Rhode Island Comprehensive Solid Waste Management Plan – Draft

December 27, 2013

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I. Introduction, Vision

A. What is this plan?

This plan updates the Solid Waste Management Plan of 2007 and will ensure that the State of Rhode Island has a comprehensive and coordinated plan to provide cost effective and environmentally compliant waste management and recycling services for residents, businesses, industry, and municipalities. It is intended to guide activities of the Rhode Island Resource Recovery Corporation (RIRRC) and the Department of Environmental Management (DEM). As an element of the State Guide Plan, it sets forth goals, objectives, and policies that must be reflected in future updates of municipal comprehensive plans. It also serves to meet the need for a solid waste management plan as required by the Federal Resource Conservation and Recovery Act of 1976. This plan describes existing practices, programs, and activities in all major solid waste management areas and develops recommendations specific to each area. It also describes potential avenues for solid waste management in Rhode Island post-closure of the Central Landfill.

B. Why has it been developed?

This Plan has several purposes. It:

- Serves as the long-range policy and program guidance document for the RI Resource Recovery Corporation and other State agencies.
- Functions as the Statewide Resource Recovery System Development Plan containing 20-year projections of waste generation, recycling, and disposal compared with capacity.
- Guides the activities of Department of Environmental Management and serves as the state solid waste management plan as required by the Federal Resource Conservation and Recovery Act.
- Serves as the solid waste management element of the State Guide Plan that in turn guides municipal Comprehensive Community Plans.

C. What issues does it seek to address?

D. Vision Statement

In 2035, responsibility for sound solid waste management is shared-we all understand that each of us has a role to play. We have made strides in reducing the amount of waste each of us generates as individuals, we have implemented statewide Pay as You Throw, and every community uses automated collections systems for curb side collections with 95-gallon carts for recyclables. Our landfill is nearing closure and our recycling facility is at the end of its useful life. The next stage of sustainable waste management is upon us, and difficult decisions must be made.

> ***To be truly sustainable, Rhode Island must invest in full-scale residential composting facilities. We must make organics management a top statewide priority. We must continue to invest in manufacturing processes that use recyclables as feedstock and provide long-term high-quality jobs. We must implement the best state of the art technologies and public policy practices to maximize the remaining years of the central landfill, increase the remaining usefulness of the Materials Recycling Facility, and begin the transition to the solid waste management practices that will take Rhode Island into the 22nd century.***

This plan will describe the path to the 22nd century, using the following goals:

> **Goal 1:** Reduce the amount of Rhode Island generated solid waste requiring disposal through increased source reduction, reuse, recycling, and composting.
>
> **Goal 2:** Manage the solid waste that ultimately must be disposed in an efficient, equitable, safe and environmentally protective manner, consistent with the statutory solid waste hierarchy.
>
> **Goal 3:** Adopt stable, long-term funding mechanisms that provide sufficient revenue for state, regional, and local programs while providing incentives for increased waste reduction and diversion.
>
> ?Goal 4: Productive communication of plan priorities and processes to municipal officials and planners for incorporation into local guidance documents.?

II. Overview of Solid Waste in Rhode Island

A. What is Solid Waste, What is Recycling

Report Terminology

Solid Waste – the entirety of non-hazardous waste materials disposed and recycled by all sources.

Refuse – will refer to those materials disposed and recycled from both residential and commercial sources but excluding C&D, sludge, industrial, and agricultural wastes. What is classified by the USEPA as "municipal solid waste".

Municipal – will refer to that solid waste which municipalities take responsibility for collection and disposal.

Commercial – will refer to that solid waste generated by businesses and institutions including industrial and agricultural wastes managed by commercial haulers.

Recycle – will refer to traditional the use of discarded materials to make new products, and specifically not include waste to energy.

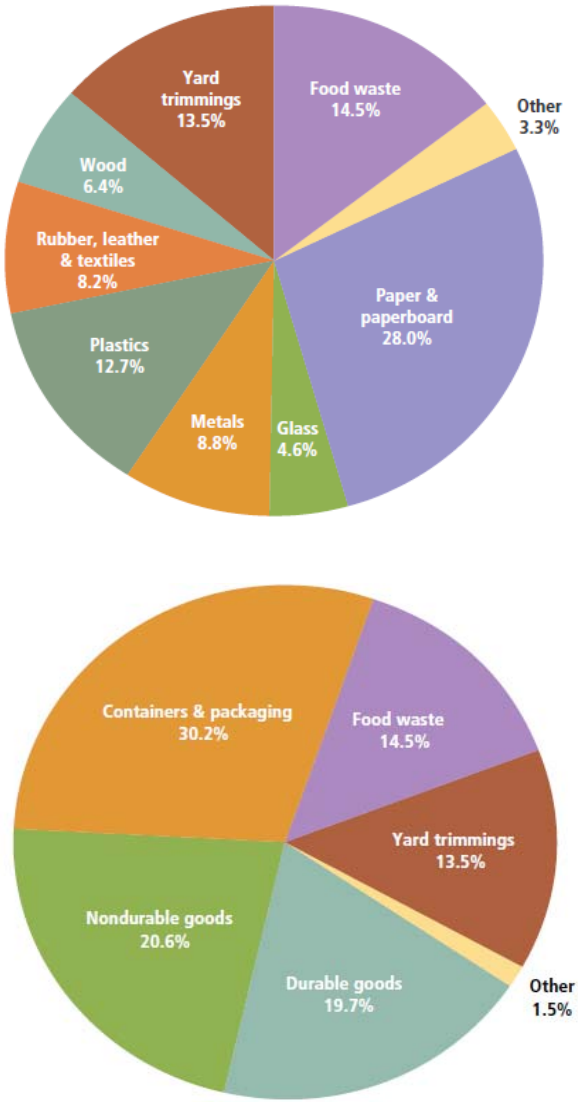
Solid waste, more specifically *municipal solid waste* (MSW), and *recycling* are terms used generically but often have subtly different meanings among professions and across jurisdictions. In Rhode Island, Solid Waste is defined by statute (RIGL § 23-18.9-7) as garbage, refuse, tree waste and other discarded solid materials generated by residential, institutional, commercial, industrial, and agricultural sources, and specifically excludes sewage sludge, used asphalt, and concrete. MSW as defined in Rhode Island statute(RIGL § 23-19-5)is more specific to "solid waste generated by the residents of a municipality in the course of their daily living, the disposal of which the governing body of that municipality has undertaken in the discharge of its duties to protect the health of the municipality…", and specifically excludes solid waste generated by any manufacturing or commercial enterprise. RIDEM regulations differentiate between MSW, *commercial solid waste* (CSW) and *non-municipal residential waste* in order to accommodate recycling regulations across different generators and managers of solid waste.

Alternatively, the U.S. Environmental Protection Agency (USEPA), many other states, and the solid waste industry nationally, apply the combined categories of material classified in Rhode Island as *MSW*, *CSW* and *non-municipal residential solid waste* under the umbrella of "*municipal solid waste"*, while specifically excluding solid waste from industrial, agricultural, and construction and demolition sources. However, in practice, solid waste disposal facilities, and in particular Resource Conservation and Recovery Act (RCRA) Subtitle D Landfills, often called "municipal solid waste landfills", actually handle

solid wastes from all sources. Disposal facilities typically do not categorize wastes by the source, complicating the reporting, tracking and planning for solid waste management.

Similarly, the term *recycling* which is defined in Rhode Island statute as "…the reuse of recovered resources in manufacturing, agriculture, power production, or other processes." However, in most other jurisdictions the production of power from waste is specifically excluded from *recycling*. Furthermore, it is common for people to use *recycling* to refer to the *reuse* of items in their original form (e.g., thrift ship donations). However, most industry professionals regard *reuse* of items as a form of waste prevention, which occurs prior to the actual generation of waste.

