 20,559.28 tons paper.

Metals – Nearly all metals are recyclable to one degree or another. Those able to be successfully sorted and separated by Resource Recovery’ Materials Recycling Facility typically include smaller tin and aluminum food and beverage containers. All other metals are generally classified as scrap. In FY 22 5,806.60 tons of mixed recycling metals were estimated to have been received by Resource Recovery’s MRF. This constituted 6.04% of the mixed

recycling tonnage for that timeframe. Of the metals received, 43.68% or 2,536.38 tons were estimated to be tin, 42.44% or 2,464.59 tons aluminum with the remaining 13.8% or 805.63 tons being scrap.

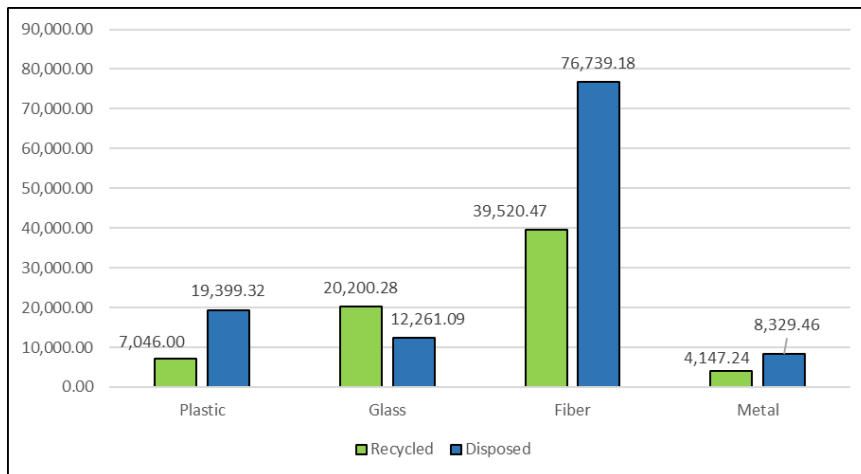
Figure 5 - FY 22 RIRRC MRF Mixed Recycling Stream Composition

Material Types	Tons	% Total
Plastic		
<i>PET (1)</i>	6,215.77	6.46%
<i>HDPE (2)</i>	3,936.58	4.09%
<i>PVC (3)</i>	0.00	0.00%
<i>LDPE (4)</i>	1,290.61	1.34%
<i>PP (5)</i>	2,793.60	2.90%
<i>PS (6)</i>	1,474.99	1.53%
<i>Other (7)</i>	460.93	0.48%
Glass	20,200.28	21.00%
Fiber		
<i>Cardboard</i>	23,754.89	24.69%
<i>Paper</i>	20,559.28	21.37%
Metals		
<i>Tin</i>	2,536.38	2.64%
<i>Aluminum</i>	2,464.59	2.56%
<i>Scrap</i>	805.63	2.11%
MSW/Other	2,028.11	2.11%
Fines	829.68	0.86%
Shrinkage	6,860.92	7.13%
Total	96,212.25	100.00%

2 - PROPORTIONATE VOLUME RECYCLED VERSUS DISPOSED

Figures 6 and 7 below provide estimates of the amount of mixed recyclable commodities produced by Resource Recovery’s Materials Recycling Facility (MRF) versus those disposed of in its Central Landfill during FY 22. As opposed to Figure 5 above which presents by individual material type, these figures use just the four simplified categories of plastic, glass, fiber and metal since a means for projecting landfill disposal volumes by the exact same detailed commodity types was not available.

Figure 6 – FY 22 RIRRC Proportionate Tonnage Recycled vs. Disposed



Tonnages reported as “MRF Recycled” are actual weights from all FY 22 outbound MRF commodity shipments. However, not all of the plastic, fiber and metal that arrives at the MRF are reflected in these outbound commodity totals. This is because certain portions of each end up in the facility residual or waste stream due to either being of the wrong size or color or from having been improperly prepared or mishandled prior to arriving at the MRF.

“Landfill Disposed” tonnages on the other hand are estimates that were produced by first applying the material composition percentages identified through the corporation’s [2015 Solid Waste Characterization Study](#)⁹ to the total amount of like wastes scaled in for disposal during FY 22. As with the 2015 study, these like wastes included material from residential, institutional, commercial and industrial sources, but excluded processed and unprocessed construction and demolition debris, soils, and sludge. Resulting totals were then revised to account for the tonnage of mixed recyclables estimated to have been disposed of in rejected loads and as MRF residue.

Figures 6 and 7 illustrate that in FY 22 Rhode Island’s Mixed Recycling Program diverted significant amounts of reusable material away from disposal. To put this in perspective, the 70,913.99 tons of commodities that were produced by the MRF in FY 22 was slightly larger than the total amount of municipal waste that was generated by the City of Providence over this same timeframe. That being said, it must also be recognized that an even larger amount, an estimated 116,729.05 tons of additional mixed recycling materials never found their way toward reuse in FY 22 and were landfilled instead primarily as a result of being improperly managed at the curb. This included an estimated 19,399.32 tons of plastics, 12,261.09 tons of glass, 76,739.18 tons of fiber and 8,329.46 tons of metal.

As the tonnages noted above are for mixed recycling program eligible materials only, it is also worth noting that there are additional volumes of similar materials likely disposed in FY 22 that were not mixed recycling eligible. These are estimated to have included: 1) 39,386 tons of plastic films, bulky plastics, Styrofoam and plastic composites; 2) 57,403 tons of coated hot and cold, shredded, compostable and composite papers; and 3) 7,542 tons of scrap metal. Although “Glass Bottles and Jars” are listed as “Recycled”, this commodity stream is no longer

⁹ <http://www.rirrc.org/sites/default/files/2017-02/Waste%20Characterization%20Study%202015.pdf>

able to be shipped for the production of new glass products and is instead beneficially reused onsite by Resource Recovery for landfill construction and operation purposes (see “5-Recycling Markets” below for additional information).

