



July 8, 2009

The Honorable Senate President M. Teresa Paiva-Weed
318 State House
Providence, RI 02903

Dear President Paiva-Weed,

As you are aware, the 2008 session of the General Assembly passed S2771A, the Plastic Bottle and Container Labeling Act, directing the Rhode Island Resource Recovery Corporation to "create a plan that quantifies and details the impacts of a beverage container deposit of \$.05 on beverage containers sold in Rhode Island".

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We engaged DSM Environmental, Inc. of Rutland, VT to conduct the study, which is hereby forwarded to you for your review. RIRRC is confident in the results of the study which clearly supports making major and specific improvements to our existing curbside program as the most effective way to increase recycling. This alternative system was seen as far superior to an enhanced bottle bill because it diverted almost twice the amount of new recyclables for about one third the cost of the bottle deposit program. We hope that you will view the conclusions drawn as a road map for the future of recycling in Rhode Island. The road may not be the one you had hoped to have us follow, however, we fully believe that it is the path to take and will help achieve our goals and the goals of those who care, as you do, about recycling in Rhode Island.

This report would not be considered definitive had it not been for significant assistance from a wide variety of stakeholders, particularly the RI Beverage Association, the RI Food Dealers Association, representatives from McLaughlin-Moran, and the RI Recycling Coalition. Each group was extremely helpful, willing to share knowledge and data, and deserves acknowledgement and thanks.

RIRRC is now planning the next big step in recycling in Rhode Island. We believe that single-stream recycling will deliver the increases we need to help us advance our goal of extending the life of the Central Landfill. We also recognize that there needs to be additional attention paid to roadside trash and public recycling opportunities. We would like to work with you in the 2010 legislative session to address the litter issue specifically, and use some of the findings from the Bottle Bill study as the springboard to doing so.

I appreciate your support of recycling and waste reduction, and I look forward to working with you and your office to advance our mutual goals.

Sincerely,

A handwritten signature in black ink that reads "Michael J. O'Connell". The signature is written in a cursive style.

Michael J. O'Connell
Executive Director
Rhode Island Resource Recovery Corporation

cc: Senator V. Susan Sosnowski
Kevin Madigan, Senate Fiscal Office
Marie Ganim, Senate Policy Office
Kelly Mahoney, Senate Policy Office
Attachment (1)



Analysis of Beverage Container Redemption System Options to Increase Municipal Recycling in Rhode Island



Prepared For



Rhode Island Resource Recovery Corporation



FINAL REPORT

May 2009



Prepared By

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Introduction

During the January, 2008 session of the Rhode Island General Assembly an Act *Relating To Health and Safety – Plastic Bottle and Container Labeling Act* (Act) was adopted requiring that the Rhode Island Resource Recovery Corporation (RIRRC) “create a plan that quantifies and details the impacts of a beverage container deposit of \$.05 on beverage containers sold in the state of Rhode Island.”

The Act lays out nine issues that the RIRRC was required to address in its report back to the General Assembly in 2009. These can be summarized as:

- *Defining the beverage containers that should be included in the deposit system;*
- *Quantifying any taxes and deposits that are already charged on beverage containers in the state and comparing those charges with beverage container charges in the Commonwealth of Massachusetts and the State of Connecticut;*
- *Determining the appropriate labeling requirements for beverage containers subject to the deposit;*
- *Identifying the appropriate entities to collect, redeem and transfer beverage containers and deposits;*
- *Defining the redemption methods that could be used and identifying appropriate locations for redemption centers including centers operated by the (RIRRC) as well as by businesses;*
- *Identifying the costs to the (RIRRC) and any other entities identified in the study for providing redemption services;*
- *Recommending how unclaimed deposits could be used;*
- *Analyzing possible impacts to municipal recycling programs; and,*
- *Recommending possible alternatives to a beverage container deposit system that would yield significantly increased recycling rates statewide.*

The RIRRC contracted with DSM Environmental Services, Inc. (DSM) to conduct the analysis described in the Act. DSM's scope of work was summarized by RIRRC as follows:

“The Consultant should also incorporate qualitative and quantitative research on comparable jurisdictions that have a beverage container redemption system. The research should explore and compare the beverage container redemption system options and alternatives to a beverage container redemption system. The goal of the research and the report is to identify which approach has the greatest potential to achieve the highest diversion of recyclables from the waste stream, reduce statewide litter, provide the greatest levels of service, are the most equitable, the most efficient, cost-effective and economically sustainable.”

In essence, DSM's scope of work required that it first specify the bottle bill system for analysis, and then specify the alternative system for analysis. Specifying the bottle bill system necessarily required that all of the issues listed in the Act (above) be addressed by DSM.

Systems for Analysis

Stakeholder Meetings

DSM conducted stakeholder meetings in November and December, 2008 in an attempt to more clearly define the components of both the bottle bill system and the alternative system that the stakeholders felt best represented the intent of the Act. Meetings were held with representatives from the following organizations:

- RIRRC
- Office of the President of the Senate
- Senate Policy Office
- Secretary, House of Representatives, Environment and Natural Resources Committee
- Rhode Island League of Cities and Towns
- Recycling Coordinator, City of East Providence representing municipal interests of the Rhode Island Recycling Coalition
- McLaughlin & Moran
- Audubon Society
- Rhode Island Food Dealers Association
- Nestle Waters
- Coca-Cola Enterprises
- American Beverage Association

In addition, DSM had several telephone and e-mail communications with the Container Recycling Institute, proponents of a bottle bill, and with Northbridge Environmental, with whom the American Beverage Association contracted to provide DSM with Rhode Island specific data on the quantity and package mix of beverage containers sold in Rhode Island.

DSM also met with the Director of the Maine Department of Agriculture, Division of Quality Assurance and Regulations, who is responsible for enforcing the provisions of Maine's expanded bottle bill (the only expanded bottle bill in the east). DSM also visited one of the largest automated redemption processing operations in Maine to determine what alternatives to reverse vending machines existed. Finally, DSM engaged in conversations with TOMRA, the largest vendor of reverse vending machines in the world and, a large provider of redemption services in New England and California.

Based on the stakeholder meetings and research DSM prepared a draft outline of the two proposed systems for analysis which was distributed to all of the stakeholders at the end of December, 2008.¹ This outline contained DSM's best estimate of the baseline beverage container recycling rate in Rhode Island (based on draft sales estimates provided to DSM at that time), together with descriptions of a bottle bill and alternative system for significantly increasing beverage container recycling in Rhode Island. Limited stakeholder comments were received on the outline of the two systems, allowing DSM to move forward with the analysis in early January, 2009. Those comments that were received were taken into consideration for the final system analyses.

¹ *Systems Outline, Bottle Bill and Non-Bottle Bill Alternatives for Significantly Increasing Beverage Container Recycling in Rhode Island, Prepared by DSM, December 29, 2008.*

Bottle Bill System

The bottle bill system envisioned by the stakeholders is different from the conventional bottle bills that currently exist in the east in that a third party – the RIRRC - is assumed to be responsible for managing the entire redemption system, taking the distributors and the retailers out of the management of returned containers. This allows for initiation of the deposit at the retail level (in most cases) and for the commingling of containers so that there is no counting by brand. Based on discussions with stakeholders, and an investigation of Maine's expanded bottle bill, key components of the bottle bill system that DSM has analyzed for this report are:

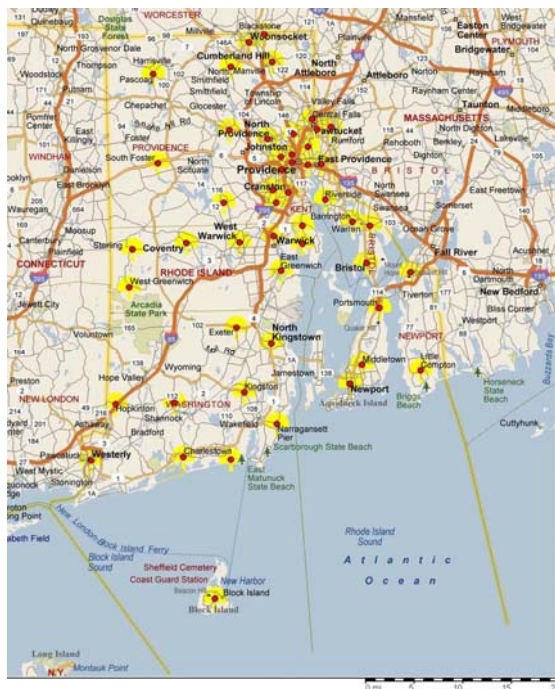
- Includes all beverage containers (carbonated and non-carbonated) but excludes milk, and beverages in aseptic cartons, gable-top boxes, and foil pouches;
- Deposit is initiated by the retailer (not the distributor), except for on-premise consumption (bars and restaurants);
- On-premise sales deposit is initiated by the bar or restaurant;
- Retailers and bars/restaurants pay deposit to State once per month based on verifiable system (similar to sales tax);
- No beverage container subject to the deposit can be sold without the UBC code first being registered with the State (department to be designated by the State);
- It is the distributor's responsibility to register the UBC code, or, in the case of central warehouse shipping to retailers in Rhode Island, either the warehouse or the retailer must register the UBC code²;
- Any retailer selling beverages in containers subject to the deposit, without the UBC code being registered, must immediately stop selling the beverage, and can be subject to fines or license suspension;
- Enforcement of the requirement that only registered beverage containers are sold rests with a state regulatory body paid for and staffed using escheat funds and with capability for auditing retail locations using hand held UBC scanners³;
- RIRRC is responsible for maintaining system of "conveniently located" redemption centers;
- The number of redemption centers is restricted by convenience and/or size (with minimum and maximum throughput). Based on limited survey data on redemption center use in other bottle bill states, it is assumed that there would be a redemption center located within a 7 mile radius of all households in rural areas (e.g. within a 14 mile diameter circle), and with a minimum size/throughput of 2 million redeemed containers per year, and that redemption centers in urban areas will be within one mile "walking" distance (e.g. 2 mile diameter circles) with a maximum size of 20 million redeemed containers per year. Based on these assumptions we estimate that there would be a need for roughly 50 redemption centers in RI (Figure 1, below, illustrates the approximate locations of redemption centers under these assumptions);

² DSM recognizes that registration of thousands of UBC codes is an onerous task, but is not aware of any other way to enforce that all beverage containers subject to the deposit are sold with the deposit on them.