Figure 1A. Refuse Material Composition (before recycling)



Source: USEPA – Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2011

These different meanings cause confusion when it comes to comparing waste generation and diversion across jurisdictions that apply different meanings to these terms. For the purpose of this plan we will apply the term refuse when referring to those materials classified by USEPA as municipal solid waste; along with *industrial, agricultural, construction and demolition "C&D"*; and the term *solid waste* by itself will be used on its own will imply the entire gamut of non-hazardous materials disposed and recycled. The terms *municipal* and *commercial* will be utilized when differentiating waste and recycling for which municipal governments have taken responsibility or not. For the purposes of this plan we will use the definition of recycling provided by the USEPA: "the series of activities by which discarded materials are collected, sorted, processed, and converted into raw materials and used in the production of new products; excluding the use of these materials as a fuel substitute or for energy production." Definitions aside, for planning and management purposes it is important to understand the nature of materials that make up solid waste, the sources of these materials, and how they are managed in practice. The materials in solid waste include organics such as paper, yard trimmings and food waste; and inorganics such as plastics, metal, rubber, leather,

textiles, wood and glass. Sources of refuse include packaging materials, food waste and yard waste, durable and non-durable goods.

The USEPA provides estimates of refuse composition nationally for the year 2011 (See Figure 1A. Refuse Material Composition (before recycling)Figure 1Figure 1A. Refuse Material Composition (before recycling) **Error! Reference source not found.**). C&D waste is generated through the construction, renovation and demolition of structures and is made up primarily of wood, drywall, metals, plastics, roofing, rubble, brick, glass and miscellaneous materials. The composition of industrial and agricultural wastes varies by industry and source. However, such waste streams are typically more homogenous and depending on the source offer unique opportunities for recycling.

We are all responsible for managing wastes at the source, whether at home, in public areas, at work or in school. While the provision of special collection programs for reuse, composting, and recycling are often dictated by both public and private waste managers, all of us play a role in determining whether solid waste is generated in the first place, and whether to participate in waste reduction (e.g., home composting), reuse, and recycling programs that are available at home, in public spaces, and in the workplace.

In the United States municipal governments generally provide for the collection and transportation, and arrange for the processing of recyclables or disposal of solid waste from single family homes and small apartment houses, as well as schools and other municipal facilities. Municipal governments provide these services either directly with municipal crews and equipment, or indirectly through contracts with commercial solid waste haulers. Therefore, local municipal governments have the primary role in determining how municipal sector wastes are segregated for recycling, collected and transported to ultimate processing and disposal. Municipal sector solid wastes make up almost half the total refuse.

Most large municipalities provide their residents with curbside collection of refuse and segregated recycling while others, typically smaller, rural municipal governments, provide residents with drop off collection of solid waste and segregated recycling. In these communities the majority of residents hire subscription collection services from private haulers, whom may or may not offer recycling collection service. In other jurisdictions local governments award exclusive franchise agreements for residential subscription service in an area, in return for leveraged pricing and guaranteed collection of segregated recycling. Some communities provide both curbside collection of materials and drop off collection of segregated recycling, and special materials.

Refuse collection at the curb from residences traditionally has been accomplished using rear loader packer trucks, while curbside recycling has utilized specialized two compartment side loading trucks with minimal compaction. More recently, curbside collection of both refuse and recycling is more often being performed with automated collection vehicles and large volume wheeled toters issued to all households. Such automated systems provide collection efficiency gains that improve the viability of curbside recycling programs.

It is the private haulers that provide for the collection and transportation of solid waste and segregated recyclables from the commercial sector. The type and size of business impacts how commercial sector

waste can be segregated, collected and transported. The decisions to segregate commercial sector waste for recycling are primarily made by business facility managers, construction managers and private waste haulers. There are three basic types of hauling services provided to commercial waste generators. The most common type of commercial service is dumpsters collected by front-end loader trucks serving multiple customers on a single route, including multi-unit residences, schools, and other public buildings. Larger commercial customers, institutions, and industrial sources are often served utilizing enclosed roll-off compaction containers that are designed to be picked up, transported, and emptied one container at a time. These detachable and self-contained compactor boxes are typically integrated into the customer's facility structure and are used for collecting refuse or segregated recyclable (e.g., corrugated cardboard). The other major type of waste collection service is the open-top roll-off most often utilized to serve the construction industry, but also in residential cleanups and at some businesses.

The ultimate disposition of solid waste depends on the materials, the source, the opportunities available to capture materials for recycling, and the availability of processing and disposal facilities. Solid waste generated from all generators is either separated at the source for recycling, or discarded as mixed waste. Recycling segregation at the source can occur to varying degrees. In Rhode Island residential programs paper and packaging materials are combined together and collected in one container. This is commonly called 'single stream'. Also in many communities yard debris is separated and collected for composting. Many businesses separate items such as corrugated cardboard, paper, or mixed containers for recycling. In each of these cases segregated materials are delivered to a processing facility which sorts and often bales the materials for shipment to a processor who will then refine the material into raw materials, which can then in turn be manufactured into new goods.

In general, mixed refuse collected from residents and businesses is typically sent to a disposal facility directly, or via solid waste transfer stations that aggregate materials from collection vehicles into large tractor trailer trucks for long distant transport. Disposal facilities are either waste to energy "WTE" facilities where the mixed waste is used to generate power (see Appendix ??), or solid waste landfills where materials are buried for ultimate disposal. In many cases, materials may be extracted from the mixed refuse at transfer stations and Waste To Energy (WTE) facilities. Another important consideration in the management of solid waste is that recyclables processing and sorting generates waste residues, and traditional WTE processes yield about 20% ash residue, all of which ultimately require land disposal.

B. Where Does Rhode Island Solid Waste Go? Where Could It Go?

1. Current waste generation and recycling estimates

Detailed waste generation and recycling estimates for Rhode Island, along with the methods and assumptions, are contained in Appendix #: *Rhode Island Solid Waste Generation, Recycling and Disposal Estimates.* These estimates are primarily based on the sources of waste disposed at RIRRC combined with data on the material composition by source of refuse from USEPA publications (US Environmental Protection Agency, 2013). These estimates are extrapolations and include some assumptions regarding commercial sector materials exported to other states. These estimates help to provide some insight to the relative composition and recycling rates for materials and overall quantities generated by sector. However more precise estimates will be needed for future facility planning, and identifying those providing estimates on the detailed composition of materials remaining in the RI waste stream. This will require a thorough sampling and analysis of the RI solid waste stream. Such a study is planned by RIRRC in the near future.

The amount of solid waste generated in RI peaked in the years 2005 through 2007, and dropped significantly after the economic recession in 2008. Annual waste generation, recycling and disposal have been relatively consistent in the five years since then. It is estimated that Rhode Island's current annual solid waste generation, including recycling, to be approximately 1.5M tons per year with the majority being refuse, almost half of which is from municipal and a bit more than half from commercial sources. The other largest class of RI solid waste is C&D which represents more than 200K tons of materials. While some C&D is managed through municipal transfer stations the large majority is generated, collected and managed by the commercial sector. In addition, there are significant quantities of soils, sludge, and ash that are disposed at the Central Landfill, much of which is utilized beneficially Landfill construction and as alternate cover when permissible.

In RI the majority of solid waste is, processed or disposed by RIRRC. However, significant waste materials are being recycled, composted, or transferred to nearby out of state WTE facilities operated by private firms. The Table 1, Rhode Island Solid Waste Materials Managed, below, provides estimates of RI solid waste by sector responsible for collection, type of management, and also broken out according to whether it be managed at RIRRC or not.