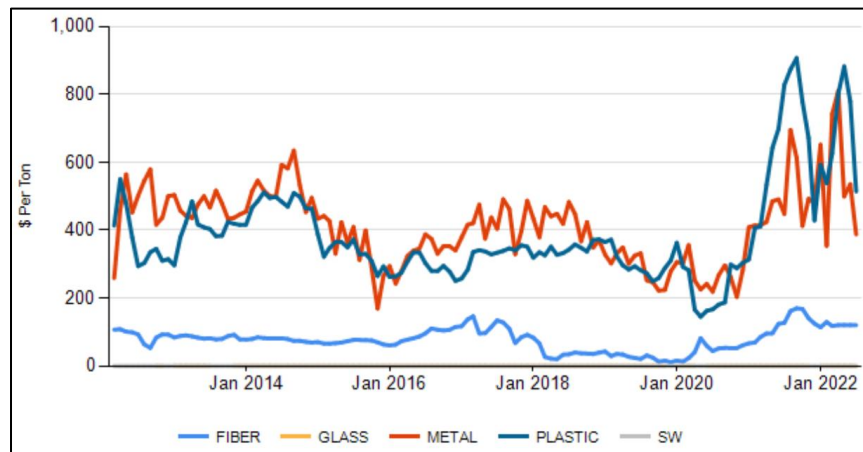
Figure 7 – FY 22 RIRRC Proportionate Volume Recycled vs. Disposed

Mixed Recycling Material Type	MRF Recycled		Landfill Disposed		Total Tons
	Tons	% Total	Tons	% Total	
Plastic	7,046.00	26.64%	19,399.32	73.36%	26,445.32
Glass	20,200.28	62.23%	12,261.09	37.77%	32,461.37
Fiber	39,520.47	33.99%	76,739.18	66.01%	116,259.65
Metal	4,147.24	33.24%	8,329.46	66.76%	12,476.70
Total	70,913.99	37.79%	116,729.05	62.21%	187,643.04

5 - RECYCLING MARKETS

The markets that Resource Recovery sells its MRF products into are much like those for other commodities in that they are global, supply and demand driven and volatile. This is particularly well exemplified when looking at what occurred in these markets between 2018 and 2022 (see Figure 8 below). In 2018 China drastically reduced its demand for recycled commodities through its “National Sword” policy. This in turn caused the pricing offered for these products to fall precipitously to the point where some even proclaimed that “recycling was dead”. As quick as this occurred however, other global forces such as the Covid-19 pandemic and its subsequent supply chain challenges reversed this trend and ultimately led to commodity pricing that was the highest that Resource Recovery has seen in at least the last decade.

Figure 8 – Historic RIRRC MRF Commodity Pricing



Plastics – Resource Recovery’s experience over the last decade indicates that the commodity markets for recycled plastics are highly variable. For example, whereas the blended rate secured for its plastic commodities dipped to its lowest in May of 2020 at \$144.79 per ton, it peaked at \$906.97 per ton in September of 2021. This equates to a 526.40% change in the per ton value of this commodity class over this time frame. Furthermore, and whereas marketable plastics made up only 9.94% of the FY 22 MRF outbound commodity stream by weight, the sale of the resulting plastics generated \$5,198,449.70 or 40.46% of the total mixed recycling revenues for that same time frame.

When breaking the FY 22 mixed recycling plastics commodity revenues down by material type, we find that although PET (Type 1) constituted 60.74% of all plastics sold by weight, it was only responsible for 46.32% of the associated revenues generating \$2,407,916.90 in sales. HDPE (Type 2) on the other hand contributed only 28.39% of the plastics weight but generated \$2,258,037.50 in sales accounting for 43.44% of the total plastic commodity revenues. Last and not least we have Type 5 – Polypropylene or PP which accounted for 10.86% of the weight and 10.24% of the plastic commodities revenues at \$532,495.30 in sales.

At no time over the last decade has Resource Recovery not been able to sell any of these plastic types into their associated commodity markets.

Glass – As alluded to above and as opposed to plastics, Resource Recovery historically lacks buyers who are willing to purchase its “mixed recycling MRF glass” for the manufacture of new products. Although there was a time when the corporation was able to give its mixed recycling MRF glass to a secondary processor who would clean it up and move it on to a regional bottle manufacturer for recycling, that firm closed its doors some years ago and demand for even free mixed recycling MRF glass dried-up within this region as a result. At the current time there simply isn’t a paying market available for this commodity within this region and there hasn’t been one for some time as evidenced above in Figure 8.

The difficulty in marketing mixed recycling MRF glass is universal and is primarily driven by the condition in which the final product exits its respective facility. Contrary to what one might think, by the time this occurs the glass is no longer comprised of whole bottles and jars that can be efficiently sorted and separated for reuse by color. Instead, it is embedded in a stream of crushed multicolor cullet that also contains many small bits of plastic, fiber, metal and food waste that otherwise get stranded at this end of the comingled container processing line (see Figure 9). As a result, mixed recycling MRF glass is dirty, requires costly secondary processing to clean up prior to remanufacture and therefore is of even lower to no value when compared to other streams such as “redemption glass” where the bottles and jars are typically kept whole, clean and are more easily sorted by color.

Figure 9 – Resource Recovery Outbound MRF Glass

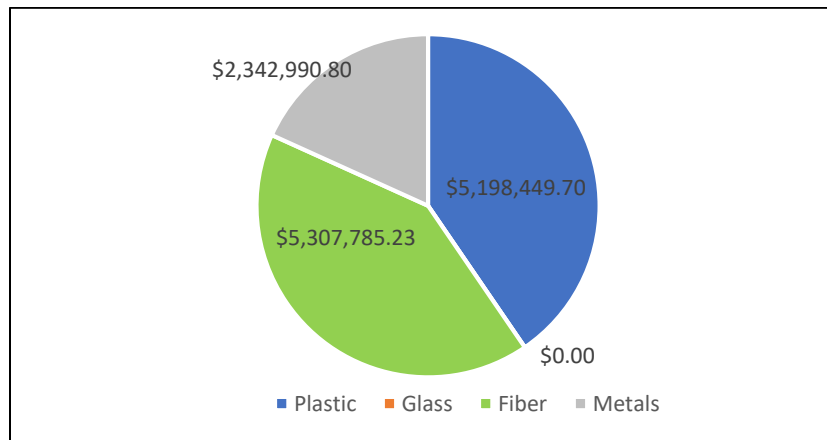


Fiber – Unlike glass, markets generally exist for the sale of the MRF’s mixed recycling fiber products. Resource Recovery’s experience indicates that fiber markets are the most variable of those discussed here. Over the last decade for example, whereas the blended rate secured for Resource Recovery fiber commodities dipped to its lowest in December 2019 at \$10.53 per ton, it peaked at \$169.74 per ton in September of 2021. This equates to a 1511.96% change in the per ton value of this commodity class over this time frame. Fiber made up 55.73% of the FY 22 MRF outbound commodity stream by weight and the marketing of the resulting fiber commodities generated \$5,307,785.23 in sales, equating to 41.31% of the total mixed recycling revenues for that same time frame.

When breaking the FY 22 mixed recycling fiber commodity revenues down by material type, we find that whereas cardboard constituted 58.24% of the categories volume by weight, it generated \$4,010,050.40 or 75.55% of total revenues for the commodity class. Newsprint on the other hand was more balanced, constituting 34.26% of the fiber volume by weight and generating 23.51% of the fiber revenues at \$1,248,023.98. Mixed paper being the lesser material type within the fiber class constituted only 7.49% of the volume and generated only 0.94% of the revenues at \$49,710.85.

Unlike plastics, it should be noted that there were two brief periods within the last decade when Resource Recovery was not able to sell all its fiber products into the commodity markets. This occurred in 2013 when China enacted their Green Fence policy to reduce the number of contaminated recycling loads entering the country and again at the end of 2019 when China’s National Sword policy went into full effect. During these times the Resource Recovery was unable to sell some of its mixed paper product and instead had to pay to have the materials shipped to recyclers.