³ For purposes of this analysis DSM has assumed that RIRRC would have this responsibility, however it may be more logical to have another State agency responsible. DSM assumes that costs would be similar.

- RIRRC is assumed to lease space (at market rates) for redemption centers, with all material processed at the RIRRC MRF in Johnston;
- Redemption center employees count returned containers, pay out the deposit, and then separate the returned containers into four categories – aluminum and plastic; clear glass; amber glass; and, green glass;
- Redemption center employees are assumed to be RIRRC employees;
- Commingled aluminum and plastic are stored in dumpsters or (for larger redemption centers) 40 yard roll-off containers and transported to the RIRRC MRF in Johnston for processing and sale;
- Upgrade of the RIRRC MRF equipment and operations to reduce material losses through the process and to maximize the recovery of containers for market;
- Storage of glass by color for transport directly to a glass bottle manufacturing facility;
- All escheats and material value returned to RIRRC to help cover the costs of managing the deposit system; and,
- On-premise beverage containers are also covered by a deposit, which originates with bar and/or restaurant but is not returned to the consumer. Instead deposits collected are remitted to the State and returned to the bar/restaurant when the containers are recycled. Larger bars and restaurants are assumed to be serviced by the same collection program as the redemption centers, but with deposits reimbursed on a weight basis while smaller bars and restaurants are expected to use redemption centers as consumers do.

Figure 1. Approximate Location of Redemption Centers to Achieve Convenience



Alternative System

The goal of the alternative system is to make significant improvements to the existing drop off and curbside collection system to achieve beverage container recovery rates closer to what might be achieved through an expanded bottle bill.

Key improvements to the existing system include:

- Conversion of the RIRRC MRF equipment and operations to single stream materials processing;
- The provision of single stream municipal curbside recycling collection in all RI municipalities with curbside collection of refuse;
- The provision of 64 gallon recycling carts to all households with curbside collection;
- Collection programs that are weekly would change to bi-weekly in most instances, and new programs would be bi-weekly collection service;
- A change in the solid waste rate structure in all municipalities to unit based pricing with pay-as-you-throw on the bag, or can;
- On-premise beverage containers are subject to a regulation requiring that all bars and restaurants permitted to serve alcohol must recycle their beverage containers (similar to the North Carolina law); and,
- An expanded public educational and promotional campaign, run by RIRRC, to continue to encourage high participation in the recycling program.

Baseline System

One key to the analysis of alternatives is an understanding of the performance of the current recycling system in Rhode Island with respect to the recovery of beverage containers. The RIRRC and Rhode Island municipalities have made significant investments in recycling infrastructure over the past ten years. DSM estimated the current recovery rate for beverage containers based on data provided by the beverage distributors on beverage container sales in RI compared to RIRRC estimates of beverage containers recycled through the RIRRC MRF in Johnston.

Based on data provided to DSM by the RIRRC Materials Recovery Facility (MRF), Rhode Island municipalities delivered roughly 89,900 tons of paper and commingled containers to the RI MRF in 2008. This includes newspaper, corrugated containers, chipboard, mixed paper, glass and plastic bottles, and aluminum and bi-metal cans.

Table 1 presents 2008 collection and recovery of residential recyclables in Rhode Island based on scale data from the RIRRC. "Collected" tons represent incoming tons delivered to the RIRRC MRF. "Sold" tons represent tons of material sold by the RIRRC MRF.

Table 1. Baseline, Municipal Recycling (Tons, CY 2008)

Material	Collected	Sold	Residue (Losses)
Fibers	58,600	56,000	2,600
Containers (1)	31,300	26,000	5,300
Other Materials (2)	3,100	500	4,100
Total	93,000	81,000	12,000

(1) Includes HDPE and Bi-metal cans.

(2) Tin foil, textiles, plastic bags, scrap metal and residue collected at curb.

Table 1 excludes commercial recyclables collected from businesses by private haulers and delivered to out-of-state recycling processing facilities, for which DSM has no data. Table 1 also excludes other materials (such as yard and tree waste) recovered by RIRRC and Rhode Island municipalities.

Table 1 illustrates relatively high loss (residue) rates for a dual stream MRF (roughly 12 percent). A significant amount of the loss is on the container side of the MRF, where the loss rate is estimated to be roughly 17 percent. One objection that bottle bill proponents have with curbside collection programs is that the loss rate reduces the actual recovery of beverage containers compared to bottle bill systems where the beverage containers typically do not go through a conventional MRF.

The loss rate at the RIRRC MRF is on the high side of loss rates that DSM has observed at conventional dual as well as single stream MRFs. For this reason it is clear that no matter which system Rhode Island eventually chooses to increase recycling, there is a need to upgrade the RIRRC MRF.⁴

⁴ RIRRC is aware of the need to upgrade the MRF, and has been actively planning for an upgrade.

Based on the quantities of outgoing material sold from the RIRRC MRF, and the composition of MRF residue (or losses), roughly 31,300 tons of containers were received at the MRF from municipalities for recycling last year out of the total of 93,000 tons. Of these 31,300 tons of containers, roughly 26,000 tons are aluminum, glass, and PET.

In order to determine the quantity of containers that are beverage containers, DSM used published national waste composition data for glass and aluminum packaging as food versus beverage containers, and unpublished PET bale composition data obtained from bale sorts at several MRF's across the country. Using these data, DSM estimates that roughly 21,500 tons of aluminum, PET and glass containers processed at the RIRRC MRF were beverage containers that would be subject to an expanded bottle bill.⁵

Per Household Recovery Rate (All Recyclables)

The data on tons of residential recyclables collected can be converted to pounds per household per year recycled equivalent to benchmark Rhode Island households against households in other parts of the country with similar demographics. This provides a rough indicator of the performance of the existing residential recycling programs, and a benchmark against which to potentially improve the existing system.

Municipalities in Rhode Island provide a variety of recycling collection programs for their residents. These range from high performing programs with weekly or bi-weekly curbside recycling collection for all households using large capacity carts and economic incentives such as pay-as-you-throw, to lower performing programs with, for example, drop-off recycling for those households that have curbside refuse collection, or bi-weekly curbside recycling collection using 18 gallon bins and no economic incentive to recycle. Data on deliveries by each municipality are maintained by the RIRRC and were reviewed carefully by DSM.

Based on delivery records by municipality, residential collection programs recovered a high of 800 pounds of recyclables per household in 2007 (rounded) to a low of 200 pounds per household (rounded). Statewide, an average of 450 pounds of material was recovered from each Rhode Island household (adjusted to account for seasonal households). Of this amount, roughly 100 pounds per year are estimated to be beverage containers.

Table 2 compares average curbside collection, in pounds per household in Rhode Island with similar state-wide data from Massachusetts. As illustrated in Table 2, Rhode Island households are doing a relatively good job of recycling already when compared to their neighbors to the North, where comprehensive bans of the landfilling of recyclables have been in place for much of the past ten years. However, because Massachusetts has a bottle bill (carbonated and malt beverages only), the estimated recovery of beverage containers must be added to Massachusetts curbside data to fairly compare the two states.

DSM estimates that beverage container recovery adds an additional 90 pounds to the per household recovery in Massachusetts, making Rhode Island and Massachusetts households essentially equal in terms of overall pounds recycled per household per year. (This estimate is based on limited data available.)

⁵ In addition, a small quantity of HDPE containers would be subject to an expanded bottle bill but to simplify the data tables are not shown.

Table 2. Comparison, RI and MA Lbs/HH/Yr Recycled

	RI (2008)	MA (2006)
Households, adjusted (1)	413,000	2,319,000
Recycling (tons)	93,000	398,000
Sub-Total, Lbs Per Household (lbs)	450	343
MA bottle bill material (lbs/HH/yr) (2)		90
Total, Lbs Per Household per year	450	433

(1) Includes only municipal household count from those municipalities reporting to MA DEP.

(2) Estimated based on units returned in MA, and RI package material mix.

Beverage Container Recovery Rates

The next step is to compare the estimated recovery rate for beverage containers between Rhode Island, which does not yet have a bottle bill, and Massachusetts which does. This requires that the tons of beverage containers collected and recycled in Rhode Island as part of the curbside and drop-off recycling programs be converted to units based on Rhode Island specific data on beverage consumption.

DSM estimates that 19,600 tons (rounded) of aluminum, PET and glass containers were recovered for recycling at the RIRRC MRF in 2008 from the 26,100 tons of aluminum PET and glass collected from municipalities. Of these collected, DSM estimates that roughly 21,500 tons were beverage containers. Table 3 presents estimates of the total tons per year collected and recovered by material type, ignoring HDPE and bi-metal containers in the totals which represent a small amount of beverage containers.

Table 3. Beverage Container Recovery, By Container Type

Material Type	Total Containers			Beverage Containers	
	Received at MRF (tons)	Losses (tons)	Sold / Recycled (tons)	% Beverage Received (%)	Collected (tons)
Aluminum Cans	990	51	938	97%	963
PET Bottles	3,933	1,196	2,737	82%	3,225
Glass	21,168	3,851	17,316	82%	17,311
Totals, Rounded:	26,100	5,100	19,580		21,500

(1) From US EPA estimates.

(2) RI specific packaging mix.

Based on Rhode Island-specific container sales data provided by the American Beverage Association, an average weight per container can be used to convert the tons, by material type to the number of units collected for recycling (Table 4). The average weight per container is relatively critical to the analysis in that changing the weight per unit can significantly change the number of units. According to data provided by the American Beverage Association based on actual Rhode Island sales data, significantly more soft drink is sold in one and two liter bottles than the national average. This increases the average PET weight per container, thereby reducing the estimated number of containers recovered when compared to national data.

Table 4. Conversion of Beverage Container Tons to Units

Material Type	Collected (tons)	Weight / Unit (1) (lbs)	Beverage Containers Collected (units)
Aluminum Cans	963	0.0293	65,788,697
PET Bottles	3,225	0.0608	106,096,461
Glass	17,311	0.5454	63,480,039
Totals, Rounded:	21,500		235,365,200

Using the estimated number of beverage containers recycled from Table 4 and dividing it by the 2006 Rhode Island population equates to an estimated 211 containers recycled per capita last year in Rhode Island. This compares to sales per capita, using the same unit mix for beverage containers of an estimated 569 containers per household. This results in an average beverage container recovery rate for Rhode Island of 39% (Table 5).