Table 1.Rhode Island Solid Waste Materials Managed (tons)

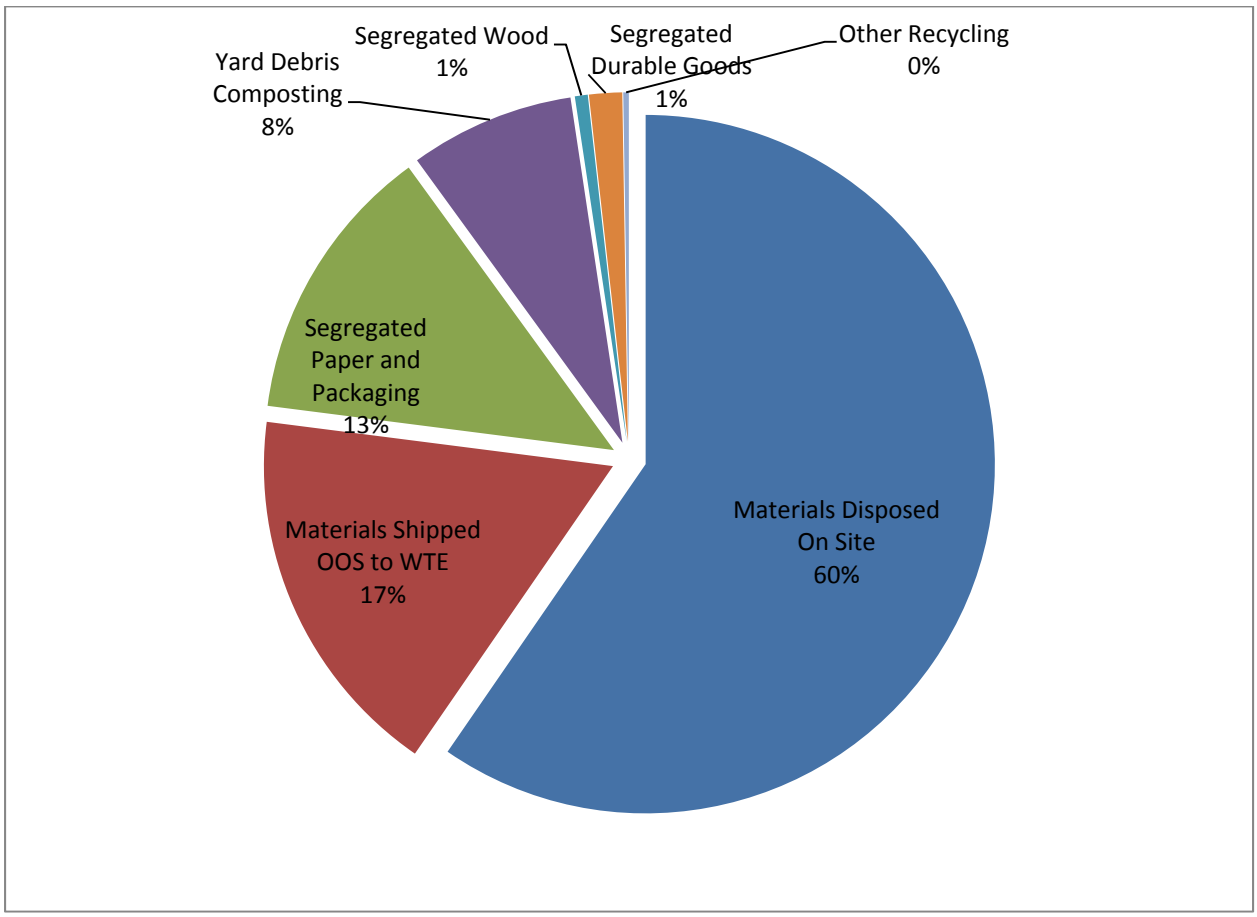
Category	RIRRC Materials (2010 - 12 Average)	Other Facilities (estimated)	Total Materials Managed
Total Solid Waste Generated	**1,113,000**	**393,500**	**1,506,500**
Refuse	**838,000**	**340,500**	**1,178,500**
Commercial	**359,000**	**299,000**	**658,000**
Mixed Refuse	336,000	200,000	536,000
Segregated Paper and Packaging	7,000	75,000	82,000
Yard Debris Composting	9,000	20,000	29,000
Wood	6,000	1,000	7,000
Segregated Durable Goods	1,000	3,000	4,000
Other Recycling	0	0	0
Municpal	**479,000**	**41,500**	**520,500**
Mixed Refuse	354,000	3,500	357,500
Segregated Paper and Packaging	93,000	0	93,000
Yard Debris Composting	30,000	31,000	61,000
Wood	0	0	0
Segregated Durable Goods	2,000	4,000	6,000
Other Recycling	0	3,000	3,000
C&D	**162,000**	**53,000**	**215,000**
Commercial	**152,000**	**50,000**	202,000
Unprocessed C&D	60,000	50,000	110,000
Processed C&D and Residuals	92,000	0	92,000
Municpal	**10,000**	**3,000**	**13,000**
Unprocessed C&D	9,000	3,000	12,000
Processed C&D and Residuals	1,000	0	1,000
Sludge, Soils and Ash	**110,000**	**0**	**110,000**
Commercial	**107,000**		107,000
WTE Ash	25,000		25,000
Soil	61,000	0	61,000
Sludge Ash	15,000	0	15,000
Sludge	6,000		6,000
Municpal	**3,000**		3,000
Sludge	3,000		3,000
Soil	0		0
Industrial	**3000**	**0**	**3000**

The ultimate destination of RI waste materials depends on who is managing it, how it is segregated at the source and collected, and how much material is actually recovered in the processing of recyclables and from sorting refuse at transfer stations; and finally, whether it be disposed locally in a RI landfill or shipped to out of state (OOS) disposal facilities. Figure 2. *Current Disposition of RI Wastes*provides a breakdown of the current disposition of solid waste.

The majority of refuse in RI is disposed, with about 700K tons being buried in at the RIRRC Central Landfill and another 200K exported to nearby states for disposal, primarily in refuse incinerators. It is

estimated that RI is currently recycling approximately 25% of its refuse, although without additional information from the private sector, this estimate can only be characterized as a best guess. This recycling is primarily municipal paper and packaging processed at the RIRRC Materials Recycling Facility (MRF), commercial recycling occurring through transfer facilities and private recycling brokers, and yard waste composting at RIRRC and other private facilities. Other materials, primarily durable goods, are being collected and recycled through other programs run by RIRRC, municipalities, and the private sector. These materials include old appliances, electronic waste, mattresses, and textiles.

Figure 2. Current Disposition of RI Wastes



In order to estimate the types of materials that are being captured from the refuse stream and how much material might potentially be diverted in the future, the USEPA's characterization of refuse by source (see Figure 1B.) can be aggregated into the RI refuse management categories identified in Figure 2 above (with the addition of *food waste*). Applying the estimated refuse generation of 1.2M tons to the USEPA characterization's share of refuse by source, we can estimate current capture rates for the RI refuse stream and how much of each material remains disposed. By making some assumptions as to how much material might be potentially diverted in each management category, estimates of what the future waste generation, recycling, and ultimate landfill disposal might look like are developed. Table 2, Estimates of Current and Potential Recovery for Refuse by Source, below shows how the estimated disposition of RI waste compared to the USEPA estimate of the share by source.

Table 2: Estimates of Current and Potential Recovery for Refuse by Source

Row Labels	EPA Sum of % of Generation	Estimated Generation (K tons)	Assumed Recoverable	Assumed Recoverable (K tons)	Estimated Current Recovery	Estimated Recoverable Amount in Waste	Estimated Waste Remaining Under Full Potential Recovery
Papers, Containers and Packaging	39.6%	467	65.0%	303	153	150	163
Durable Goods	19.6%	231	25.0%	58	18	40	174
Food Waste	13.9%	164	50.0%	82	-	82	82
Yard Debris	13.4%	158	90.0%	142	90	52	16
Other	9.5%	112	25.0%	28	3	25	84
Wood	4.0%	47	75.0%	35	7	28	12
Grand Total	**100.0%**	**1,179**	**55%**	**648**	**271**	**377**	**530**

2. What are the options for managing wastes

The most environmentally preferred and most cost effective option for managing solid wastes is through prevention of wastes to begin with. Efforts to reduce the waste stream such as home composting, donating old clothes, and office paper reduction programs, can significantly reduce the amount of specific waste streams. However, broadly speaking, when solid wastes are generated, they are either disposed directly as mixed waste in a landfill or WTE facility; segregated into material specific fuels for the production of energy (e.g., wood/biomass, tire derived fuels, and anaerobic digestion of organics); or recycled into new products.

Papers and packaging materials are what most often come to mind when residents consider recycling, and includes those materials targeted in RI's municipal recycling programs such as cardboard, office papers, printed materials, packaging papers and containers of all types associated with both residential and commercials sources. While paper and packaging materials have been the main focus of recycling efforts in RI to date, we are still only recovering a third of the estimated potential. Commercial sector recycling of paper materials has had some successes in larger enterprises, but for most small business and facilities cost effective collection and recycling services is not practical under current markets and incentive structures. Furthermore, some municipalities still lag in capturing an acceptable level of the targeted materials. Program performance aside, the fact is many of these materials are not even targeted in the existing program due to the lack of markets and the practicability of sorting additional materials.