Figure 10 – FY 22 MRF Mixed Recycling Commodity Revenues



Metals – In Resource Recovery’s experience, the recycled metals commodity markets have been the least volatile over the last decade. The blended rate secured for Resource Recovery metal commodities over this time frame dipped to its lowest in November of 2015 at \$169.43 per ton and peaked at \$810.42 per ton in April of 2022. This equates to a 378.32% change in the per ton value of this commodity class when compared to itself. Whereas metals made up only 5.84% of the FY 22 MRF outbound commodity stream by weight, the marketing of the resulting commodities generated \$2,342,990.80 in sales equating to 18.23% of the total mixed recycling revenues for that same time frame.

When breaking the FY 22 mixed recycling metals commodity revenues down by material type, we find that although aluminum constituted 52.27% of all metals sold by weight, it was responsible for 64.51% of the associated revenues generating \$1,511,557.30 in sales. Tin on the other hand contributed 28.31% of the metals weight but generated \$569,776.31 in sales accounting for only 24.32% of the total metal revenues. Last and not least we have the scrap category which accounted for 19.43% of the weight and 11.17% of the revenues at \$261,657.19 in sales.

At no time over the last decade has Resource Recovery not been able to sell any of these metal types into their associated commodity markets.

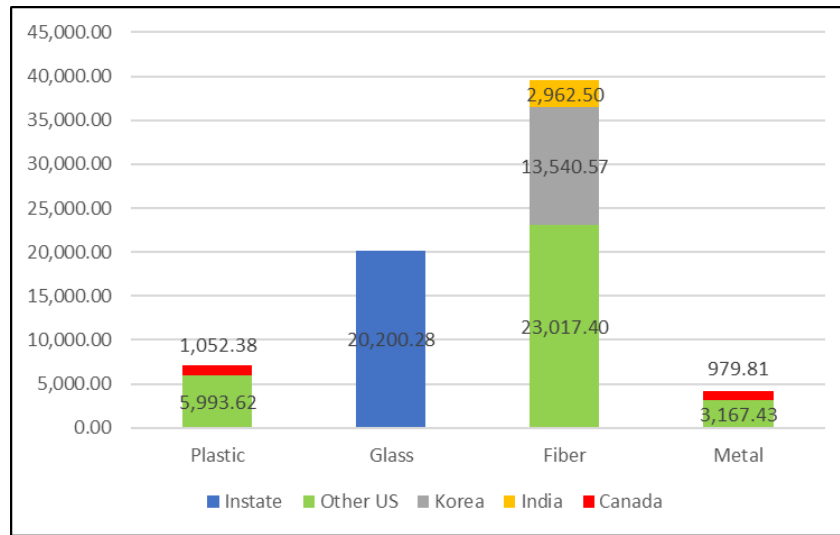
Figure 11 – FY 22 MRF Mixed Recycling Commodity Revenues

Mixed Recycling Material Type	MRF Outbound			
	Tons	% Tons	Revenue	% Revenue
Plastic				
<i>PET (1)</i>	4,279.85	6.04%	\$2,407,916.90	18.74%
<i>HDPE (2)</i>	2,000.66	2.82%	\$2,258,037.50	17.57%
<i>PP (5)</i>	765.49	1.08%	\$532,495.30	4.14%
Glass	20,200.28	28.49%	\$0.00	0.00%
Fiber				
<i>Cardboard</i>	23,017.40	32.46%	\$4,010,050.40	31.21%
<i>Newsprint</i>	13,540.57	19.09%	\$1,248,023.98	9.71%
<i>Mixed Paper</i>	2,962.50	4.18%	\$49,710.85	0.39%
Metals				
<i>Aluminum</i>	2,167.63	3.06%	\$1,511,557.30	11.76%
<i>Tin</i>	1,173.98	1.66%	\$569,776.31	4.43%
<i>Scrap</i>	805.63	1.14%	\$261,657.19	2.04%
Total	70,913.99	100.00%	\$12,849,225.73	100.00%

3 - FATE OF RECYCLED COMMODITIES

In discussing the fate of the mixed recycling commodities processed at Resource Recovery’s MRF it is important to note that the corporation does not market its products directly to those who ultimately recycle them into new products. Instead, it enlists the services of brokers and dealers who sell individual shipments into the global supply chain on a daily basis. Similar to other commodity sales, the final destination of any one of the hundreds of these shipments that are made across a given year can and often does change from load to load. As a result, Resource Recovery may be far removed from end users and may not know of the materials final destination or what specific items the materials will be made into. That said, Resource Recovery’s brokers are able to report on the general geographies into which the loads are sold and shipped. What follows is based on that reporting for FY 22 and covers the four primary material categories addressed above.

Figure 12 – FY 22 MRF Shipped tonnage By Destination



Plastics – 85.06% of the mixed recycling plastics marketed by Resource Recovery’s MRF in FY 22 shipped to non-instate US destinations. This included all of the PP (Type 5) which went to Alabama and all of the HDPE (Type 2) which went to North Carolina (78.65%), Alabama (15.25%) and Pennsylvania (6.10%). PET (Type 1) on the other hand shipped in roughly equal estimated quantities to Georgia, North Carolina, Pennsylvania and internationally to Quebec, Canada.

Glass – As discussed above, all of the glass sorted from the mixed recycling stream by Resource Recovery’s MRF remained on site and was beneficially reused by the corporation for Central Landfill operation purposes as markets for the sale of the material did not otherwise exist.

Fiber – 58.24% of the mixed recycling fiber commodities produced by the MRF in FY 22 shipped to non-instate US destinations. This included all of the cardboard which was shipped to Massachusetts. The remaining fiber products shipped internationally including all of the newsprint which went to Korea and all of the mixed paper which was delivered to India.

Metals – 76.37% of the mixed recycling metals commodities produced by the MRF in FY 22 shipped to non-instate US destinations. This included all of the aluminum where 73.72% of the total went to Illinois and an estimated 19.36% and 6.92% shipped to Alabama and Kentucky respectively. All scrap metals also shipped to non-instate US destinations with 89.31% of it having been delivered to a Massachusetts dealer and the remaining 10.69% having been shipped to Illinois. Similarly, 53.04% of the tin shipped to the same Massachusetts dealer. An additional

1.76% of the tin went to Illinois with the remaining 45.20% of the tin having been shipped internationally to Ontario, Canada.

Task 6: A Review of current initiatives in neighboring states and nationally to reduce plastics, glass, fibers metals, and aluminum and additional financial and market tools that may be employed.