Table 5. Recovery Rate at MRF of Beverage Containers Sales

Material Type	Received at MRF (units)	Sales (units)	Recovery Rate (%)
Aluminum Cans	65,788,697	232,582,566	28%
PET Bottles	106,096,461	238,812,054	44%
Glass	63,480,039	136,285,614	47%
Total	235,365,196	607,680,234	39%

It should be noted that the actual recovery rate of beverage containers in Rhode Island is probably above 40% because the data on aluminum recovery ignore buy-back center recycling as well as any “leakage” of beverage containers to Massachusetts, including redemption of cans marked with the MA indicia and those that are fraudulently redeemed. This beverage container recovery rate can be compared against a reported Massachusetts recovery rate for carbonated and malt beverages (covered by the Massachusetts bottle bill) of 68 percent.⁶ However this rate is based on the return rate of beverage containers covered under the Massachusetts bottle bill (e.g. carbonated and malt beverages) and excludes beverages returned through curbside programs as well as those not covered under the Massachusetts bottle bill so an accurate direct comparison is not possible.

Rhode Island’s estimated rate can also be compared to an *estimated* recovery rate for Maine beverage containers of 86 percent, which is the only eastern state with an expanded bottle bill. However, while Massachusetts receives relatively good data on recovery rates because the escheats are returned to the State, this is not the case in Maine, where there is no reporting requirement. As such, Maine has no real way of accurately estimating the actual recovery rate.⁷

In summary, the State of Rhode Island is doing a relatively good job of recycling when compared to Massachusetts – one of the few New England states with relatively good data on recovery, and a state with a long commitment to increasing recycling. However, the recovery rate for beverage containers is estimated to be roughly one-half of what it would be under a bottle bill when compared to Massachusetts (where good quality data exist), or Maine, which has an expanded bottle bill.

⁶ Recovery rates for bottle bills are typically calculated based on units sold, not tons. Reported rates for Massachusetts vary from year to year but have been below 70 percent for the past three years.

⁷ See *Response to Chapter 40 Resolve, To Estimate the Annual Value of Uncollected Bottle Deposits, Fraud and Total Costs under Maine’s Bottle Bill*, A Report Prepared for the 123rd Legislature Joint Standing Committee on Business, Research and Economic Development, by the Maine Department of Agriculture, Division of Quality Assurance and Regulation.

Costs and Benefits Associated With Implementation of an Expanded Bottle Bill

System Costs

DSM has estimated expected annual costs associated with development and operation of a third party (RIRRC) operated redemption system, with the deposit initiated at the retail level. Redemption costs for bars and restaurants have then been added to the RIRRC redemption costs to complete total system costs.

A third party redemption system envisioned by stakeholders would be unique to Rhode Island, and there is limited experience available for DSM to rely on in estimating both start-up costs, and annual operating costs. Of particular concern to RIRRC is the estimated time and cost associated with developing an entire system of redemption centers spread throughout Rhode Island. DSM has attempted to address this concern by including estimated costs for a one year development period involving real estate leasing, construction of improvements at all redemption centers, and associated project and construction management costs.

Redemption Centers

A key assumption to estimate costs and expected beverage container return rates is the number of redemption centers required to support a third party redemption system independent of retail returns.

There are limited data on the behavior of households and individuals redeeming containers at independent redemption centers. While DSM conducted surveys at redemption centers and retail stores for the State of Massachusetts in 1998 and for Vermont in 2006, the Massachusetts survey data were considered out-dated, and the Vermont data not relevant to the behavior of Rhode Island residents. Therefore, DSM conducted limited surveying at redemption centers in Massachusetts near the Rhode Island border during the fall of 2008 in an attempt to update DSM's data on the behavior of Massachusetts redemption center users.

DSM's 1998 state-wide surveys in Massachusetts indicated that the average redemption center user drove four miles out of his/her way to redeem containers. This included both urban users and suburban/rural users. DSM's recent survey data for southern Massachusetts indicated that the average user drove 4.63 miles round trip out of his/her way to use the redemption centers.

Based on DSM's surveys, constraints were set up to estimate the number of redemption centers thought to be necessary to balance RIRRC costs with reasonably convenient drop-off locations for users. The constraints were:

- Redemption centers had to be located within a 7 mile radius of all households in rural areas (e.g. within a 14 mile diameter circle);
- Rural area redemption centers had a minimum size/throughput of 2 million redeemed containers per year;
- Redemption centers in urban areas would be no more than a one mile "walking" distance (e.g. 2 mile diameter circles); and,
- Urban area centers had a maximum size of 20 million redeemed containers per year.

Based on these constraints 50 redemption centers would be required to provide convenient redemption locations in Rhode Island. Figure 1 illustrates the distribution of redemption centers based on these constraints.

On-Premise Recycling

No other bottle bill state has a similar system to what is being proposed for Rhode Island. This is especially the case for on-premise (bars and restaurant) sales, where the distributor typically provides collection of redeemed containers. For purposes of this analysis DSM has assumed that the bar or restaurant would be required to pay the deposit to the State (just as a retailer would). However, unlike the retail sales situation, where the retailer passes the deposit on to the purchaser of the container, who ultimately makes the decision on whether and how to redeem the deposit, in the case of on-premise sales the bar or restaurant would ultimately decide if they want to redeem the containers.

DSM has assumed that small bars and restaurants would choose to deliver their deposit containers to one of the RIRRC redemption centers. However, larger bars and restaurants are assumed to be serviced by the same collection program as the redemption centers. These bars and restaurants would pay the full cost of collection and would be reimbursed for the redemption value of the containers based on agreed upon weights of beverage containers stored in 4 or 6 cubic yard dumpsters..

RIRRC Annual Costs

DSM has estimated costs associated with establishing 50 stand-alone redemption centers. Key cost assumptions are:

- RIRRC is assumed to lease space (at market rates) for redemption centers, with all material (except glass) processed at the RIRRC MRF in Johnston.
- RIRRC would need to make a significant investment in the first year (estimated at \$3.6 million) to acquire leases on 50 buildings throughout Rhode Island, and then modify all of these buildings for redemption as well as for storage of redeemed containers. DSM has assumed that this will require twelve full time RIRRC people to manage the leasing and construction necessary to get the redemption system up and running over the first year.. Start-up costs are amortized over ten years in Table 6.
- Redemption center employees are assumed to be RIRRC employees.
- Redemption center employees redeem containers and pay out the deposit, and then separate the returned beverage containers into five streams - commingled plastic and aluminum containers, and three colors of glass.
- Each material type is stored in locked dumpsters (or roll-off containers depending on the size of the redemption center).
- RIRRC will collect (or contract with a third part to collect) containers with delivery to the RIRRC MRF.
- RIRRC is assumed to install new single stream processing equipment at their existing MRF, with storage capacity for color separated glass, and a separate in-feed conveyor for commingled aluminum and plastic beverage container material to the container line.
- All escheats and material value are assumed to be returned to RIRRC to help cover the costs of managing the deposit system.

In addition to the Redemption Center capital and operating costs, the RIRRC would incur significant management costs, including:

- Auditing of retail sales to assure that only beverage containers with a deposit were being sold in Rhode Island⁸;
- Hiring and supervision of redemption center employees – all of whom will be responsible for handling redemption of containers and therefore could be involved in fraudulent activity;
- Reporting to the Rhode Island Legislature on return rates and annual costs;
- Education of citizens concerning the redemption system;
- Management of logistics of collection;
- Marketing of beverage container material; and,
- On-going management of leased buildings and neighborhood issues associated with 50 drop-off recycling locations.

Finally, RIRRC will incur costs (and realize revenues) associated with processing the beverage containers at the RIRRC MRF.

To maximize the revenue, and minimize beverage container losses, it will be necessary for RIRRC to keep redeemed glass beverage containers separate from the aluminum and plastic beverage containers at each redemption center. Further, glass containers will need to be separated by color so that the resulting recovered glass can be sold directly for new glass container manufacturing.

Costs for collection and trucking (as well as leased building size and configuration) presented in Table 6 are based on the assumption that aluminum and plastic beverage containers would be commingled at each redemption center, but that glass would be kept separate by color (but broken to prevent re-redemption). All material is assumed to be delivered to the RIRRC MRF. Commingled plastic and aluminum would be dumped on the tipping floor separate from single stream materials, and run on the container line only. Glass would be dumped into large transfer containers for hauling directly to glass container manufacturers. It is likely that clear glass would always have a market, but that there would be times that brown, and especially green glass, would have to go to lower value uses.

Because of the large losses on the container line at the existing RIRRC dual stream MRF, DSM has assumed that the RIRRC would have to upgrade the existing MRF under any system, including a bottle bill system reliant on processing of material through the RIRRC MRF. The RIRRC has made initial estimates of the capital cost of an upgrade, and DSM has relied on these estimates.

However, because the bottle bill material would be delivered to the MRF separate from paper, DSM has assumed that total MRF upgrades that can be attributable to a bottle bill system are roughly one-half the capital cost of renovations under the alternative system. In addition, processing costs would be less than those for the alternative system, where beverage containers would be mixed with paper. This is especially the case for color sorted glass which would simply be loaded into transfer trailers for delivery to glass container plants.

⁸ It should be noted that this function could be carried out by another State agency, however the costs are likely to be similar.

Table 6 presents annualized costs to the RIRRC associated with operating the 50 redemption centers and transporting the material to the RIRRC MRF and/or the glass container recycling location. Table 6 includes the MRF operating costs and estimated material revenues based on historic material prices. Material prices have been adjusted up compared with material revenues from an alternative system to reflect higher values for deposit containers.

Table 6. Total RIRRC Redemption Costs, Annualized

Cost Category	Annual Cost
Administrative, Management and Audit	\$1,278,800
Amortization of Start-Up Costs (10 yrs)	\$758,616
Collection and Trucking	\$1,086,370
Redemption Center Leasing and Operations	\$8,260,763
MRF Processing Cost	\$1,096,523
RIRRC Annual Cost	\$12,481,073
<i>Less Material Sales Revenues</i>	<i>(3,000,000)</i>
Net RIRRC Annual Costs	\$9,481,073

Consumer Cost

There is also a cost to the consumer associated with the bottle bill in that the consumer can not set out containers with other recyclables if they want to redeem the deposit. Instead, they (or a third party) must return them to a separate location (e.g. redemption center), which may, or may not, be on their way to work or another errand.