Organics offers the other greatest opportunity for the diversion of waste from disposal as mixed waste. Organics waste comes from two primary sources, yard waste and food waste. Yard waste composting occurs at the highest levels of any source materials managed in RI with over half the estimated generation being composted. While yard waste collection programs come at a cost, this material is widely collected and managed by many municipalities, commercial landscapers, and private processors

due to the feasibility to compost yard waste locally at a fraction of the cost of disposal. On the other hand, current collection and processing of segregated food wastes is practically non-existent in RI. Current food waste diversion from disposal is occurring in the form of home composting, a few instances of local neighborhood composting, minimal composting of commercial food waste, and the use of food waste as livestock feed. Current RIDEM regulations governing the composting of food wastes make it impractical to invest in on a municipal level.

Yard waste and food waste are mentioned together here because of the potential to collect and process these organic wastes together. There are two basic categories of technologies for processing segregated organics. Most typical is aerobic decomposition, or composting, either in outside windrows or in contained facilities. While this method is commonly used with yard waste, most vegetative food wastes can be accommodated with aerobic decomposition when blended with yard debris too. When performed properly, aerobic decomposition produces nutrient rich stable soil amendment. The other option for processing organics is anaerobic digestion, which involves heating the organic waste in the absence of oxygen to produce a syngas which can be burned for the production of energy. In addition, an organic material that is potentially suitable for some land applications results from the anaerobic digestion.

Durable goods, making up approximately 20% of refuse by source, offer another big opportunity for recycling. Traditional recycling of durable goods occurs namely in the recycling of large metal appliances as scrap, and the culling of tires for reuse as a tire derived boiler fuel in nearby Sterling, CT. More recent efforts to recycle durable goods have targeted electronic wastes and mattresses through extended producer responsibility (EPR) programs. Nonetheless, current capture rates for durable goods waste remain low and offer the potential for significant gains in diversion from this source of wastes.

Wood is separated into its own category in the list of sources of solid waste. A significant amount of wood waste is segregated from both the refuse and C&D waste streams although wood separated at transfer stations recycling and that managed by RIRRC is assumed to be from the refuse waste stream. The segregated wood reported here are primarily pallets, clean construction debris, stumps, and large green waste. Segregated clean wood and wood chips managed by RIRRC is ground and utilized on site to stabilize landfill roads and related site work. While the use of clean wood as a mulch or erosion control aid is the primary opportunity for reuse. The likely opportunity for diversion of wood wastes from landfilling is to thermal biomass conversion, as a boiler fuel. A number of such facilities exist in the region with a new facility under construction in nearby Plainfield, CT will process 960 tons of wood biomass from construction debris and used pallets each day and generate 37.5MW of net power.

The last source of refuse in the list above is the “Other” category. The items in this category are primarily non-durable goods and other organics. The items currently recycled in this category include textiles, used motor oil and filters, HHW among other items collected and recycled by municipalities. While there are opportunities to capture and recycle items in this category, its limited share of total refuse and diverse nature of items covered will make gains in this category harder to achieve.

While not included in the analysis of the refuse portion of waste, C&D, sludge, soils, and ash wastes need to be part of this discussion of management options. In practice, these other classes of solid waste are often managed in the same facilities as refuse, and often used in a beneficial manner in the operation of solid waste landfills.

Generation of C&D waste in RI peaked prior to the 2008 economic crash. However, given what we know Rhode Island currently generates over 200K tons annually. Over the last decade in Rhode Island the face of C&D processing has changed significantly. Historically, there were a handful of C&D processing operations in RI serving the regional market. These facilities recovered the marketable components of the C&D waste stream (e.g., wood for WTE, and recycling of concrete, metal, and cardboard). What remained was buried in the landfill as waste with the screenings used beneficially as alternate daily cover. Just prior to the turn of the century RIRRC received approval to utilize ground C&D debris as an alternate daily cover material for the landfill and entered the C&D processing market.

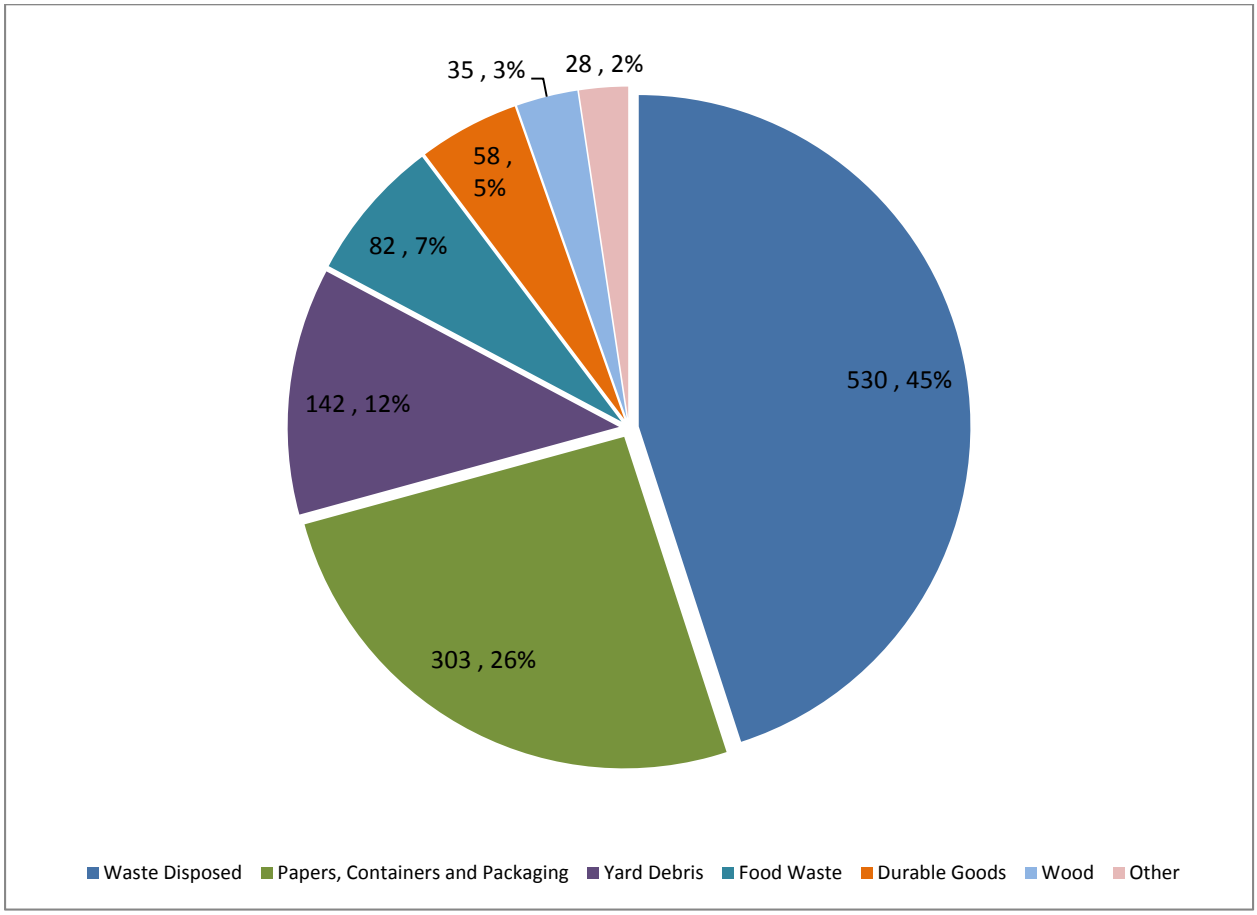
While traditional processors significantly reduced the volume of the C&D stream prior to disposal, RIRRCs process removed only metals, refuse, and other non-grindable components of C&D. Unable to compete with RIRRCs vertically integrated processing with the use of material in the landfill, many of the other C&D processing operations ceased operation. Others have closed due to local opposition (i.e., Pond View facility in East Providence) and the economic realities of the last five years. More recently, in 2012 the use of C&D materials as landfill cover was prohibited by the RI statute in response to odor issues at the Central Landfill, resulting in and RIRRC has ceasing operation of its C&D processing operations. All C&D currently received at RIRRC is buried in the landfill as waste after metals and cardboard are pulled at the RIRRC Tipping Facility. As of September 2013 there is only one other C&D processing facility in operation in RI. The J.R. Vinagro facility, a neighbor to the Central Landfill, is permitted to handle 2K tons per day (tpd) of C&D and 500 tpd of refuse. However, most of the C&D handled at this facility is believed to be from out of state sources. The C&D waste stream offers significant opportunity for diversion from land disposal in RI. Many materials in C&D can be recycled: metal, cardboard, roofing shingles, siding, and clean wallboard from construction. C&D Wood can be diverted to biomass WTE facilities, and concrete and other aggregates are readily ground and reused.