Global

Chinese National Sword Policy

In 2018 China enacted the “**National Sword**” Policy¹⁰ that significantly reduced their import of the world’s recyclable waste and left the governments and waste companies across the world to re-think their current practices and seek out alternatives. A pillar of this change was to impose strict quality control standards prohibiting importing of low-quality recyclable waste that was mixed with landfill waste (trash) and food waste (organics). This low-quality characteristic of the world’s recyclable waste largely was associated with the transition away from separated materials (plastics, glass, fiber, aluminum and metals) towards “single stream” recycling where society was allowed to put “almost anything” into the recycling bin. As a result of the overall globalization of waste management, barriers to recycling goals are difficult for individual states to overcome, especially for smaller states, without addressing national and global issues like markets and infrastructure.

United Nations Plastics Treaty

At the fifth session of the United Nations Environment Assembly (UNEA-5.2)¹¹ in Nairobi a resolution¹² was passed to end plastic pollution and forge an international legally binding agreement by 2024. Heads of State, Ministers of environment and other representatives from UN Member States endorsed this landmark agreement that addresses the full lifecycle of plastic from source to sea citing that plastic production has risen exponentially in the last decades and now amounts to some 400 million tons per year— a figure set to double by 2040. Inger Andersen, Executive Director of the UN Environment Programme (UNEP), said the agreement is the most important international multilateral environmental deal since the Paris climate accord. With a mandate to begin negotiations for a United Nations Treaty on plastic pollution, it is a key moment in the effort to eliminate plastic waste and pollution on a global scale. The mandate agreed by UN member states opens the door for a legally binding treaty that deals with the root causes of plastic pollution, not just the symptoms. Critically, this includes measures considering the entire lifecycle of plastics, from its production to product design, to waste management, enabling opportunities to design out waste before it is created as part of a thriving circular economy.

Building on this international treaty, DEM Director Terrence Gray has been designated as a state representative to these international discussions by the Environmental Council of States (ECOS), a national organization of state environmental agency directors.

National

The “**Save our Seas 2.0 Act**”¹³ was passed into law and establishes requirements and incentives to reduce, recycle, and prevent marine debris (e.g., plastics), including requirements to establish a Marine Debris Response Trust Fund, a Marine Debris Foundation, a Genius Prize for Save Our Seas Innovations, a strategy to improve waste management and recycling infrastructure, a Waste Management Revolving Fund for states, a Waste Management Infrastructure Grant program, a Drinking Water Infrastructure Grant program, a Wastewater Infrastructure Grant program, and a Trash-Free Water Grant program.

¹⁰ - [Piling Up: How China’s Ban on Importing Waste Has Stalled Global Recycling - Yale E360](#)

¹¹ - <https://unplasticstreaty.org/>

¹² - <https://www.unep.org/news-and-stories/story/what-you-need-know-about-plastic-pollution-resolution>

¹³ - [S.1982 - 116th Congress \(2019-2020\): Save Our Seas 2.0 Act | Congress.gov | Library of Congress](#)

Building on this law, DEM is working with the National Oceanographic Atmospheric Association (NOAA) on the development of a regional marine debris management plan for southern New England coastal states.

The **“Break Free from Pollution Act”**¹⁴ was introduced to Congress and the bill aims to reduce the production of a variety of products and materials, including plastics, and increase efforts to collect, recycle, or compost products and materials. The bill makes certain producers of products (e.g., packaging, paper, single-use products, beverage containers, or food service products) fiscally responsible for collecting, managing, and recycling or composting the products after consumer use. The bill establishes minimum percentages of products that must be reused, recycled, or composted; and an increasing percentage of recycled content that must be contained in beverage containers. The bill would phase out a variety of single-use products, such as plastic utensils. The bill also sets forth provisions to encourage the reduction of single-use products, including by establishing programs to refund consumers for returning beverage containers and by establishing a tax on carryout bags. The bill creates a temporary moratorium on new or expanded permits for certain facilities that manufacture plastics until regulations are updated to address pollution from the facilities, whereas the Environmental Protection Agency (EPA) must publish guidelines for a national standardized labeling system for recycling and composting receptacles. Producers must include labels on their products that are easy to read and indicate whether the products are recyclable, compostable, or reusable. The EPA must also ensure that certain clothes washers have filtration units as required by this bill. Lastly, the bill establishes limitations on the export of plastic waste to other countries.

The **“CLEAN Future Act”**¹⁵ creates requirements and incentives to reduce emissions of greenhouse gases. The bill establishes an interim goal to reduce greenhouse gas emissions to at least 50% below 2005 levels by 2030 as well as a national goal to achieve net-zero greenhouse gas emissions by 2050. Each federal agency must develop a plan to achieve the goals. Beginning in 2023, retail electricity suppliers must provide an increasing percentage of electricity that is generated without the release of greenhouse gases into the atmosphere (zero-emission electricity). By 2035, the suppliers must provide 100% zero-emission electricity or demonstrate alternative means of compliance. For example, the suppliers may buy credits under a trading program that allows entities to buy, sell, and trade credits to demonstrate compliance. The bill also establishes a variety of requirements, programs, and incentives to reduce or eliminate greenhouse gas emissions by (modernizing the electric grid and supporting clean energy microgrids, increasing the use of renewable energy and advanced nuclear power technologies, increasing energy efficiency in buildings, homes, and appliances, supporting clean transportation, including electric vehicles and related charging infrastructure, issuing greenhouse gas standards for certain vehicles, engines, and aircraft, promoting manufacturing and industrial decarbonization, including through buy-clean programs, supporting environmental justice efforts; and reducing methane, plastics, and super pollutants).

The **“National Recycling Strategy”**¹⁶ has been activated by the Environmental Protection Agency (EPA) to increase recycling by 50% by 2030 through the following initiatives (Improve Markets for Recycling Commodities, Increase Collection and Improve Materials Management Infrastructure, Reduce Contamination in the Recycled Materials Stream, Enhance Policies to Support Recycling, and Standardize Measurement and Increase Data Collection. The Rhode Island Department of Environmental Management (DEM) is an active member of the Environmental Council of States (ECOS) and the Association of State and Territorial Solid Waste Management Officials (ASTSWMO), and both organizations are working with States to implement the EPA National Recycling Strategy,

The **“Infrastructure Investment and Jobs Act”**¹⁷ was passed into law in 2021 and provides new funding for infrastructure projects, including for roads, bridges, and major projects; passenger and freight rail; highway and pedestrian safety; public transit; broadband; ports and waterways; airports; water infrastructure; power and grid reliability and resiliency; resiliency, including funding for coastal resiliency, ecosystem restoration, and weatherization; clean school buses and ferries; electric vehicle charging; addressing legacy pollution by cleaning up Brownfield and Superfund sites and reclaiming abandoned mines; and Western Water Infrastructure. Specifically

¹⁴ - [S.984 - 117th Congress \(2021-2022\): Break Free From Plastic Pollution Act of 2021 | Congress.gov | Library of Congress](#)

¹⁵ - [H.R.1512 - 117th Congress \(2021-2022\): CLEAN Future Act | Congress.gov | Library of Congress](#)

¹⁶ - <https://www.epa.gov/recyclingstrategy/national-recycling-strategy>

¹⁷ - [H.R.3684 - 117th Congress \(2021-2022\): Infrastructure Investment and Jobs Act | Congress.gov | Library of Congress](#)

related to plastics, glass, fibers, metals and aluminum, it provides **\$275 million** for Solid Waste Infrastructure for Recycling grants to support Building a Better America. This is allocated as \$55 million per year from Fiscal Years 2022 to 2026 to remain available until expended

Regional

Coordination of regional recycling efforts in EPA's Region One (New England States) is served by the Northeast Waste Management Officials Association (NEWMOA) and the Northeast Recycling Council (NERC). DEM and RIRRC actively participate in information exchanges with these regional partners. The Product Stewardship Institute, based in Boston, is a national organization that is very active in the region on policy and legislation related to Extended Producer Responsibility on many of these materials.