DSM's surveys of redemption center users at southern Massachusetts locations provide some insight into the redemption behavior of households and individuals. DSM's survey of 126 users over three days found that on average users redeemed 327 containers per trip, driving 4.63 miles round trip out of their way to use the redemption center.

Annualizing the survey data from the redemption center users, DSM estimates that the average redemption center user redeems 5,321 containers per year, driving 152 miles round trip out of their way to use the redemption centers.⁹

Based on DSM's best estimate of the number of beverage containers that would be redeemed annually in Rhode Island under an expanded bottle bill, redemption of containers will require that users drive roughly 11.1 million extra miles, costing \$6.1 million dollars (based on the current allowable U.S. IRS mileage rate). Table 7 shows these calculations.

⁹ Redemption center users tend to be a combination of households returning their own containers, janitors from institutions returning containers collected at the business or institution, and people who are out on the sides of the road, either picking up litter, or scavenging from recycling bins. This combination results in the high recovery rates reported for bottle bill states when compared to curbside collection only systems.

Table 7. Average Redemption Center User

	Redemption Center	
	<i>Average User</i>	<i>All Users</i>
Containers Delivered (ctrs)	5,321	390,400,000
Extra Miles Driven (miles)	152	11,116,117
Transport Cost (.55/mile)	\$84.84	\$6,113,864
Tons Delivered (tons)		21,150
Cost/Ton (\$)		\$289
Cost Per Container		\$0.016

Cost of Lost Sales to Rhode Island Merchants

One issue that continues to be debated across the country is the impact that a deposit on beverage containers has on sales of beverage containers. This issue was raised during the stakeholder meetings because of differences in sales and excise taxes between Massachusetts and Rhode Island which currently provide for a slight sales advantage in Rhode Island when factoring in the deposit in neighboring Massachusetts.

Research has been conducted on the issue of lost sales associated with a deposit, but it is not definitive, with both proponents and opponents of bottle bills presenting their own studies.

Part of the reason that the studies are not definitive is that there are many variables to control for, including:

- Existence of bottle bills in bordering states;
- Difference in sales tax rates by beverage type and application in surrounding states (e.g. does the sales tax apply to beverages only or to food items also, and does it include alcoholic beverages, and if so, are there excise taxes on alcohol that also impact price);
- The location of existing retail hubs due to other factors (e.g. major transport junctions, geography, historic retail locations, and new major distribution centers);
- Short term impacts versus longer term impacts;
- Ability to obtain accurate sales data from retailers in border areas; and,
- Pricing practices of beverage distributors.

It was beyond DSM's scope of work to calculate the potential impact on sales associated with an expanded bottle bill. However, because DSM has attempted to quantify all of the potential benefits of a bottle, some rough estimate of the lost sales costs should be included.

The most economically rigorous analysis that DSM has been able to obtain is the University of Kentucky, Center for Business and Economic Research study conducted for the Kentucky Grocers Association in 1999. The University of Kentucky study uses Department of Agriculture studies on the elasticity of demand for various products to estimate the change in demand for beverage containers associated with an increase in the cost of beverage containers associated with a deposit system.

The increased cost of beverage containers associated with a bottle bill is the deposit (for those consumers who choose not to redeem the deposit), and the cost to consumers associated with storing and transporting the beverage containers if they choose to redeem the deposit.

Economic theory clearly demonstrates that as prices increase, demand is reduced. The change in demand associated with the change in price is called the “elasticity of demand”. Goods for which there are ready substitutes have higher elasticity than goods for which there are not as many opportunities for substitution.

In the case of the proposed expanded bottle bill for Rhode Island there are several factors that impact on the elasticity of demand.

First and foremost is that the surrounding states of Connecticut and Massachusetts are either considering, or have adopted an expanded bottle bill, meaning that Rhode Island consumers may not be able to travel to either of these neighboring states to avoid the deposit. That means that there will not be a cost savings to Rhode Island consumers associated with traveling to purchase the same beverages.¹⁰

Therefore, the primary “cost” to consumers is the cost to those consumers who choose not to return their beverage containers to redeem the deposit and for those consumers who must store and transport their beverage containers to a redemption center to redeem their containers.

Clearly the elasticity of demand changes depending on the type of beverage. For example, the demand for alcohol might be more inelastic (because there aren’t readily available substitutes when all alcoholic beverages are covered by an expanded bottle bill) than the demand for water or juice. In the case of water, consumers can choose tap water over bottled water, and in the case of juice, consumers can choose frozen concentrate juice (which is not subject to the deposit), or, in some cases could substitute milk for juice.

The University of Kentucky study estimated that this inconvenience cost would reduce sales of beverage containers in Kentucky by \$100.7 million based on the elasticity of demand for the various beverages, and the fact that residents could travel to non-bottle bill states from all borders, magnifying the impact on sales in border communities.

For purposes of DSM’s analysis, the impact of lost sales for Rhode Island, when compared to Kentucky, has been reduced by 50 percent to account for the fact that Rhode Island is surrounded by states with a bottle bill. This reduction (to approximately 2 percent of sales) represents the lower end of estimated losses in sales reported in the literature.

Kentucky has roughly four times the population of Rhode Island. Adjusting for Rhode Island population and then adjusting for the fact that Rhode Island is surrounded by bottle bill states yields an estimated loss in sales of approximately \$12.5 million per year.

There are, however, a number of studies of bottle bills that maintain that there is no impact on sales. Unfortunately, none of the studies that DSM has found provide a detailed economic analysis to make this assertion. Therefore, DSM has chosen to report the cost of an expanded bottle bill both with and without lost sales for lack of definitive analysis on this issue.

Lost Revenue to Rhode Island Municipalities

One of the concerns raised by municipalities in Rhode Island during the initial stakeholder meetings was the impact on the State mandated recycling rates, as well as the potential loss in revenue sharing associated with diversion of beverage container material from municipal recycling collection programs to the redemption system. DSM has attempted to estimate how

¹⁰ There is currently a 7 percent tax on alcoholic beverages in Rhode Island. This makes the sale of a case of beer similar (without a deposit in Rhode Island) to the sale of a case of beer with a deposit in Massachusetts. Therefore, if the deposit were added to the cost in Rhode Island, there would be an increased price for alcoholic beverages in Rhode Island compared to Massachusetts.

much beverage container material currently collected from municipal recycling programs (and how much revenue) would be lost to the redemption system.

DSM estimates that, based on average material prices received at the RIRRC MRF over the past twelve years, municipal material revenue reimbursement would be reduced by roughly \$1.4 million statewide. This should be viewed as a rough estimate only, given the volatility in materials prices over the past twelve months, combined with the fact that the RIRRC only started MRF material revenue sharing with the municipalities over the past two years, and could reverse this decision going forward.

It should also be noted that while there would be a potential loss in revenue sharing to the municipalities, total revenue to the RIRRC would increase. This is because additional beverage container material over and above current quantities would be available to market through the RIRRC MRF. It is assumed that the municipalities would not share in this revenue because it would be needed to help finance the redemption system managed by the RIRRC.

Table 8. Estimated Municipal Revenue Sharing Losses Under Bottle Bill

Material	Current Curbside Collection (tons)	Curbside, with Bottle Bill (tons)	Losses (tons)	Material Value (\$/ton)	Lost Revenue (\$)
Aluminum	1,000	180	820	\$1,050	\$861,000
Glass	21,200	5,600	15,600	\$0	\$0
PET	3,900	1,000	2,900	\$200	\$580,000
Total:	26,100	6,780	19,320	NA	\$1,441,000

Costs to Bars and Restaurants

As discussed above, the use of a third party redeemer (the RIRRC) requires that a system for redeeming beverage containers from bars and restaurants be incorporated into the bottle bill redemption system.

DSM has modeled the redemption system (and the alternative recycling system presented below) based on the successful North Carolina mandatory recycling requirement for all bars and restaurants with a liquor license. In essence, bars and restaurants in Rhode Island would be required to pay a deposit to the State on all beverage containers sold. They could then redeem the containers at one of the RIRRC redemption centers, or they could contract with the RIRRC to collect the beverage containers at the bar or restaurant, with payment for redeemed beverage containers based on the average weight of the beverage containers at the time of collection.¹¹

According to data collected by DSM there are roughly 1300 bars and restaurants in Rhode Island. DSM has assumed that one-quarter of these bars and restaurants would be small, and would choose to deliver their beverage containers to an existing RIRRC redemption center. The other 75 percent are assumed to pay the RIRRC to collect the containers. DSM has then used case study data from North Carolina on the storage and collection costs experienced in North Carolina to estimate the cost to those Rhode Island bars and restaurants which choose to pay RIRRC for collection. This results in an estimated cost of \$1.5 million dollars per year.

¹¹ Vermont has a similar system in place for commingled glass containers collected at redemption centers, and based on the average weight of a Gaylord of glass.

System Benefits

Bottle bills generate a number of benefits; some of them associated with the general increase in recovery of material (plastic, aluminum and glass), and some unique to the bottle deposit (litter). A comprehensive study of the economic and environmental benefits of a deposit system for beverage containers in Washington State was carried out in 2005.¹² This study attempted to quantify the following benefits associated with a deposit system:

- Reduced greenhouse gas emissions;
- Decreased litter costs;
- Avoided acidification and eutrophication;
- Reduced human toxicity and disability adjusted life years;
- Decreased garbage collection costs; and,
- Decreased disposal costs.

DSM's scope of work was more limited, but did call for quantification of the impact on Greenhouse Gas (GHG) emissions, as well as a discussion of the potential impact on litter generation associated with an expanded bottle bill.

Rough estimates of the additional benefits described in the Washington State study were then made using the data presented in the Washington State study, as adjusted to the population of Rhode Island.

Greenhouse Gas Emissions

The US EPA WARM Model was used to evaluate GHG emissions reductions associated with the baseline system, the expanded bottle bill system, and the alternative system.

Table 9, below presents the results of the WARM Model run using the change in quantities of beverage containers recovered under an expanded bottle bill. Based on the WARM Model, the expanded bottle bill would result in a reduction in GHG emissions, reported in Metric Tonnes, Carbon Equivalent (MTCE) of 11,200 tons (rounded) per year. However, driving the beverage containers to the redemption centers results in additional GHG emissions. Adjusting for these additional emissions yields a net reduction of roughly 9,700 tons of GHG emissions per year.