Finally, the landfill disposal of sludge, soils and ash ultimately cannot be avoided. Sludge from waste water treatment is closely regulated in RI by DEM, and only limited amounts are allowed disposed at the Central Landfill. Most of RI sludge is incinerated, with a small amount being composted with yard debris in Bristol. Ash from the local sludge incinerators and the tire incinerator in Sterling, CT is also received at the Central Landfill and used beneficially as an alternate daily cover. Similarly, waste soils are disposed at the Central Landfill, and when permissible used beneficially as cover and as controlled fill in the construction of landfill caps. Sources of these soils are typically construction and remediation projects making year to year volume projections difficult but these materials will continue to be disposed in landfills for the foreseeable future.

3. What is the realistically recoverable portion of solid waste and what will it take?

Given these estimates of waste by source and the optimistic assumptions contained in Table 2 above regarding the recoverable fraction of each source, it is estimated that the RI waste stream could be realistically be reduced to 55%,or more, of total generation (see Figure 3, Potential Disposition of RI Refuse). However, such a reduction will require a great deal of capital investment in processing facilities, coordination among participants managing waste at all levels, and a willingness among residents and businesses to reduce materials consumption and segregate wastes into multiple streams.

Figure 3. Potential Disposition of RI Refuse (K tons)



Capturing 65% of paper and packaging will require a significant increase in collection of these materials in those municipalities that are under performing, and will utilize the entire 150K ton, two shift capacity of the RIRRC MRF. Likewise, commercial sector recycling of paper and packaging will have to expand tremendously, and additional sorting capacity for commercial materials will have to be developed.

Furthermore, markets for many items will have to be fostered. For example, currently much of RI's recovered glass is disposed in the Central Landfill due to the cost of sorting and delivering this material to a processor. Similarly, markets for many of the mixed plastics and film plastics are still developing and such materials often find their way to WTE facilities for disposal rather than true recycling into new products.

While yard waste diversion has been largely successful in RI there still remains significant improvement to reach the 90% recoverability assumption. Municipal collection programs will need to be expanded in underserved municipalities and additional capacity will need to be permitted and developed. Preferably, more yard waste will be composted locally, ideally at home or at local facilities that minimize transportation costs yard debris and in the distribution of finished compost.

Capturing 50% of RI food waste presents the biggest opportunity and perhaps the greatest challenge confronting this plan. While there are gains to be made in the reduction of this waste stream, ultimately achieving large scale diversion of food waste will require the permitting and development of significant processing capacity. Furthermore, collection of food wastes from both residents and businesses will need to be implemented dramatically changing the way solid wastes are commonly managed at the source.

Collection and recycling of durable and non-durable goods will also need to be expanded significantly. Some of these materials can be targeted through continued expansion of extended producer responsibility programs while others such as textiles can be improved through market development and consumer education.

Construction and demolition debris presents another significant opportunity for diversion from disposal. Because so much of this materials has historically been utilized as cover in the Central Landfill local C&D processing markets have lagged finding it difficult to compete. However, with the recent prohibition on utilizing C&D as landfill cover and the opening of the J.R. Vinagro processing facility the commercial sector is poised to step up recovery of C&D materials for recycling and in WTE. In order to facilitate actual recycling C&D market development of outlets for some materials such as clean wallboard and roofing shingles will need to be improved.

A final consideration here is that the diversion of solid waste from land disposal of this magnitude will involve some form of WTE. This maybe refuse incineration, refuse derived fuel, biomass conversion of wood waste, or the anaerobic digestion of organics, and may be operated locally here in RI or in neighboring states.

C. Who Does What

Responsibility for solid waste management in Rhode Island is divided among several agencies, but principally sits with the RIRRC and DEM. Municipalities also play a role, as do several other state agencies. The current arrangement for solid waste management in Rhode Island is the result of major changes over the past 26 years that expanded the role of government and centralized functions at the state level.

Federal, state, and local environmental protection regulations have influenced solid and hazardous waste management decisions from design of laws to selection of technologies. Federal pollution control laws, most notably the Clean Water Act and the Clean Air Act, established regulatory approaches (permit requirements, analytical techniques, etc.) and minimum standards. In Rhode Island, most of these regulations -- wetlands, air pollution control, water quality, coastal management -- are administered at the state level by either the Department of Environmental Management or the Coastal Resources Management Council. Drinking water quality is regulated by the Department of Health. In addition, a groundwater classification program developed by the DEM includes provisions for waste management facilities.

The major government responsibilities for solid waste management in Rhode Island are regulation, enforcement, planning, programs, facility siting and the provision of facilities, financing, technical assistance, and public education. While the division of responsibility for the development of facilities and regulation is relatively clear-cut, institutional arrangements for other functions have become increasingly complex and important as state government expands its waste management activities to include recycling and waste prevention and adopts a multi-agency approach.

1. FEDERAL GOVERNMENT

The major influence of the federal government in state solid waste management is on regulatory programs. In addition to minor funding for recycling and waste prevention projects, the EPA provides information, policy guidance, and program guidance.

EPA regulates solid waste management under the Resource Conservation and Recovery Act (RCRA). EPA, which has delegated its solid waste management regulatory authority to DEM, requires the state to adopt regulations and management plans related to solid, hazardous, and other wastes.

2. STATE AGENCIES

In contrast to most other states, Rhode Island state government agencies not only regulate solid and hazardous waste management, but also provide recycling and disposal facilities for municipal and commercial solid waste. In many other states, regulation is dispersed throughout state, county, and municipal government agencies. However, in Rhode Island, the small size of the state, the dominance of the central metropolitan area, and the minimal level of regional or county government have contributed to centralization of these functions at the state level.

In Rhode Island, most major waste management functions are vested in two agencies: the RIRRC and DEM. RIRRC's major responsibility is developing and operating facilities and programs for solid waste

management, and developing public education and outreach materials for use by the general public, while the DEM is mainly responsible for regulating solid and hazardous waste management. However, both agencies have other responsibilities, including planning, public education, technical assistance, and funding.

RIRRC's role includes:

- ownership and operation of the Central Landfill;
- ownership and operation of the Materials Recycling Facility which serves the recycling needs of all of Rhode Island's municipalities;
- operation of the state's household hazardous waste disposal program; and
- various waste prevention, resource recovery, and recycling programs including the management of specific types of waste including construction & demolition debris, waste tires, leaf & yard debris, white goods, clean wood, waste oil, and wastewater treatment plant sludge.

DEM's role includes:

- regulation of the design and operation of waste management facilities; and
- regulation of waste management programs and selected extended producer responsibility programs.

The Rhode Island General Laws include widely different approaches to allocating responsibilities for waste management. For example, the implementation of statutorily mandated municipal recycling programs at the local level requires a high level of coordination between RIRRC and the municipalities. As another example, solid waste facility siting requires a high level of coordination at the state level among the Governor's Office, RIRRC, DEM, the State Solid Waste Facility Siting Board, and the State Planning Council (SPC).

Rhode Island Resource Recovery Corporation

RIRRC, a quasi-state agency, is charged with developing "an integrated statewide system of solid waste management facilities" [RIGL §23-19-4(b)], including recycling facilities. Facilities can be funded through revenue bonds. RIRRC plans, owns, and operates solid waste management facilities, and plans and implements commercial and municipal recycling and waste prevention programs. As the principal solid waste management organization in the state, RIRRC disposes of more than 99 percent of the state's solid waste and processes more than 95 percent of the recyclables recovered from the municipal waste stream.

The RIRRC is governed by a nine-person Board of Commissioners established by Section 23-19-6 of the Rhode Island General Laws. The Board of Commissioners, as RIRRC's governing body, establishes policy and approves all major contracts, projects, facilities, programs, the agency's annual budget, and its Five-Year Capital Program.