The Recycled Content Legislation Workgroup is a Joint Workgroup between NEWMOA and NERC intended to facilitate the development of model recycled content legislation¹⁸ to advance increased use of recycled materials in a variety of products, starting with plastic film and containers. This effort has resulted on some states adopting the guidance into new and improved recycling law.

"The proposed legislative strategy encourages a circular economy in plastics. The other benefits of mandating minimum postconsumer recycled content in plastic products and packaging include conservation of resources, reduction in greenhouse gas emissions and other environmental impacts of producing plastics products from petroleum and gas, strengthened domestic markets for products made with post-consumer plastics, and increased stability in the plastic scrap markets.

The DEM Office of Land Revitalization and Sustainable Materials Management (OLRSMM) is currently working with NEWMOA states to compile a table of the result of implementation of various approaches to recyclables collection and utilization. Financial and market tools utilized successfully in other states will be identified and reported out through collaboration with participating agencies.

Neighboring States - Massachusetts

S503¹⁹ is legislation to reduce plastic packaging waste with a specific focus on **sustainable food service ware** where all retail food establishments must have food ware that is biodegradable, compostable, recyclable, or reusable, with the specific definition that "Recycling" does not include burning, incinerating, converting, or otherwise thermally destroying solid waste.

S579²⁰ is legislation to reduce single-use plastics from the environment with a specific focus on **single-use plastics bags** where the legislation is like Rhode Island that requires "stitched handles". Massachusetts has had local "bag bills" across the Bay state for nearly 30 years and while those efforts have been vital for the progression of these types of legislation, it has also illustrated the challenges of varying definitions of local ordinances. This movement to a statewide policy will help the business community for compliance and further reduce (eliminate) plastic bags from the terrestrial and marine environment.

S494²¹ is legislation to combat **disposable straw waste** where the legislation is like Rhode Island that requires "straws on request". Further inspection of the enforcement as described in chapter 140 should be performed for alignment with Rhode Island strategies and metrics should be gathered in partnership with the environmental community (monitoring litter at beach cleanups) and the business community (monitoring the reduction in order quantities of straws) to measure the effectiveness of the law.

¹⁸ - https://www.newmoa.org/publications/Model_Recycled_Content_in_Plastics_Legislation_Final.pdf

¹⁹ - <https://malegislature.gov/Bills/192/S503>

²⁰ - <https://malegislature.gov/Bills/192/S579>

²¹ - <https://malegislature.gov/Bills/192/S494>

S1370²² is legislation to restrict the use of **polystyrene (a.k.a Styrofoam)** relative to prohibiting the dispensing of food in disposable food service containers made from polystyrene or from expanded polystyrene. This also includes retail establishments from providing food in similar containers.

S2159²³ and other bills are taking strides to address **nips and miniatures** that are major source of litter and cause issues within single stream recycling. These bills are like the legislation introduced in the State of Rhode Island in recent years.

it is not readily apparent of any new legislation for **glass, fiber or metals and aluminum**. These materials are highly recyclable and are now part of single stream recycling across the country. While a viable collection mechanism does exist for these commodities, market forces ultimately dictate whether materials are recycled into similar materials.

Neighboring States - Connecticut

Similar efforts are also underway in the State of Connecticut and while this section does not expand on the details, the efforts are listed with the supporting links for Food service trays²⁴ and Straws²⁵ and Plastic Bags²⁶ and Polystyrene²⁷ and Nips²⁸.

Financial and Market Tools

As we enter 2023 it is commonly known that societal health and environmental health are inseparable. Actions are underway at all levels to use the finite resources of the planet in a responsible way, making sure that individual freedoms are maintained and that no group of people are harmed or treated unfairly in the production, distribution, storage or management of materials. Numerous financial and market tools may be employed to advance the environmental goals in the State of Rhode Island not limited to Extended Producer Responsibility (EPR), Private Public Partnerships (PPP), Environmental, Social and Corporate Governance (ESG), and Circular Economy Initiative (CEI).

It should be noted that single pieces of legislation, omnibus legislation, management plans, and strategic plans will undoubtedly continue to evolve with some areas of overlap and these areas are points of opportunity for consolidation, standardization, and achieving greater efficiency, effectiveness, and more productive results for the desired outcomes.

Economies of Scale of Regional Solution

With Rhode Island considering a bottle bill (container deposit return laws), this positions the entire Northeast region (New England + New York) to have a similar process in place except for New Hampshire. With effort put forth from various channels to initiate a similar effort in New Hampshire, this would generate the economies of scale of a regional solution that would greatly reduce the challenges associated with beverages crossing state borders and the complexity of labeling, deposit amounts, redemption methods, and refund amounts. Please see the response to item #13 for additional detail on bottle bill legislation.

²² - <https://malegislature.gov/Bills/192/S1370>

²³ - <https://malegislature.gov/Bills/192/S2159>

²⁴ - <https://www.wfsb.com/2022/04/21/ct-senate-passes-bill-that-bans-single-use-styrofoam-trays-schools-restaurants/>

²⁵ - <https://www.cga.ct.gov/2020/TOB/S/PDF/2020SB-00299-R00-SB.PDF>

²⁶ - <https://portal.ct.gov/DRS/Legislative-Summaries/2019-Legislative-Updates/Single-Use-Plastic-Bag-Fee#:~:text=July%201%2C%202021%2C%20the%20single,Gen.>

²⁷ - <https://www.ctinsider.com/news/article/Senate-passes-polystyrene-foam-ban-starting-in-17117829.php>











²⁸ - <https://www.cga.ct.gov/2021/ba/pdf/2021SB-01037-R01-BA.pdf>

Task 7: A comparison of container deposit programs, including their methods and administration, that rely on state administration with those that utilize third-party nonprofit entity administration subject to state regulation.