Table 9. Estimated Change in GHG Emissions Under Bottle Bill (MTCE)

	Baseline (MTCE)	Bottle Bill (MTCE)
Total GHG Emissions (MTCE)	(57,627)	(68,782)
Incremental GHG Emissions (MTCE):		(11,156)
Consumer GHG Emissions to Deliver Recyclables		1,414
Net Incremental GHG Emissions (Savings)		(9,742)

Converting the incremental GHG emission savings to a cost savings is challenging. Carbon trading, using an estimated value of \$10 per MTCE, yields roughly \$100,000.

¹² Morris, Jeffrey, B. Smith, and R. Hlavka, *Economic & Environmental Benefits of a Deposit System for Beverage Containers in the State of Washington*, Prepared for the City of Tacoma Solid Waste Management, April, 2005

Impact on Litter

DSM reviewed 23 litter studies conducted between 1993 and 2006, and encompassing 13 different states (Florida has had five separate studies over this period). Efforts were made to obtain data from both bottle bill and non-bottle bill states.

DSM ultimately used 19 litter studies that followed statistically valid data collection techniques. However, only one of the 19 litter studies for which data were publicly available was conducted in a bottle bill state (Iowa). Table 10 presents a comparison of the results for the 19 studies.

Table 10. Comparison of Litter Studies

Date	State	Unit of Measure	Beverage %	Debris %	Packaging%	Misc Items%	Bottle Bill
1993	Hawaii	Total Items	7.30	5.70	29.50	20.00	2005
1994	Florida	Large Items	21.07	14.90	15.44	20.02	No
1995	Florida	Large Items	16.59	20.73	15.02	17.70	No
1996	Florida	Large Items	16.72	19.87	17.61	15.75	No
1997	Florida	Large Items	14.95	22.01	17.94	14.47	No
1998	Oklahoma	Total Items	12.40	N/A	15.00	N/A	No
1998	Kentucky	Total Items	8.60	19.60	28.40	17.90	No
1999	Kentucky	Total Items	48.00	N/A	16.00	15.00	No
1999	Pennsylvania	Total Items	5.10	19.00	21.00	N/A	No
2000	Mississippi	Total Items	13.10	12.80	29.00	18.90	No
2001	Florida	Large Items	16.46	25.81	14.13	17.63	No
2001	Iowa	Total Items	4.60	N/A	N/A	N/A	1979
2001	North Carolina	Total Items	11.10	11.80	25.60	26.10	No
2002	Florida	Large Items	13.94	25.61	15.06	19.86	No
2004	New Jersey	Total Items	9.20	6.30	23.60	28.60	No
2004	Ohio	Weight	27.00	29.00	16.90	6.00	No
2005	Washington	Large Items	9.00	9.00	45.00	25.00	No
2006	Tennessee	Total Items	5.20	18.50	16.40	48.30	No
2006	Georgia	Total Items	4.40	10.40	19.10	49.10	No
Average			13.93	16.94	21.15	22.52	

The methodology for litter studies, and the subsequent litter categories reported for each study, varies greatly. The majority of litter studies report the pieces of litter counted by category, and do not report weights, or convert litter into percent by volume. In addition, there are no common set of categories to categorize the counted litter, and different studies choose different size pieces of litter as a cut-off for counting.

For example, in Florida, “large” litter items were defined as any piece of litter 4 inches or more and “small” litter items were defined as any piece less than 4 inches. The percentage of litter in the Florida studies is reported as the percent of large litter in Table 10, not as a percent of the entire litter collected. Conversely, a number of studies counted all litter over 1 inch in size, and provided the percentage of litter types as a percent of the total count of litter. This is important because cigarette butts often account for a high percentage of the litter when included in the litter studies. Only one study in this comparison used the weight of litter as their unit of measure; the 2004 Ohio Study.

Because litter category definitions vary among studies, subgroups from various studies were summed by DSM into larger categories with similar definitions. Further, in comparing the data presented in Table 10, the comparison should be viewed as at best a rough comparison due to

different methodologies for counting litter, the different categories used for each study, and different minimum size (1" versus 4") of the litter collected.

As illustrated by Table 10, on average, beverage containers represent the smallest of the four categories of litter, when counting number of units.¹³ However, beverage containers are the second largest category when measuring litter based on weight (Ohio).

Part of the reason that beverage containers are a smaller portion of total litter categories is that "Miscellaneous Items" (paper scraps, miscellaneous metal, and miscellaneous plastic) represents a large number of pieces. This is due in part to roadside mowing which chops up larger pieces of paper and plastics more readily than beverage containers.

Packaging is the second largest category in the data set presented in Table 10. Definitions vary from study to study, but in general this category includes snack wrappers, fast food packaging of all types (plastic, paper, and metal), product packaging and outer packaging.

Debris is, on average, the third largest category. The definition of debris includes vehicle, home and construction debris. Much has been written about deliberate versus non-deliberate roadside litter. In general, the conclusion of litter studies reviewed by DSM is that debris is often not deliberate, but rather falls off of the truck that is transporting it.

Impact of Deposits on Beverage Container Litter

DSM reviewed various studies on the impact of beverage container deposits on beverage container litter. Reports vary widely on the impact of deposits on beverage container litter. In general the studies indicate that beverage container litter is reduced between 55 and 75 percent due to deposits.

It can be speculated that this reduction in beverage container litter is not the result of people storing the containers in their cars, but rather as a result of people picking up the containers that have been littered to redeem the deposit.

DUI laws in most states prohibit the carrying of open alcohol containers in the automobile. People litter alcoholic beverage containers to avoid the open container violation, for which the cost far exceeds the value of the deposit.

Only 8 of the 19 studies shown in Table 10 identified alcoholic beverage containers as a subgroup. These eight studies (all in non-bottle bill states) indicate that alcoholic beverage containers averaged 9.85 percent of total litter, or 71 percent of total beverage container litter.

Several studies looked specifically at the percent of beverage container litter that was non-carbonated. Two studies were conducted in New York, which has a deposit on carbonated beverage containers only. The New York Public Interest Research Group (NYPIRG) conducted a study in 2008 of New York State beverage container litter which concluded that non-deposit containers made up 61% of the beverage containers. Similarly, Scenic Hudson conducted 176 cleanups and found that 61% of the beverage containers were non-deposit containers. Finally, the American Littoral Society found that 62% of the beverage containers across their 67 cleanups were non-deposit containers.

Finally, because Rhode Island is an ocean state, DSM attempted to obtain data on coastal litter studies. In 1995, volunteers collected trash from coastal waterways around the world as part of

¹³ The one exception is the 1999 Kentucky study which did not report/count debris – which typically is a significant quantity of total litter.

the 10th annual International Coastal Cleanup. Information from the Rhode Island collection was printed in “Coastal Features Fall 1996”. Since it was not a roadside litter study and the collection methodology greatly differed from the studies presented in Table 10, DSM did not compare the results to the other 19 litter studies.

The largest category of litter collected along Rhode Island coastal shores and waterways in 1995 was cigarette butts. The second largest category for 1995 was fast food packaging (aggregating several similar subcategories). The third largest category for 1995 was beverage containers, at 8.24% of the total litter collected (metal, plastic and glass).

The International Coastal Cleanup takes place every year and the 2007 data were obtained from the <http://www.oceanconservancy.org> web site for Rhode Island. The largest litter category for 2007 was cigarette butts. The second largest category for 2007 was fast food packaging (aggregating several similar subcategories). The third largest category for 2007 was beverage containers, increasing from 1995 to 13.5% of the total litter collected. This percent closely matches the average for the 19 studies presented in Table 10.

Economic Benefit of Reducing Beverage Container Litter

Reducing beverage container litter has two significant economic benefits. First, it reduces the significant cost associated with picking up litter, and second, it reduces public health and farm animal health costs.

Estimated Reductions in Litter Collection Costs

According to the Washington State study¹⁴ litter collection costs roughly \$1,200 per ton. Assuming that an expanded beverage container deposit reduces beverage container litter by an average of 65 percent (the mid-point of the range of reported reductions), and that beverage container litter represents 14 percent of litter, then the expanded bottle bill should reduce total litter collection costs by nine percent.

DSM has not been able to find any data on total tons of litter collected annually in Rhode Island. However, a search of the literature turned up a detailed analysis of litter collection quantities throughout the United States published in 1993.¹⁵

Data from the 1993 report covers eight states spread throughout the United States and were averaged and then divided by population in these states to develop a per capita litter collection rate of 4.6 pounds/capita. Applying this average to Rhode Island’s current population yields an estimate of 2,450 tons of litter collected annually in Rhode Island. Multiplying 2,450 tons times an estimated nine percent reduction in litter pieces collected due to an expanded bottle bill yields an annual reduction of 223 tons of litter. Multiplying this reduction in litter collected by \$1,200 per ton yields an estimated savings of \$267,500.¹⁶

Estimated Reductions in Public Health and Farm Animal Health Costs

Reducing beverage container litter (especially broken glass) also has public, and farm related benefits. According to a study conducted for the Michigan Great Lakes Protective Fund, “*in the year after Massachusetts enacted the bottle bill, outdoor glass-related injuries to children treated*

¹⁴ J. Morris, B. Smith and R. Hlavka, *Economic & Environmental Benefits of a Deposit System for Beverage Containers in the State of Washington*, April, 2005

¹⁵ Andres, D.L., *Disposal of Roadside Litter Mixtures*, American Association of State Highway and Transportation Officials, National Research Council, US Federal Highway Administration.

¹⁶ It is recognized that beverage container litter is heavier than some other types of litter, however litter collection costs are much more dependent on the number of pieces collected than on the weight.

at the Children's Hospital in Boston dropped 60 percent, while other childhood accidents remained steady or increased slightly".¹⁷ Farmers, especially cattle farmers, are also impacted by broken glass when it becomes entrapped in cattle feed.

The Michigan Great Lakes Protective Fund report estimates that on average the beverage container litter related benefits are worth an average of \$3.23 per capita per year (ranging from a low of \$.89 to a high of \$8.40). Multiplying the average per capita health benefit of beverage container litter reduction times Rhode Island's population results in an estimated public health savings of \$3.2 million per year.