Facilities

The RIRRC operates the major solid waste management system in Rhode Island. This consists of five unique operation onsite: 1) the Central Landfill; 2) the Tipping Facility; 3) the Landfill Leachate Treatment Facility; 4) the pumping station and sewer main which deliver treated landfill leachate to the Cranston waste water system; 5) a composting facility which handles commercial and municipal leaf and yard debris and clean wood; 6) the MRF; and, 7) the Eco-Depot for household hazardous waste. All facilities are located at the RIRRC complex in Johnston.

Waste Prevention

RIRRC also has been delegated responsibility to encourage waste prevention [RIGL §23-19-4 (f)].

System Development Plan (SDP)

The SDP includes waste generation rates by municipality, municipal and commercial tonnage, baseline solid waste data for the state, 20-year solid waste projections for the RIRRC waste management facility and program planning, and a provision for the annual assessment of the effectiveness of the RIRRC facilities and programs. The SDP must be consistent with the DEM regulations and the State Guide Plan.

Comprehensive Solid Waste Management Plan

RIRRC, the DEM, and the SPC cooperate in the preparation of the Plan [RIGL §23-19 (6)] which is a required element of the State Guide Plan.

Solid Waste Facility Siting

Siting state solid waste facilities is provided for by RIGL §23-19, which gives RIRRC broad authority to plan, acquire sites, and develop facilities.

In 1989, legislation [RIGL §23-19-10.2] established a process for the siting of solid waste disposal facilities. The legislation required a statewide search to identify the most environmentally appropriate site(s) for solid waste facilities. One of the law's most important features is the granting of eminent domain to RIRRC under tightly controlled and limited circumstances requiring that any new sites to be acquired must be: 1) certified as consistent with the State Guide Plan by the SPC; 2) approved by a Solid Waste Facilities Siting Board; and 3) approved in writing by the Governor. Solid waste facility sites that do not require the use of eminent domain are not subject to the aforementioned process but do require approval by the SPC.

RIRRC has the power to adopt rules and regulations concerning the operation of its programs and facilities [RIGL §23-19-10(5). In accordance with RIGL §23-19-13.1 to promulgated rules and regulations to ensure that out-of-state waste is not disposed of at the Landfill. The prohibition is also incorporated into the Commercial Solid Waste Contracts for implementation.

As part of its responsibility to manage facilities, RIRRC also establishes policy governing the types of waste accepted at its facilities and conditions under which waste will be accepted. An example is the July 1987 policy restricting disposal of certain sludges and liquids.

Financial Assistance

Financial assistance provided by RIRRC directly to citizens includes:

- receiving and disposing of household hazardous waste at no cost to Rhode Island residents. Since the assumption by RIRRC of this responsibility from the DEM in 2001, the cost of this program through August 2013 was approximately $850,000 annually;
- providing backyard composting bins at a discount of about 50 percent.

Regional Participation

RIRRC has assumed a leadership role in the Northeast Recycling Council (NERC), Solid waste Association of North America (SWANA), the Product Stewardship Institute (PSI), and the Electronics Recycling Coordination Clearinghouse (ERCC).

Rhode Island Department of Environmental Management

In addition to broad authority to "supervise and control the protection, development, planning, and utilization of the natural resources of the state . . ." [RIGL §42-17.1-2], the DEM has specific responsibilities for solid waste management.

The Department's major function in this area is regulatory: permitting and monitoring solid waste facilities and adopting and administering regulations and environmental regulations (particularly, air, water quality, and freshwater wetlands that affect or are affected by waste management). These functions are primarily carried out by DEM'S Office of Waste Management.

DEM's solid waste and recycling programs are summarized below.

Statewide Source Separation and Recycling Program

The Department's role in the statewide source separation and recycling program includes adopting rules and regulations for recycling activities and revising them as necessary, compliance and enforcement of municipal and commercial recycling regulations, and coordinating litter control activities. Again, many of these activities have been largely curtailed due to budgetary cutbacks.

System Development Plan

DEM reviews the SDP as part of the process for licensing RIRRC disposal facilities and ensures that the SDP is consistent with the DEM regulations.

Comprehensive Solid Waste Management Plan

DEM cooperates with the RIRRC and the SPC in the preparation of the Plan, which is a required element of the State Guide Plan.

Solid Waste Facility Licensing

DEM establishes minimum standards for permissible types of refuse disposal facilities, and the design and construction, operation, and maintenance of disposal facilities [RIGL §42-17.1-2(p)]. The Department is also authorized to issue and enforce rules, regulations, and orders as necessary to carry out its duties.

Regulatory Authority

DEM's Office of Waste Management is responsible for adopting and administering rules and regulations governing the management of solid waste and the design and operation of solid waste facilities (see appendix) including the following:

DEM has developed a registration program for Intermediate Processing Facilities to allow the processing of recyclables without having to obtain a Solid Waste Facility license. This will also provide the department with valuable recycling data.

DEM has also promulgated and is responsible for enforcing the Rules and Regulations Governing the Generation, Transportation, Treatment, Management, and Disposal of Regulated Medical Waste in Rhode Island, as amended in July 1994.

Furthermore, with respect to solid waste recycling, the following regulations and statute fall under DEM's jurisdiction:

- Rules and Regulations for the Reduction and Recycling of Municipal Solid Waste, March, 1997, which define recyclables; set standards for municipal ordinances governing the separation of municipal waste into recyclable and non-recyclable components; specify compliance standards for recycling programs; and, establish procedures for financial aid to cities and towns.
- Rules and Regulations for Reduction and Recycling of Commercial and Non-Municipal Residential Solid Waste, October 13, 1996, which define commercial recyclables; set schedules for submitting waste prevention and recycling plans; and, establish enforcement procedures for the regulations.
- R.I.G.L. §23-18.16-1 et. seq. Newspaper Recyclability, establishes minimum recycled content requirements for newsprint and for the publications to report their use of recycled content.

The Department also has the authority to adopt rules and regulations as may be necessary to require the collection and recycling of telephone directories, determine the recyclability of beverage containers, implement and carry out the provisions of the Toxics in Packaging Act, and to establish specifications for the purchase of recycled products by the State.

The Department's Office of Water Resources oversees the Rules and Regulations for the Treatment, Disposal, Utilization, and Transportation of Sewage Sludge. These regulations apply to sewage sludge generated by publicly- or privately-owned facilities and cover incineration, treatment (including composting), land disposal, and land application. The current version of the regulations was adopted in May 1997.

Facility Reporting

DEM collects annual facility reports from all permitted solid waste facilities on the source and disposition of all materials handled.

National and Regional Coordination

On the national level, the Department is actively involved in the national Association of State and Territorial Solid Waste Management Officials (ASTSWMO). Regionally, the DEM plays a coordinating role with other regional state solid waste regulatory agencies through its participation in the Northeast Waste Management Official's Association (NEWMOA), which produces a biannual report on regional waste generation and state imports and exports. The DEM also participates in the regional Interstate Mercury Education and Reduction Clearinghouse (IMERC), the Product Stewardship Institute (PSI), the Toxics in Packaging Clearinghouse.

The Departments of Administration and Health

Certain other agencies have limited, specific responsibilities for solid waste management. These include the Department of Administration (Division of Planning, Budget Office, and Office of Purchasing), and the Department of Health.

Department of Administration

Division of Planning

The Division of Planning provides planning services to the Governor and other state agencies; coordinates development decisions within the framework of state plans; maintains a planning information base; and provides services related to local planning and municipal affairs. The State Planning Council (SPC), which is comprised of State, municipal, and federal government representatives and members of the public, provides policy direction to the Division of Planning. The SPC is responsible for promulgation of the State Guide Plan, which includes this Comprehensive Solid Waste Management Plan (Element 171) and other plans related to the physical, social, and economic development of the state.

Furthermore, the SPC is statutorily responsible for certifying that new solid waste facility sites proposed by RIRRC comply with site evaluation and assessment standards and procedures issued by the Council. The Division of Planning also reviews such proposals for compliance with the State Guide Plan. RIRRC's SDP establishes the need for solid waste management facilities under RIGL §23-19-4(b). The SPC reviews and approves this need determination since the SDP is included in Element 171 of the State Guide Plan. According to state law, the SPC has the additional powers to determine the geographic distribution of solid waste facility sites in the state and to designate areas where solid waste management facilities are prohibited.