National

Currently there are 10 states that have a bottle bill (container deposit return laws) which is generally known as a process that adds a small deposit to the retail price of a consumer product such as a bottle of soda, beer or another beverage in a similar container. The consumer returns the empty container to a retailer, redemption center, or redemption device and is repaid the amount of the original deposit. Vermont was the first state in 1953 to move towards this program definition which prohibited the sale of beer in a non-refillable bottle. Just one year after the formation of the Environmental Protection Agency, in 1971 Oregon became the first state to pass a bottle bill that required that all beer and soft drink containers to have a refundable deposit with a primary focus on litter prevention. A high-level summary²⁹ of existing bottles bill is shown below.

BOTTLE BILL FACT SHEET

State	Return Rate	Deposit Value	What's Included	Percent of Beverage Containers Sold Eligible for Deposit Refund
CALIFORNIA	62% (2020) 	5¢ < 24 ounces 10¢ ≥ 24 ounces	Beer, soda, all other non-alcoholic beverages, wine coolers, distilled spirits coolers	87%
CONNECTICUT	44% (2020) 	5¢	Beer, soda, sparkling water, bottled water, flavored water	77%
HAWAII	62% (2019) 	5¢	Beer, soda, sparkling water, all other non-alcoholic beverages, wine coolers, distilled spirits coolers	88%
IOWA	65% (2016) 	5¢	Beer, soda, mineral water, wine coolers, wine, liquor	65%
MAINE	84% (2017) 	15¢ Wine & Liquor ≥ 50 mL 5¢ All others	All beverages except dairy products and unprocessed cider	91%
MASSACHUSETTS	43% (2020) 	5¢	Beer, soda, mineral water	42%
MICHIGAN	89% (2019) 	10¢	Beer, soda, mineral water, kombucha, wine coolers, distilled spirits coolers	57%
NEW YORK	64% (2020) 	5¢	Beer, soda, mineral water, bottled water, flavored water, wine coolers	78%
OREGON	86% (2019) 	10¢	All beverages except wine, distilled liquor, dairy and plant-based milk and infant formula	88%
VERMONT	77% (2020) 	15¢ Liquor 15¢ 5¢ All others 5¢	Beer, soda, mineral water, wine coolers, liquor	48%

²⁹ - https://content.presspage.com/uploads/2379/1920_bottle-bill-infographic-v11.jpg?10000

Regional

Container deposit systems exist in four New England States as well as New York and a closer inspection of the program characteristics are shown below.

State	2020 Redemption Rate	Amount of Deposit	Handling Fee	Beverages Covered	% Bev Units Sold Covered by Deposits	Population with Curbside Access
CT	44%	5¢	Beer – 2.5¢ Other – 3.5¢ Nips – 5¢ sales fee	Beer & malt beverages, Carbonated soft drinks, sparkling water - Bottled water, Other non-carbonated beginning 1/1/23	77%	86%
MA	43%	5¢	Redemption Centers – 3.25¢ Retailers – 2.25¢	Beer & malt beverages, Carbonated soft drinks, sparkling water	40%	77%
VT	78%	Liquor – 15¢ Other – 5¢	Branded sorted containers – 4¢ Commingled brands – 3.5¢	Beer & malt beverages, Carbonated soft drinks, sparkling water, Wine coolers, Liquor	46%	76%
ME	76%	Wine & Liquor (50ml>) – 15¢ Other – 5¢	4.5¢	All beverages except dairy products and unprocessed cider	92%	67%

Methods of Administration

Maine

The administration of the “returnable beverage container” program³⁰ is performed by the Department of Environmental Protection who is responsible for licensing and renewals of redemption centers, registration of beverage container labels, and questions on initiator of deposit or contracted agent. Additional roles for the licensing of retailers are performed by Department of Agriculture, Conservation & Forestry and of eating establishments by The Department of Health & Human Service. The latter two departments are part of pre-existing operations.

Vermont

The “beverage container; Deposit-redemption System” program³¹ is primarily performed by the Department of Natural Resources with assistance from the Agency of Education, commission of liquor and lottery. Their Secretary of Natural Resources office plays a role for various registration requirements and the financials involve the Commissioner of Taxes.

³⁰ - <https://www.maine.gov/dep/sustainability/bottlebill/index.html>

³¹ - <https://legislature.vermont.gov/statutes/chapter/10/053>

Massachusetts

The “Deposit Bottle & Can Recycling” program³² is offered by the Department of Environmental Protection and performs specific roles for the program such as the beverage container redemption center initial registration. The Department of Revenue oversees collection of unredeemed deposits that accrue into the General fund.

Connecticut

The “bottle bill” program³³ was administered by the Department of Energy and Environmental Protection (DEEP) Commissioner and now is performed by the Department of Revenue Services Commissioner (DRS). The funds are held in a special trust fund for the state and changes to the law now allow the DEEP and DRS to file complaints with the attorney general and does not involve the State Treasurer. Unredeemed deposit balances are eventually transferred from the DEEP account into the States’ general fund.

Analysis of container deposit systems in Neighboring States

Massachusetts and Connecticut have had beverage bottle deposit laws since the early 1980’s. Since that time, the market has changed in significant ways. Due to inflation, the shrinking value of a 5-cent deposit has resulted in decreasing redemption rates. Therefore, states are legislating increases in the deposit amounts to 10 cent per container and adding new categories with hopes of increasing the redemption and recycling rates. In New England, Maine is a leading supporter of redemption-based container recovery, with Massachusetts and Connecticut also introducing expansions of their bottle bill laws. This change of “definition of bottles” to be more encompassing of “containers” is transforming bottle bills into more comprehensive regulation that has greater overlap with recycling (single stream or mixed stream) and some of the objectives of extended producer responsibility.

The bottle bill in Massachusetts has recently had active dialogue. For example, the bottle bill has been a target of Senator Edward J. Kennedy. His Resolution S.568: provides for an investigation and study of enhancing statewide recycling programs that “would explore the feasibility of a single-stream recycling program along with other recycling and composting initiatives. It would also investigate the feasibility of amending a “sunset provision” to Massachusetts’s bottle deposit law, where the program would be repealed if the recycling rates for materials covered under the law and not covered under the law are equal”

In opposition, the Container Recycling Institute wrote a letter³⁴ containing fact and figures praising MA’s bill and provided evidence of other states that had improved over MA by additional measure that MA could institute as well. “In conclusion, the bottle bill is Massachusetts’ most successful recycling program. While it’s 43% redemption rate is low compared to other container deposit states’, it is nearly double that of the 22% collection rate of the state’s curbside recycling. Updating Massachusetts’ deposit law to include non-carbonated beverages, and to have a 10¢ deposit, would help secure Massachusetts’ position as a recycling leader.

Task 8. An analysis of the ways and means to enhance the development and expansion of markets for post-consumer recycled plastic, glass, fibers, metals and aluminum, including state and local purchasing and procurement practices.

In the current structure of the Rhode Island Department of Environmental Management there are not dedicated resources to the enforcement and oversight and improvements for recycling, and while this area is receiving greater attention, it requires creative approaches that embrace the vision of the ocean state as opposed to strict mandates for change. Doing nothing has societal and environmental costs and doing something does have economic costs, however these costs should be seen as an investment into the prosperous future of Rhode Island where we are working to restore, protect and promote the natural beauty and primitive ruggedness of the ocean state.