Avoided Disposal Cost Savings

DSM's best estimate is that an expanded bottle bill would reduce waste disposal by 20,812 tons per year (the estimated increase in beverage container recovery under the bottle bill). The current RIRRC tipping fee for municipal waste is \$32 per ton for material delivered under the cap, and \$60 - \$70 per ton for material delivered above the municipal cap. Roughly 70% of the waste is delivered by municipalities, at the \$32 per ton tipping fee, and roughly 30% of this material is assumed to be delivered from bars and restaurants, at \$65 per ton. The resulting avoided disposal cost savings to the municipalities and businesses would be \$870,000 (rounded).

Avoided Collection Costs

Removal of 20,812 tons of beverage containers from the waste stream may also reduce refuse collection costs (although these costs are primarily transferred to those redeeming containers – see above). Unfortunately, there is no straightforward method to estimate collection cost savings because the savings will vary significantly from municipality to municipality depending on the types of collection trucks, distance to the landfill, and the existing excess capacity that may, or may not exist in each municipality.

Using generic estimates of collection costs, DSM estimates that municipalities in Rhode Island could save roughly \$1.3 million (rounded) annually in collection costs associated with the reduction in tons of beverage containers that are currently disposed as refuse that would instead be redeemed for deposit. DSM's estimate of collection cost savings is based on the following crude assumptions:

- The average density of aluminum, glass and PET beverage containers is 62, 515, and 34 pounds per cubic yard, respectively;
- Compaction ratios for aluminum, glass and PET beverage containers are 4 to 1 for aluminum, 2 to 1 for glass, and 3 to 1 for PET;
- Converting the tons redeemed by material type to compacted cubic yards yields 168,548 cubic yards;
- An average rear loading packer truck can collect 13,520 yards per year, meaning that 12 fewer trucks would be needed per year; and,
- The average all in truck cost per year is \$80,000.

Ecosystem and Public Health Benefits

The manufacture of aluminum, especially, as well as PET beverage containers from virgin materials both have significant environmental impacts. The WARM model results (above) have been used to quantify the GHG emission savings (in carbon equivalents). However, additional ecosystem damage and public health costs are also incurred in the production of beverage

¹⁷ Stutz, J., and C. Gilbert, *Michigan Bottle Bill, A Final Report to: Michigan Great Lakes Protective Fund*, July 10, 2000.

containers. The State of Washington study¹⁸ on deposit systems presents estimates of these ecosystem and public health benefits associated with increased recycling of beverage containers under an expanded bottle bill.

Because independent calculation of these benefits is outside of the scope of this study, DSM has made the simplifying assumption that the current recycling rate for beverage containers in Rhode Island is roughly equivalent to the beverage container recycling rate in Washington, and has then adjusted the estimated benefits associated with an expanded bottle bill for the State of Washington to Rhode Island based on the difference in population. Based on this highly simplified assessment, it is roughly estimated that the ecosystem and public health benefits accruing from the increase in beverage container recycling are worth roughly \$1.3 million per year.

Summary of Costs and Benefits Associated With an Expanded Bottle Bill

Table 11 summarizes the costs and benefits presented above for the expanded bottle bill system. These costs can be compared against the cost of the alternative system and against the change in the recovery rate for beverage containers and the expected impact on the recycling rate.

As illustrated by Table 11, system-wide costs to the RIRRC, bars and restaurants, and consumers returning containers are estimated to be \$20.2 million. Cost savings and material revenues result in a net cost of roughly \$14.8 million before accounting for potential losses in sales revenues to retailers or the environmental and health benefits.

¹⁸ J. Morris, B. Smith and R. Hlavaka, *Economic & Environmental Benefits of a Deposit System for Beverage Containers in the State of Washington*.

Table 11. Summary of Expanded Bottle Bill Costs/Benefits (Annualized)

Costs	Annual Cost (\$)
RIRRC (Redemption and Processing Cost)	\$12,481,073
Consumers (Self-transport cost)	\$6,113,864
Restaurants and Bars (Collection cost)	\$1,598,580
Sub-Total, Added Costs	\$20,193,517
Cost Savings and Revenues	
Reduced litter collection costs	-\$267,500
Reduced refuse collection costs	-\$1,290,000
Avoided disposal fees	-\$870,000
Material Revenue	-\$3,000,000
Sub-Total, Cost Savings & Revenues	-\$5,427,500
Net Cost	\$14,766,017
Estimated Environmental Benefits	
Carbon Savings Value	\$100,000
Reduced public and farm animal health costs from litter	\$2,800,000
Ecosystem and public health benefits associated with increased recycling	\$1,300,000
Sub-Total Benefits	\$4,200,000
Net Cost/Benefit	\$10,566,017
<i>Retailers Lost Sales Estimate</i>	<i>\$12,500,000</i>
Net Cost/Benefit	\$23,066,017

Costs and Benefits Associated With Implementation of an Expanded Curbside Collection System

The primary goal of the alternative system would be to make significant improvements to the existing drop off and curbside recycling collection system in the hopes of achieving beverage container recovery rates closer to what might be achieved through an expanded bottle bill.

Rhode Island municipalities collected an average of 450 pounds of recyclables per household (rounded) in 2008. This includes scrap metal, paper, and bottles and cans set out at the curbside or dropped off at drop-off recycling facilities. Deducting scrap metal, and losses incurred at the RIRRC facility, the per household recycling rate falls to 390 pounds per household (rounded).

The goal would be to raise the average quantity of material recycled per household to 600 pounds per year. To achieve this increase DSM has assumed that the following key improvements to the existing system would be made based on DSM's observations of high performing recycling systems around the United States:

- Conversion of the RIRRC MRF equipment and operations to single stream materials processing – both to reduce losses, and to allow for processing of single stream material collected curbside and at drop-offs;
- The provision of single stream municipal curbside recycling collection in all RI municipalities with curbside collection of recyclables;
- The provision of curbside collection to the roughly 100,000 households that currently do not have curbside recyclables collection (primarily multi-family households);
- The provision of 64-gallon recycling carts to all households with curbside collection;
- A change in the solid waste rate structure in all municipalities to some type of pay-as-you-throw on the bag, or can, to create an economic incentive to recycle;
- Restaurants and bars with a liquor license would be subject to a regulation requiring that they recycle their beverage containers (similar to a recently implemented North Carolina law); and,
- An expanded public educational and promotional campaign, run by RIRRC, would be implemented to continue to encourage high participation in the recycling program.

System Costs

For purposes of this analysis, and to be consistent with the analysis of the expanded bottle bill system, DSM has assumed that the RIRRC would bear the cost of improving the municipal collection programs and assisting bars and restaurants with complying with mandatory recycling of beverage containers. Estimates for each of these costs are presented below.

Improvements to the RIRRC MRF

The RIRRC has recognized the need to make improvements to the existing MRF for some time now, given the relatively high losses of material – especially on the container line – and the desire

to process single stream material to enable collection efficiencies among Rhode Island municipalities.

RIRRC has previously estimated that conversion to single stream processing at the existing MRF would require a roughly \$8 million investment. Based on discussions with RIRRC, DSM has increased the estimated capital cost to \$10 million, amortized over 15 years. The change to single stream recycling will also involve additional operating costs. DSM estimates that it will cost the RIRRC \$45 per ton to process material through the new single stream MRF.

The investment in single stream should significantly reduce material losses, and therefore increase material revenues, and will also allow municipalities to reduce their recycling collection costs.

Investment in Carts

The key to improving the household participation and set-out rate is to provide adequate storage capacity to each household for recyclables. It has been DSM's experience that the provision of 64 gallon rolling carts is one of the most important ways to increase household storage capacity.

RIRRC provided DSM with a list of municipalities and household counts of households that already had been provided a rolling cart. It was assumed that all other households receiving curbside collection would be provided with a rolling cart. The estimated capital cost for these carts is \$15.4 million, which has been amortized over a ten year lifetime of the carts. An additional ten percent has been added to annual operating costs to account for the replacement of carts over a ten year period.

In addition to the investment in carts there will be a need for municipalities (and/or the private companies providing the collection service) to invest in cart tippers and/or new trucks to collect the carts. DSM has assumed that municipalities and private collectors would initially add cart tippers to the existing fleet, but that over time some municipalities and private companies would switch to automated collection of both refuse and recyclables.

Change in Collection Frequency

The provision of 64-gallon rolling carts should allow some municipalities that are now collecting recyclables weekly to shift to bi-weekly collection because there will be sufficient storage capacity in the carts for households to store recyclable for two weeks.¹⁹ This will reduce collection costs for some Rhode Island municipalities which currently offer weekly collection.

For purposes of this analysis DSM has used recent recycling collection bid prices in New England to estimate the cost to Rhode Island municipalities associated with collecting recyclables from those households not already receiving curbside recycling collection, and to estimate the cost of reducing collection frequency from weekly to bi-weekly collection.

¹⁹ There will be high recycling communities where bi-weekly collection will not be possible with a single 64 gallon cart. Warwick reports that given the volume they are collecting now that bi-weekly collection would not be sufficient with a single cart. In other cases it may be politically unacceptable to move to bi-weekly collection. However, DSM believes, based on set-out rate studies that it has completed for many communities every other week collection would be sufficient. For purposes of this analysis DSM has assumed that 75 percent of Rhode Island communities could implement bi-weekly collection. Actual savings will be less if a significant number of communities choose not to switch to bi-weekly collection.

PAYT Pricing

The other key to increasing household recycling is to provide an economic incentive to recycle. For purposes of this analysis DSM has assumed that Rhode Island would mandate implementation of some form of user fee system (PAYT pricing) for refuse collection. Revenues from these user fees have not been included in this analysis because the user fee is assumed to be revenue neutral, in that it would reduce property tax revenues required for refuse collection.

Increased Funding for Public Education

Research on sustaining high recycling rates demonstrates that a continued investment in public education is necessary. For purposes of this analysis DSM has assumed that the RIRRC would invest \$1 per household per year in public education programs designed to promote higher participation and capture rates.

On-Premise Recycling

As discussed above, DSM has assumed that Rhode Island would enact a mandatory recycling requirement for all bars and restaurants with a liquor license²⁰ to implement a recycling program for beverage containers. This requirement is modeled after North Carolina's law.