Office of State Purchasing

The Office of State Purchasing is charged with promoting the purchase of recycled products as well as adopting regulations for purchasing recycled products. This office also is responsible for soliciting bids for and awarding contracts to establish Master Price Agreements (MPA) for use by state agencies and departments for refuse and recycling hauling services, medical waste disposal services at State Hospitals, recycling of universal waste produced by state agencies and departments, as well as removal

of hard to handle items such as white goods. Municipalities have access to MPAs, but choose to solicit their own bids for contracted hauling services or haul refuse and recycling themselves.

Solid Waste Facilities Siting Board

The Solid Waste Facilities Siting Board was created in 1989 as a part of the Department of Administration. The members are appointed by the Governor and include the Governor's legal counsel, the Director of the Department of Administration, a business or industry representative, a member of the RI League of Cities and Towns, and an environmental advocate. The Siting Board is charged with advising the Governor on the need of RIRRC to acquire additional future solid waste management facility sites.

Department of Health

The Department of Health regulates management of infectious wastes from hospitals and laboratories.

3. LOCAL GOVERNMENT

Cities and towns, once the major providers and regulators of local solid waste disposal, continue to have an important but far more limited role in providing solid waste disposal service and in regulating private solid waste service providers. However, in some respects, particularly separation and collection of recyclables and directing the flow of locally generated solid waste, their responsibilities have expanded.

Providing for Recycling and Disposal

With the establishment of the Rhode Island Solid Waste Management Corporation (later the Rhode Island Resource Recovery Corporation) in 1974 and its statutory mandate to provide low cost disposal of municipal refuse, the historical responsibility for solid waste disposal began to transfer from the municipalities to the State. This transfer accelerated as most municipal landfills closed during the 1970's and 1980's. Initially, cities and towns negotiated a tipping fee that has always been lower than the fees paid by the private sector for the disposal of commercial waste. Beginning in 1992, the municipal tipping fee was set by statute at $32.00 per ton while the average commercial tipping fee has averaged between $50 to $60 per ton.

The 1986 amendment to the solid waste statutes further limited municipal responsibility for disposal by excluding those wastes not acceptable at an RIRRC facility, as well as hazardous wastes. Collection responsibilities of municipalities were broadened, however, to cover separate collection of recyclables.

State law requires municipalities to adopt ordinances to mandate source separation and recycling programs and allows municipalities to design and implement programs to fit local circumstances. Local conditions vary greatly between rural, suburban, and urban communities. The success of municipal recycling programs depend not only on the commitment of the local government but also on factors such as the percentage of people living in poverty, the percentage of the population who are transient, and the number of people living in multi-family residences which are not covered by municipal recycling.

Municipalities are required to ensure that all recyclables recovered from their solid waste are delivered to a RIRRC facility. As an incentive to encourage recycling, the General Assembly, in 1986, passed a bill that the discounted municipal tipping fee shall apply only to that tonnage of solid waste disposed by each municipality which is less than or equal to a solid waste tonnage Cap established by RIRRC. All MSW in excess of a municipality's Cap is disposed of at the CSW tipping fee, which is substantially higher than the municipal tipping fee. The incentive for municipalities to increase their diversion rate is heightened by a decrease in the Municipal Cap because the lower the Municipal Cap, the more MSW tonnage the municipality must dispose of at the higher commercial rate.

Furthermore, the statute requires that cities and towns must dispose of their solid waste at the Central Landfill or an RIRRC-designated disposal facility. Tiverton is the only municipality specifically exempted by the law from this requirement because the town has an active landfill (which was still in operation at the time that this Plan was adopted). To meet this responsibility, most municipalities provide collection directly or by contract. In some communities, individual residents hire private haulers to collect their solid waste which may or may not be sent to RIRRC.

Regulation

In 1975, the State assumed responsibility for licensing solid waste management facilities. In 1986, municipalities were authorized by state law to license local collectors, haulers, and operators of transfer stations [RIGL §23-18.9-1 (b) (1)]. Under the 1968 Refuse Disposal Act cities and towns were required to regulate collection, hauling, and disposal.

The 1986 legislation established requirements for the adoption of local regulations for:

- the fair allocation of the Municipal Tipping Fee among privately contracted collectors of municipal refuse [RIGL §23-18.9-1(b)(3)]; and
- the separation of solid waste into recyclable and non-recyclable components [RIGL §23-18.9-1(b)(4)].

Financing

Since 1986, municipal solid waste tipping fees have been established by state law and since FY 1992, have been annually set statutorily by a state budget provision at $32.00 per ton, significantly lower than commercial solid waste tipping fees.

Financial assistance, both direct and indirect, by RIRRC for municipal solid waste management activities has been extensive. Municipalities tip recycled materials free of charge at RIRRC facilities, and RIRRC financed the first three years of each municipality's recycling program. These initial recycling program start-up costs included purchase of some municipal recycling trucks and the funding of municipal recycling coordinators. RIRRC also provided each municipality with new blue and green recycling bins for the Maximum Recycling Program free of charge. In 2001, RIRRC began providing household hazardous waste disposal services free to municipalities and in 2004, the Corporation began receiving and composting leaf and yard waste from municipalities free of charge. In addition, RIRRC has provided annual grants (totaling more than two million dollars over the years) to municipalities. RIRRC has

provided a wide range of recycling/waste prevention-related research and innovative technology/program grants to municipalities that have totaled more than one million dollars.

Municipal solid waste costs are generally financed by local general revenues, largely the property tax. Charlestown, Hopkinton, New Shoreham, North Kingstown, Richmond, South Kingstown, Narragansett, West Greenwich, Tiverton, Central Falls, North Smithfield, West Warwick and Westerly however, have implemented various types of partial and/or hybrid user fee programs to pay for the cost of solid waste collection and disposal.

4. THE TOWN OF JOHNSTON

In April 1996, RIRRC and the Town of Johnston ratified a Host Community Agreement. Under the agreement, RIRRC annually pays the Town a base payment of $1.5 million; 3.5 percent of RIRRC's previous fiscal year's gross revenues; allows a set amount of additional free tipping for Johnston residents; and methane royalty payments. In the first full year of the agreement, FY 1997, these payments totaled more than $3.2 million and have exceeded $3.2 million annually thereafter due to escalators built into the payments.

The Host Community Agreement contains various "good neighbor" provisions whereby the Corporation agrees to provide in-kind services such as road sweeping and litter pickup in the vicinity of the Central Landfill. Perhaps the most important good neighbor issue is to control odors.

5. PRIVATE SECTOR ROLE

As governments have assumed more responsibility over waste management, the role of the private sector has also changed, with most municipal refuse now either collected or transported to the Central Landfill by private haulers under contract to municipalities. Private haulers have, for the most part, taken over the collection of trash from municipal public works crews as municipalities have increasingly out-sourced this job. In 2012, only six municipalities, Barrington, Central Falls, Coventry, Lincoln, Warwick, and West Warwick collected trash curbside using their own staff and equipment. All other municipalities either contracted out the collection of trash or left it to homeowners to individually hire private haulers for the purpose. Private arrangements continue to predominate in collection, hauling and recycling commercial/industrial solid waste.

Similarly, in the field of recycling, most municipal recyclables are handled by private haulers operating either under contract to municipalities or on their own business initiative. Therefore, the success of most municipal recycling programs depends not only on the quality of municipal management, but also on the effectiveness and efficiency of the haulers' operations and the relationship between the haulers and the municipalities who hire them.

While municipalities have maintained an operational and/or management role in the field of municipal recycling, there is no operational involvement by state or local government in commercial recycling, which is conducted entirely by private sector. Hauling firms recover large volumes of recyclable

materials, particularly wood and corrugated cardboard. Other haulers specialize in processing construction and demolition debris and recovering recyclables from the C&D stream. Companies such as International Forest Products, United Paper Stock, and Berger have been in the business of buying and re-selling all types scrap papers for decades.

The hauling industry in Rhode Island has undergone very significant transformations over the past 20 years. As recently as the mid-80s, it consisted entirely of small, local, independent privately-owned firms, several of which owned and operated landfills. By 2004, after a period of consolidation during the 1990s, the hauling industry in Rhode Island was dominated by two large publicly-owned national firms, Republic Services and Waste Management, Inc. In addition, three other RI haulers (Patriot, MTG/Mega, and Waste Haulers) have grown dramatically over the last several years in RI and the region. Together, these five firms control approximately ## percent of the commercial solid waste business in the state. There were also roughly 50 small, local privately-owned firms active in Rhode Island in 2005. No private sector firm has owned a landfill in Rhode Island in the past 20 years.