³² - <https://www.mass.gov/deposit-bottle-can-recycling>

³³ - <https://portal.ct.gov/DEEP/Reduce-Reuse-Recycle/Bottles/Bottle-Bill-Legislation>

³⁴ - <https://www.container-recycling.org/index.php/publications/cri-letters-and-briefings>

State agencies and municipalities should be encouraged to make common bulk purchases to achieve economies of scale, that may result in overcoming financial barriers for purchasing post-consumer products. It should be noted that often budgetary and time constraints focus efforts on the use of the most convenient and economical materials to obtain (such as gravel, asphalt, etc.) and not maximizing use of glass or plastic recycled material alternatives. The use of recycled materials in public works could be strengthened if procurement procedures were amended and there was strong oversight of the degree to which procurement of recycled materials was prioritized. It should be noted that there is much interest nationally in using recycled materials such as glass and tires in road building and other public works projects.

An avenue to explore the use of post-consumer recycled materials could be to create scalable demonstration projects of these alternative materials at DEM facilities such as state parks, and at local universities. By demonstrating the viability of these projects alongside identifying the barriers to entry, it would serve to engage the local business community and make connections of how using recycled material locally is an action that aligns with the Act on Climate.

Additionally, building on the RI 2030 Small Business Goal, efforts should be made to initiate local market development for recyclables, and closing the loop on the circular economy in Rhode Island. Commerce RI could explore the potential to recruit new business ventures that utilize the materials collected by RIRRC, reduce the transportation costs of shipping materials out of state for closed loop solutions, and return the materials as new finished products into the local markets. Rhode Island is a unique position to put in place proof of concept solutions that scale in size and operation, and in doing so it can generate interest from across the country, similar to the effort so far with offshore wind. This approach will foster the need and opportunity for enhancing workforce development and postsecondary education.

Task 9: A study of the costs and practicality of new recycled content technologies, including successful approaches to recycle plastic, glass, fibers, metals, and aluminum materials development employed by other states.

This is a large topic and deserves a formidable investment of resource time to review new recycled content technologies and current success rates. Fortunately, the DEM has hired a Program Services Officer with a focus on Sustainable Management and this resource will be acting in partnership with DEM and RIRRC staff to explore additional options.

Here is an initial example of an innovative recycling potential entitled “PureCycle” - “PureCycle Technologies LLC., a subsidiary of PureCycle Technologies, Inc³⁵., holds a global license for the only patented solvent-driven purification recycling technology, developed by The Procter & Gamble Company (P&G), that is designed to transform polypropylene plastic waste (designated as No. 5 plastic) into a continuously renewable resource. “The unique purification process removes color, odor, and other impurities from No. 5 plastic waste resulting in an ultra-pure recycled (UPR) plastic can be recycled and reused multiple times, changing our relationship with plastic.”³⁶

In comparison to plastic, the recycling rate of aluminum and metal is higher, as metal has intrinsic value. Since aluminum is a more recyclable material, encouraging more use of aluminum beverage containers such as wine and beer cans will result in increased high-quality recycling. At this time recycled glass is not economical compared to virgin material in the production of glass containers. Large quantities of problem-glass waste have previously had to be taken to landfill, at high cost. Made up of fine particles of glass co-mingled with other waste (including paper, plastics, metals and organics) this waste stream cannot be traditionally recycled back into the production of bottles or jars. This needs to be addressed on a regional basis. Currently much of the glass is crushed and used as landfill alternate daily cover. Waste glass has been used in a pilot project with RI DOT as aggregate in asphalt.

³⁵ - <https://www.purecycle.com/blog/orlando-magic-advance-sustainability-efforts-with-purecycles-purezero-tm-program>

³⁶ IBID

Task:10. An analysis of the trends in new plastics, glass, fibers, metals and aluminum being developed, opportunities for reduction and recycling, and market development; 11. Recommendations for market-based recycling opportunities for plastics, glass, fibers, metals and aluminum. 12. Recommendations for incentives for expanded in-state end uses for plastics, glass, fibers, metals and aluminum.

Tasks 10, 11 and 12 are tied together and at report creation time this is an introductory of ideas and anticipate the new DEM resource (mentioned above) to advance this area in partnership with DEM and RIRRC staff. Previous responses to task #5 shares how current recycling is done regionally and much of the actual reclamation of recycled materials to useable products is done out of state and outside of our ability to oversee.

As DEM is not empowered or staffed to oversee recycling of materials defined as “recyclables” in the regulations, our experience with innovative recycling in the region is very limited. Other kinds of solid waste, whether originating within or outside of Rhode Island can be recycled or beneficially reused if they receive a Beneficial Use Determination from the Department. Currently we have approved of the following:

- Richmond Sand and Gravel
- Cumberland Foundry
- Compost Plant (in final stages of review)

Organics in the form of leaf and yard waste are currently being composted, although limitations to capacity result if large amounts of organics, especially food waste, being thrown away.

Glass recycling- As mentioned previously, recycled glass has been successfully used in projects in the region to make concrete and asphalt. However, there is significant cost in crushing to the level that it is an adequate replacement for sand in these products.

There are several innovative glass recycling coming to the market (example shared below with limited detail) as the DEM staff does not have an expertise in these areas. Pozzotive^{®37} is a ground glass pozzolan and industrial filler made from 100% recycled post-consumer glass. It is a safer, sustainable, and higher-performing material that dramatically reduces embodied CO2 emissions in concrete. Products are manufactured from waste bottle glass that would otherwise be landfilled. Most glass is sourced from material recovery facilities that sort curbside-collected recyclables into homogeneous product streams, one of which is glass. Like all recovered recyclables, the glass is unclean and must be cleansed to a very high standard. Pozzotive[®] utilizes an innovative patented process to separate glass from non-glass materials, clean the residual organics from the glass containers and mill the glass into a fine powder. The most common application for the end product is use as a high-performance ground glass pozzolan in the production of concrete.

Composting

Currently, both leaf and yard waste and food waste is successfully composted into useable soil. If more public works projects used soil derived from composting, it would help keep the businesses viable.

Anaerobic Digesting

Anaergia operates of very large anaerobic digester. This facility converts food waste to an energy source (natural gas) and a solid digestate used as a soil amendment. The technology has been widely employed in Europe for decades but is relatively new in the US. This facility currently operates at a fraction of its permitted capacity and the company is investing significant fund to make the operation financially profitable.

Task 13: A detailed plan regarding what would be necessary to implement a bottle redemption program based on best practices as identified in the study in Rhode Island within two (2) years.