DSM's estimated cost to the bars and restaurants to comply with the law are also modeled after case studies of North Carolina bars and restaurants conducted by North Carolina after implementation of the mandatory recycling requirement. Costs to bars and restaurants are assumed to be the same for the alternative system as they would be for the expanded bottle bill system (see above), except that bars and restaurants would contract with private haulers instead of the RIRRC to collect the beverage containers.

Recovery of Beverage Container under the Alternative System

Table 12 presents DSM's best estimate of the change in total tons of beverage containers collected for recycling under the alternative system when compared to the expanded bottle bill system. As illustrated by Table 12, the alternative (enhanced) system recovers more recyclables when compared to an expanded bottle bill because of the increase in fiber (paper) estimated to be collected under this system. However, Table 12 also illustrates that recovery of beverage containers is less under the alternative system when compared to the expanded bottle bill.

Table 12. Comparison of Beverage Container Recovery

Material	Baseline Collected (tons)	Baseline Recycled (tons)	Enhanced System (tons)	Bottle Bill Recycled (tons)
Fibers	58,600	56,000	77,021	56,000
Aluminum Cans	1,000	940	1,994	3,100
PET Bottles	3,900	2,700	5,047	5,900
Glass	21,200	17,300	25,904	31,800
HDPE	2,690	2,224	3,655	2,690
Tin	3,579	3,093	4,861	3,579
	90,969	82,257	118,481	103,069

²⁰ Class B-T (Victualer, Tavern), Class B-M (Brew Pub) and Class D (Club)

System Benefits

Given the recovery of additional recyclables estimated in Table 12, estimates can be made of the benefits of the alternative system for comparison against the estimated benefits of the expanded bottle bill.

Greenhouse Gas Emissions Reductions

The US EPA WARM Model was used to compare GHG emissions savings associated with recycling under the baseline system, the expanded bottle bill system, and the alternative system.

Table 13, presents the results of the WARM Model run using the change in quantities of beverage containers recovered under an expanded bottle bill, and run using the change in paper recovery and beverage container recovery under the alternative (enhanced) system. As illustrated by Table 13, the alternative system results in greater GHG emission savings due to the large increase in paper recycling when compared to the expanded bottle bill, which does not impact on paper recycling.

Table 13. Estimated Change in GHG Emissions (MTCE)

	Baseline (MTCE)	Bottle Bill (MTCE)	Enhanced (MTCE)
Total GHG Emissions (MTCE)	(57,627)	(68,782)	(74,661)
Incremental GHG Emissions (MTCE):		(11,156)	(17,034)
Consumer GHG Emissions to Deliver Recyclables		1,414	0
Net Incremental GHG Emissions (Savings)		(9,742)	(17,034)
	<i>Valued at \$10 per ton:</i>	<i>(\$97,417)</i>	<i>(\$170,339)</i>

MTCE = metric tons of carbon equivalent

Impact on Litter

DSM has made the assumption that the alternative system does not have any impact on reducing litter, and therefore there are no economic benefits associated with litter reduction under the alternative system.

Avoided Disposal Costs

DSM's best estimate is that the enhanced recycling system would reduce waste disposal by roughly 36,000 tons (rounded) per year. At the rate of \$32 per ton tipping fee (which most municipal waste is disposed at), avoided disposal cost savings to the municipalities would be roughly \$1.15 million (rounded).²¹

²¹ Because of the MRF upgrades under the enhanced system, the residue or loss rate is assumed to be significantly lower which increases the total tons of material counted in avoided disposal costs.

Avoided Collection Costs

Removal of an additional 26,000 tons of recyclables from the waste stream may also reduce refuse collection costs²². Using generic estimates of collection costs (see discussion under the expanded bottle bill, above) DSM estimates that municipalities in Rhode Island could save roughly \$800,000 annually in collection costs.

Ecosystem and Public Health Benefits

As discussed under the expanded bottle bill, the manufacture of aluminum, especially, and PET beverage containers from virgin materials both have significant environmental impacts. The WARM model results (above) have been used to quantify the GHG emission savings (in carbon equivalents). However, additional ecosystem damage and public health costs are also incurred in the production of beverage containers as well as in the production of paper. The State of Washington study²³ on deposit systems presents estimates of these ecosystem and public health benefits associated with increased recycling of beverage containers under an expanded bottle bill.

Because independent calculation of these benefits is outside of the scope of this study, DSM has made the simplifying assumption that these ecosystem and public health cost savings would be similar for the enhanced system as they are for the expanded bottle bill. This is because, while the quantity of beverage containers recycled is less under the enhanced system, there is a significant increase in paper recycling under the enhanced system. While the ecosystem and public health benefits of recycling paper are probably not as great on a per ton basis, the total impact of recycling is probably similar.

Summary of Costs and Benefits Associated With Enhancing the Existing Recycling System

Table 14 (on the next page) summarizes the costs and benefits presented above for the alternative (enhanced) system. A comparison of Table 14 with Table 11 illustrates that total system costs are less for the alternative system than for the expanded bottle bill.

As illustrated by Table 14, the largest single cost will be for implementation of curbside collection for households not currently receiving curbside collection. DSM has estimated the additional cost based on the marginal cost of adding these, primarily, multi-family households to existing curbside collection programs.

²² Because the enhanced recycling system would eliminate the high residue rate at the MRF, the tons of material recovered (and associated avoided disposal costs) would be greater than the difference between current collection quantities and collection quantities under the enhanced system.

²³ J. Morris, B. Smith and R. Hlavaka, *Economic & Environmental Benefits of a Deposit System for Beverage Containers in the State of Washington*.

Table 14. Summary of Costs to Improve Existing Recycling Collection and Processing System

Cost Category	Annual Costs (\$)
RIRRC MRF upgrade	\$1,100,000
Cart purchase and annual replacement	\$3,729,132
Collection truck upgrades	\$770,000
New household collection costs	\$4,860,000
Increased public education costs (\$1/household)	\$412,517
Bars and restaurant recycling	\$1,598,580
MRF Processing Cost (\$45 / ton)	\$1,550,509
<i>Sub-Total, Increased Cost</i>	\$14,020,738
Cost Savings	(\$)
Savings in switch to bi-weekly recyclable collection	-\$1,270,000
Reduced refuse collection cost	-\$800,000
Avoided disposal cost	-\$1,152,000
Material Revenues	-\$2,990,000
<i>Sub-Total, Cost Savings & Revenues</i>	-\$6,212,000
Net Cost	\$7,808,738
Environmental and Public Health Benefits	
Reduced GHG emissions	\$170,000
Reduced litter collection costs	0
Reduced public and farm animal health costs from litter	0
Ecosystem and public health benefits associated with increased recycling	\$1,300,000
<i>Sub-Total, Benefits</i>	\$1,470,000
Net Cost/Benefit	\$6,338,738

System Comparison

Materials Recovery

As illustrated by Table 15, below, DSM estimates that the alternative system (enhanced municipal recycling) would increase material recovery by roughly 15,400 tons when compared to an expanded bottle bill. This is because the alternative system would increase the recovery of fiber (paper) while the expanded bottle bill only increases recovery of beverage containers.

However, DSM estimates that the expanded bottle bill would increase the recovery of beverage containers by roughly 7,850 (rounded) tons when compared to an enhanced municipal recycling program due to the higher recovery rate for beverage containers under a deposit system.

It should be noted that DSM's projections of material recovery for both the expanded bottle bill and the alternative system are at best rough estimates based on at least the following factors:

- The actual return rate for beverage containers under an expanded bottle bill;
- Decisions by Massachusetts and Connecticut with respect to expanded bottle bills – a lack of an expanded bottle bill in either state will potentially lead to higher return rates, due in part to fraudulent redemption in Rhode Island; and,
- The willingness of the State of Rhode Island to fund and implement an enhanced municipal recycling program if there is no bottle bill - without significant funding for an enhanced system it is doubtful that significant increases in recovery will occur under the existing system.

Table 15. Comparison of Beverage Container Recovery

Material	Enhanced System (tons)	Bottle Bill Recycled (tons)	Comparison (tons)
Fibers	77,021	56,000	-21,021
Aluminum Cans	1,994	3,100	1,106
PET Bottles	5,047	5,900	853
Glass	25,904	31,800	5,896
HDPE	3,655	2,690	-965
Tin	4,861	3,579	-1,282
	118,481	103,069	-15,412

Costs

A comparison of Tables 11 and 14 illustrates an expanded bottle bill is estimated to cost roughly \$14.8 million more per year when compared to the existing system. This compares with an increase (net cost) of roughly \$7.8 million per year for an enhanced municipal recycling system (Table 14). The difference between these two systems is estimated to be roughly \$7 million (rounded) more per year for the bottle bill system.

Even when the greater environmental benefits of the expanded bottle bill are included (due primarily to reductions in litter and the environmental impacts of litter) the expanded bottle bill is

still estimated to cost roughly \$4.2 million more per year than the enhanced municipal recycling system. When accounting for the projected loss in sales revenue, the (net) cost of the bottle bill increases to \$23 million per year with a difference in costs between the two systems of \$16.7 million.

Role of Escheats

The return rate for an expanded bottle bill (and the retained escheats) is key to the final net costs. Escheats are the unclaimed deposits (or nickels remaining after beverage container redemption). DSM has estimated, based on recent California data, that the return rate for an expanded bottle bill in Rhode Island would be roughly 75 percent. This would mean that 154 million beverage containers would not be redeemed, resulting in \$7.7 million in unredeemed deposits. Subtracting this \$7.7 million from the total estimated cost of the expanded bottle bill system results in a net cost of \$7 million (rounded) which is roughly \$750,000 less than the enhanced municipal recycling system cost (at \$7.8 million).

However after accounting for lost sales (an estimated 12.5 million) and environmental costs, the difference in costs grows to an estimated \$9 million (rounded) more for the bottle bill system.

It should be noted however that the return rate is speculative. Maine estimates a return rate of 86 percent for their expanded bottle bill, while Massachusetts reports a return rate ranging from 65 to 70 percent for their bottle bill.

Cost to the Consumer

The escheat essentially represents a tax on those consumers who choose not to redeem their containers through the deposit system; the containers may still get redeemed through a third party, or recycled through the curbside system. However, under the third party redemption system proposed for Rhode Island, all consumers also incur a cost associated with redeeming their containers.

Based on surveys of redemption conducted by DSM, the average cost to return containers to a redemption center is approximately 1.6 cents per container. Therefore, even those consumers who choose to redeem their containers really receive an average of 3.4 cents for each container redeemed (after deducting their cost to deliver the beverage containers to a redemption center), while paying 5 cents for the deposit.

Recycling Rates

Table 16 presents DSM's best estimate of the change in municipal recycling rates under the two systems. As illustrated by Table 16 both the enhanced municipal recycling system and the expanded bottle bill result in increases in the overall municipal recycling rate for Rhode Island. However, because paper recycling is increased under the enhanced system, the overall recycling rate is estimated to be three percentage points higher under the enhanced system when compared to the expanded bottle bill.

Table 16. Comparison of Municipal Recycling Rates

	Baseline		Enhanced	Bottle Bill
	Collected	Recycled		
Recycled (tons)	93,000	81,000	118,500	103,100
Disposed (tons)	406,000	426,000	381,000	396,000
Recycling Rate (% by weight)	19%	16%	24%	21%

Analysis of Beverage Container Redemption System Options to Increase Municipal Recycling in Rhode Island (Final Report, May 15, 2000)

Funding

One of the key benefits of an expanded bottle bill is that it comes with a built-in funding source – escheats. Assuming an annual 75 percent return rate for beverage containers, escheats would result in roughly \$7.7 million in annual funding which would off-set approximately one-half of RIRRC’s costs to operate the deposit return system.

This is not the case with the enhanced municipal recycling system unless the Rhode Island legislature were to actively pursue a dedicated funding source.

There are five potential funding sources for the two systems. Three of the funding sources can potentially fund the expanded bottle bill. Each is summarized below.

As discussed above, the deposit is a fee charged to the consumer. Consumers who choose not to redeem their beverage containers for the deposit in essence fund a significant portion of the total cost of the expanded bottle bill system. The remaining funds necessary to cover RIRRC’s costs can be raised in two ways.

First, Rhode Island could add a handling fee to the deposit to cover these costs. Based on an assumed return rate of 75 percent, and DSM’s estimate of RIRRC costs, a handling fee of a little more than one cent per container would be sufficient to cover the remaining costs to RIRRC for operating the redemption system.

Alternatively, the RIRRC could add a surcharge to the landfill tipping fee to pay for the additional costs. This surcharge would, in essence, be paid by the municipalities using the landfill, as well as by commercial haulers. Assuming that roughly 1 million tons of solid waste is disposed of at the RIRRC landfill, a surcharge of \$5 per ton (rounded) would be necessary to cover RIRRC’s additional costs (excluding costs to the consumer) to manage the redemption system.

Three funding sources potentially exist for the enhanced recycling system. The first is the landfill surcharge discussed above. The surcharge would have to be roughly \$7 per ton to cover RIRRC’s costs to implement the enhanced recycling system.

While DSM understands the sensitivity of Rhode Island municipalities to increasing the tipping fee at the landfill, the RIRRC municipal tipping fee is roughly one-half of that in surrounding states. Given the difficulties of siting new landfill capacity anywhere, but especially in a small state like Rhode Island, the true value of future landfill capacity is probably significantly higher than the current tipping fee. Increasing the tipping fee to fund comprehensive increases in recycling would increase the life of the landfill, while also more closely reflecting the value of the landfill over time.

The second potential funding source is a packaging tax levied either on all beverage containers, or expanded to cover all packaging, with the funds dedicated to increasing recycling in the State of Rhode Island. A packaging tax is in essence a shared producer/consumer responsibility fee, much like a deposit becomes on beverage containers.

A tax of 1 cent per beverage container would raise roughly \$6.2 million per year. This tax would be borne by both the consumer and the beverage producer/distributor – depending on how much of the tax can be passed through to the consumer.²⁴

²⁴ It should be noted that Rhode Island already has a packaging/litter tax. These “Beverage Container and Participation Fees” brought in \$1.69 million in FY 2008 according to the Senate Fiscal Office. This is a combination of a \$0.04 “packaging tax” per case and a “litter tax” levied on all establishments selling packaging that might become litter.

A broader tax could be levied on all packaging, or on all packaging and all printed paper. This would be a more equitable fee given that the enhanced recycling system would increase recycling of beverage containers, paper and plastic packaging, and printed paper (newspapers and magazines).

Data are not available on how many pounds of packaging are sold with products in Rhode Island so it is difficult to determine what an appropriate fee might be. However, based on a recent waste composition analysis conducted for the Delaware Solid Waste Authority, beverage containers can be assumed to represent roughly 20 to 30 percent, by weight, of total packaging. Therefore, a levy of roughly \$0.002 - \$0.003 on the weight of packaging would raise roughly the same \$6.2 million as a \$0.01 tax on beverage containers only.

If a packaging tax were to also cover other paper collected in a residential recycling program, similar to what occurs in Ontario; the fee would be reduced to roughly \$0.0015 to \$0.0025 to raise the same \$6.2 million.

Clearly there are many administrative issues associated with a comprehensive packaging tax that are beyond the purview of this report. However, they are not insurmountable given that a number of European countries either have a packaging tax (Netherlands, Denmark), or have had a similar tax (Sweden and Finland), and others are considering implementation of a tax (Belgium, the UK, Ireland). The Province of Ontario also has a comprehensive levy on all "blue box material" to fund one-half of the cost to municipalities to collect curbside recyclables.

A comprehensive packaging tax can be implemented most simply as a revenue raising tax. The more straightforward mechanism would be to implement the tax using the existing sales tax. However, to be effective as a shared producer responsibility levy on packaging, it would be necessary to assess the tax on some actual measurement of the amount of packaging used. This could be a levy on each piece of packaging, or on the weight of packaging sold in Rhode Island.

The complexity increases if the goal is to use the levy to not only raise funds for recycling, but to encourage more environmental responsibility. For example, the Netherlands packaging tax is based on detailed calculations of the Greenhouse Gas Emission impacts of different packaging, and the Ontario levy is based on the cost to recycle each type of material.

The final funding source would be to implement a Pay-As-You-Throw (PAYT) system state-wide and require that the cost of improvements to the municipal recycling system be included in the PAYT charge. The charge per household would vary depending on how many bags each household set out but, on average, a typical Rhode Island household would have to pay \$17.50 per year in PAYT fees to fund the increased cost of the enhanced recycling system. (This is significantly less than what most PAYT systems raise on a per household basis.)

PAYT has been demonstrated to increase recycling rates, and could be an appropriate funding mechanism if the RIRRC were to invest heavily in increased infrastructure for collecting and processing recyclables. However, PAYT funding falls fully on the consumer/generator, with no shared responsibility on the packaging producer.

Conclusions

The goal of DSM's research was to *"identify which approach has the greatest potential to achieve the highest diversion of recyclables from the waste stream, reduce statewide litter, provide the greatest levels of service, and be the most equitable, efficient, cost-effective and economically sustainable"*.

DSM's analysis of an expanded bottle bill when compared to enhanced municipal curbside recycling indicate that neither system analyzed meets all of the above criteria. However, the general conclusion is that costs for the expanded bottle bill are significantly greater than for an enhanced municipal recycling collection system. The enhanced municipal recycling system also has the potential to divert more material than an expanded bottle bill.

The expanded bottle bill achieves the highest level of diversion of beverage containers, diverting roughly 75 percent of beverage containers when compared to an enhanced curbside collection program which DSM estimates would divert 59 percent of beverage containers. However the enhanced curbside system results in higher recovery rates for paper, and therefore diverts more total material than the expanded bottle bill, and results in a higher recycling rate.

The expanded bottle bill would have a greater impact on reducing statewide litter. DSM estimates that an expanded bottle bill would reduce total litter (measured in pieces of litter) by roughly 9 percent, saving an estimated \$267,000 in litter clean up costs each year in Rhode Island. DSM does not believe that an enhanced municipal recycling program would have any appreciable impact on litter reduction.

System costs for the expanded bottle bill are estimated to be significantly higher than for expansion of residential curbside collection. DSM estimates that implementation and management of the expanded bottle bill would cost the RIRRC \$12.5 million annually (including amortization of construction of redemption centers and purchase of trucks and containers). Consumers who choose to redeem their deposit containers are estimated to spend an additional \$6.1 million to drive to the redemption centers. Bars and restaurants are estimated to spend an additional \$1.6 million redeeming their deposit containers.

Total system costs of \$20.2 million for the expanded bottle bill are offset by cost savings and materials sales revenues of \$5.4 million leaving net system costs (exclusive of potential environmental benefits) of \$14.8 million. This compares with estimated net annual system costs for an enhanced curbside collection program of \$7.8 million.

The enhanced municipal recycling system also has the potential to result in higher state-wide diversion of recyclables. DSM estimates that the enhanced municipal recycling program would divert an additional 37,000 tons of recyclables over and above the current diversion through the RIRRC MRF of 82,000 tons. This can be compared to an expanded bottle bill which DSM estimates would divert an additional 21,000 tons over the baseline.

Finally, DSM was asked to evaluate which system was most equitable, efficient, and economically sustainable. Because these are broad terms it is difficult to clearly choose between the two systems. However the following general conclusions can be drawn.

- The expanded bottle bill results in a more equitable sharing of responsibility between the beverage container distributor/retailer, and the consumer, in that the deposit typically results in shared producer and consumer responsibility.

- However, the enhanced municipal recycling program is arguably a more efficient system in that consumers are not required to drive to separate redemption centers to redeem/recycle their beverage containers, but can simply recycle them using the same system set up to recycle non-beverage container material.
- Finally, neither system is economically sustainable under current tipping fees and materials values. Escheats from expanded bottle bill are estimated to generate approximately \$7.7 million in annual revenues (assuming a 75% beverage container redemption rate). Netting out the escheats still results in estimated additional annual system-wide expenditures of \$7.1 million for an expanded bottle bill compared to \$7.8 million for an enhanced curbside collection program.

In conclusion, an economically sustainable system is difficult to achieve without an additional dedicated funding source (other than the escheats). If a dedicated funding source could be identified, through either a packaging tax or a surcharge on the tipping fee, improvements to the RIRRC MRF and to municipal recycling programs could be funded to subsidize some of the cost of recycling. This should result in higher recovery rates which would benefit Rhode Island in the future, by extending the life of the landfill and by reducing the State's contribution to greenhouse gas emissions through increased recycling.