Bottle bills have their roots in the change that happened in the 50’s and 60’s where bottles that were normally reused continuously were replaced with throwaway, no-deposit beverage containers that are now the source of

³⁷ - <https://pозzotive.com/>

prolific amounts of waste and pollution that are impacting the health of the land, sea and people. Bottle bills will put in place a deposit system and creates a funded private public partnership collection infrastructure for beverage containers of all types. This will have the effect of making the producers, distributors, retailers, and consumers more responsible for packaging waste. With a thorough designed bottle bill that supports an agile approach for continuous improvement, consumers will be able to enjoy the myriad of beverage containers, litter will reduce significantly, less energy will be used for extracting virgin material for new containers, and greenhouse gases can be reduced as a result and serves as acting on climate.

The premise of the bottle bill deposit system will hinge on many main reasons not limited to increasing recycling rates and reducing plastic waste via financial incentives and increased purity of the recyclable material.

The financial incentive builds on two phases of the financial process that starts with deposit initiation phase and ends with deposit redemption phase. During the **deposit initiation phase** the distributor or bottler will provide a properly labeled and filled container to the retailer, where the retailer will sell the item to the customer. When the retailer takes ownership of the item, they provide a deposit to the distributor.

When the customer takes ownership of the item, they provide a deposit to the retailer. In some cases, the point of purchase varies, and the consumer is a customer at a store, and the item is taken off-premises for consumption, while in other situations the consumer is a customer at a bar or restaurant or event, and the item is consumed by the customer on-premises. In the latter scenario, a closer integration of business (distributor) to business (retailer) exists and provides a greater opportunity for efficiencies and effectiveness but does put more responsibility on the retailer (bar or restaurant or event).

During the **deposit redemption phase** the customer brings the empty container to the retailer or a redemption center and a reverse vending machine could be used at either location. The customer is refunded their deposit for returning the empty container. The retailer and redemption center provide the empty containers to the distributor, and they are refunded their deposits in addition to a handling fee (if applicable).

The handling fee is not explicitly listed as part of the “deposit” and may be incorporated into the price of the item by the distributor to the retailer who in turn may pass the handling fee to the customer. With this approach, the customer is paying the costs associated with the recycling.

The increased purity of the recyclable material is becoming even more essential for the fate and viability of the recycling and a bottle bill makes significant improvements by having containers (glass, plastic, aluminum) emptied and separated and therefor collected without contamination from other types of recyclable materials in single stream recycling systems. This does require a behavior change of separating and emptying beverage containers, however this responsibility is necessary and appropriate given the freedom and liberty to enjoy these beverages in the vast number of containers. This moves the recycling of these materials into a potential closed loop where the less raw materials are needed to produce new beverage containers and less containers are ending up in landfills, mixed recycling and litter.

A container deposit law or bottle bill will take a lot of time and dedication. With ten bottle bills active in the United States, other countries, and interest to reduce the impacts (or eliminate) plastics waste, this is a dynamic landscape that will undoubtedly change while legislation is being considered in Rhode Island. Using a five-phase project management approach of Initiation; Planning, Implementation, Execution, Monitoring will allow for successful implementation of a bottle bill in this state.

During the **initiation phase** it will be critical to build a group of stakeholders and decisions makers, sharing the facts of the current and future efforts, and making sure the scope of the effort is clear and bounded. Representation could include members from environmental non-profit organizations, beverage producers, processors of recycled materials, container manufacturers, hospitality industry, civic groups, soft drink manufacturers, beer and wine distributors, waste haulers, and finally the general public. The facts of current and future efforts should include and not be limited to the active bottle bills in the country, current and future efforts to increase recycling, and current and future waste and recycling methods. While this scope of information could create a complex seemingly unlimited scope of information, it is important to know the facts and then iterate with

the group on focusing and resolving on the scope and intention of the bottle bill. Whereas the legislative action to implement the bottle bill will include voices of support and opposition, the initiation phase moves forward with the understanding that compromise and working together will achieve the best results for the ocean state.

During the **planning phase** a timeline should be established to plan all the work efforts including the high-level milestones, identify the major inputs and outputs, decision making steps, and formalize a risks and issues approach to make sure the latter phases are managed on-time, on-quality, on-scope.

During the **implementation phase** the work effort (which will be identified in the planning phase) commences to define the bottle bill deposit law, how the container system works, clarity of the benefits of the proposed bottle bill, labeling requirements, defining the deposit amounts and whether this varies based on container, redemption centers requirements not limited to reverse vending machines, handling fees, storage space, staffing and overall logistics, financial mechanisms and account setups, oversight and enforcement methodology, key performance metrics, and reporting.

During the **execution phase** the actual bottle bill program will take effort and this should include a transition period for continued education and setup as well as addressing the vast number of bottles that are either not labelled properly or not handled via the initial program.

During the **monitoring phase** the program management team (to be determined) will gather input on the successes and issues and act for continuous improvement. Whereas the bottle bill is one component of a wide spectrum of efforts for responsible waste management, the program management team will remain current with the various entities perform the other services such as recycling, waste to energy, and other management strategies.

A desired law for the bottle bill could have the following elements not limited to: Title, Purpose, Definitions, Beverage registration, Labeling, Rules, Prohibitions, Educational program, Penalties, Redemption center certification, Abandoned beverage container deposits, and Exceptions.

Lastly, human resources and program infrastructure will become a formidable necessity if a bottle bill (container deposit program) moves forward, from the inception of the effort in the initiation phases to the continuous monitoring and improvements after go-live. Once the system is up and running, it is expected that there will be abandoned deposits that can be allocated for continued operation, however an initial upfront investment will be required for the program.

Appendix of Supporting information for Bottle Bill

Additional information is readily available on the New England state websites as listed below

All States

<https://www.bottlebill.org/images/Allstates/10-state%20Summary%208-5-22r.pdf>

Massachusetts

<https://www.mass.gov/deposit-bottle-can-recycling>

<https://www.mass.gov/regulations/301-CMR-400-provisions-for-recycling-of-beverage-containers-bottle-bill>

<https://malegislature.gov/Laws/GeneralLaws/PartI/TitleXV/Chapter94/Section321>

<https://www.bottlebill.org/index.php/current-and-proposed-laws/usa/massachusetts>

Connecticut

<https://portal.ct.gov/DEEP/Reduce-Reuse-Recycle/Bottles/Connecticut-Bottle-Bill>

<https://www.bottlebill.org/index.php/current-and-proposed-laws/usa/connecticut>

<https://www.law.cornell.edu/regulations/connecticut/title-22a/245>

Vermont

<https://legislature.vermont.gov/statutes/chapter/10/053>

<https://dec.vermont.gov/waste-management/solid/product-stewardship/bottle-bill>

<https://www.bottlebill.org/index.php/current-and-proposed-laws/usa/vermont>

Maine

<https://legislature.maine.gov/statutes/38/title38ch33sec0.html>

<https://www.bottlebill.org/index.php/current-and-proposed-laws/usa/maine>

<https://www.maine.gov/dep/sustainability/bottlebill/index.html>