Other

Other private entities play important roles too. Non-profits (e.g., Salvation Army and Goodwill Industries) play an important role in facilitating the reuse of clothing and durable goods that otherwise would be discarded. Other non-profits specialize in redistributing surplus supplies to the arts and education (Resources for Rhode Island Education), while others are finding their niches as a result of Extended Producer Responsibility (EPR) laws passed since 2007.

D. Current In-state Operations

1. RIRRC

Central Landfill

The landfill's elevation varies depending on where you are standing. The landfill's high points range in size, but you can think of it as being about 250 feet from its base. The very top is about 570 ft. above sea level. The landfill is not the highest point in RI. The highest point in RI is Jerimoth Hill (812ft. above sea level) in Foster. As far as man-made structures go, there are 6 buildings taller than the landfill in Providence alone. At the top of the landfill on a clear day you can see: Providence, the Fall River landfill, the Jamestown Bridge, and the Newport Bridge. The disposal footprint of the landfill is approximately 250 acres. RIRRC total property is about 1,040 acres.

There are currently five "phases" or sections of the landfill. Phases I-III are full and closed forever. Phase IV has been partially capped (closed), while the remaining section is active with Phase V. Phase V is the main active section being used for refuse disposal. Phase VI has been permitted and construction has begun. The entire Phase VI expansion is broken up into areas which make construction easier. Eventually this expansion will require the removal of our Tipping Facility (called "the Tip") and of the Waukeshapower plant, and the relocation of the compost area, the administrative building, and the clean wood grinding area.

There are limitations to how much we can expand and in which direction (currently only eastward) and we expect to cease landfill operations in about 22 years, (possibly in 2035), considering all disposal and recycling rates remain the same. As consumer consumption habits often change, the actual date of the final closure is quite fluid. This plan will also examine possible alternatives for refuse disposal when the landfill is officially closed.

As a sanitary landfill, refuse is compressed to take up as little space as possible, and is kept separate from the surrounding natural environment. Refuse is lined, buried, and covered in such a way that it has little to no contact with air, light, water, animals, or people.

There are primary and secondary liner systems (made of plastic, clay and sand) that separate the refuse from the surrounding environment. These are designed to keep leachate from passing through as well. Primary and secondary leachate flow is monitored daily. Leachate is created when rain water comes in contact with waste and moves through the landfill into the liner systems. The leachate is conveyed through a series of collection pipes from the landfill to our leachate discharge line. Currently, this line takes the leachate to a central collection point prior to discharge to the City to Cranston's sewer system for further treatment. The leachate will be pre-treated in a facility slated for completion in 2014. After pre-treatment (primarily for nitrogen) the treated water will be discharged to the Narragansett Bay Commission for further treatment before final discharge to Narragansett Bay.

The active face is where refuse trucks arrive on any given day. Bulldozers and compacters are constantly trying to get as much refuse in the smallest amount of space possible. Refuse is not just dumped anywhere. Landfill engineers use a scientific process to dictate exactly where refuse is placed each day

for the landfill to operate properly. There is constant road-building going on to get trucks to the ever-moving active face.

Each day the compressed refuse is covered with 6-8" of material. This is done to seal in the refuse, helping to reduce odors and keep animals from digging in. There are no open refuse pits. RIRRC uses primarily using gravel and Posi-shell, a spray-applied coating similar to stucco, to cover the refuse each day. Contaminated soil (below industrial direct exposure limits) is also allowed, when it is available.

Completely filled sections of the landfill are sealed with another complex system of layers in an effort to make it water-tight. Grass is planted on top to prevent erosion, and is mowed it to keep the growth of trees and bushes from occurring (roots could potentially damage the capping system).

To further protect the capping system a series of drainage benches around the landfill, along with drainage chutes down the sides to guide rainwater away from the cap and eventually into the drainage "swales" around the perimeter.

Nine ponds surround the landfill (7 collect storm water from our property and 2 from Shun Pike). The seven ponds from on RIRRC property collect the storm water that has run-off the surrounding landfill's site surface and the capped areas of the landfill (NOT the water that has percolated down and become leachate), These ponds allow sediments to settle out before the water goes back into Cedar Swamp Brook (then to Upper Simmons Reservoir). The water gets progressively clearer. Hay bales silt fences are used as temporary erosion control measures.

When Phase I was built, wastes that are now defined as hazardous were not regulated and were buried in the landfill like regular waste. In addition to this burial practice, Phase I was also not lined the way new phases are now. Because of this, Phase I has more potential negative environmental impacts and requires more attention. Phase I is a designated "Superfund Site" by the U.S. EPA and they oversee the on-going clean-up of leachate from this area, though RIRRC funds the process. Currently, the amount of toxins has leveled, and has begun to decrease.

Materials Recycling Facility

In April 2012 the Corporation completed a $17 million retrofit to the Materials Recycling Facility (MRF). This retrofit switched the processing system from a dual-stream system to a single-stream system (SSR). Under the new SSR system, recyclables no longer needed to be segregated into two separate streams-paper and cardboard, and bottles and cans. SSR allows accepted recyclables to be mixed together in the collection bin or cart and in the collection vehicle, making recycling easier for the consumer and collection easier for the hauler or municipality. The new sorting system also allowed the Corporation to expand the types of materials accepted for processing, specifically PET and PP containers and jugs.

In order for recycling to be more readily understandable to the recycling public, the education around the new system centered on defining the new accepted materials by function and shape, rather than continue to confuse the public with information about the "number in the triangle". By describing newly

accepted materials as "all plastic containers holding fewer than two gallons" the transition time for developing new recycling habits was greatly reduced, resulting in an immediate increase in the volume recycled. After passing over the scale in their truck, recyclables begin their journey through the MRF once they are unloaded onto the floor. All recyclables can be mixed together at the source, and any that aren't mixed will be mixed anyway, as they enter the MRF. Loads are inspected by our workers for contamination and potential hazards. If a load carries too much improper material, it is rejected, sent to the landfill, and the source is notified. The material to be sorted is loaded onto the conveyor belt and proceeds into the MRF.

Sorting recyclables happens manually, mechanically, and optically. Manual workers are necessary for sorting out what doesn't belong or picking out a particular material for separation. Manually sorting is most important at the very start of the sorting process, as items that are too large and/or too dangerous to go through the system are removed. Mechanically equipment such asmagnets, screens, crushers and conveyors are used to separate out materials from one another. Optically, scanners are used that recognize items based on the reflectivity of light off their surface are used to sort plastics. This recognition is paired with blasts of compressed air to sort items from each other.

Individual types of materials finally make their way into their respective storage containers. They are then baled for shipment to our buyers. This means they are tightly compressed into the large cubes.. Plastic bales weigh in the 1,000 - 1,200 lb. range, fiber materials are in the 2,200-2,400 lb. range and tin bales are in the 2,400 - 2,600 lb. range.

As exhibited in the table below, these bales are transported to facilities all over North America and the world. A critical factor in any product's recyclability is the existence of a buyer for the material. RIRRC is charged, to a degree, with market development of recyclable materials. However, Rhode Island is a very small player in the global recycling market. There are not sufficient numbers of manufacturers, exporters, or users of recycled content raw materials located in Rhode Island or the southern New England market for RIRRC to adequately perform this function. Success can be potentially had in developing niche markets for specialty materials, or by seeking specialty manufacturers for hard to market materials, such as glass. RIRRC is currently the heaviest exporter of goods in Rhode Island, shipping an average of 50 containers a week (either by road or by ship), and upwards of 80 containers a week during peak seasons.

RECYCLABLE	COMPANIES BUYING IT	DESTINATION
Aluminum	Anheuser-Busch, Evermore	Alabama, New York
#1 Plastic Bottles	NURRC, Plastrec, Wellman, America Chung Nam, 3Stone	South Carolina, Canada, Mississippi, China
#2 Clear Bottles/Jugs	Graham, KW Plastics, Conti	Pennsylvania, Alabama, Canada
#2 Color Bottles/Jugs	Envision, Entropex, RecycRPM	North Carolina, Canada
#5 Polypropiline	KW Plastics	Alabama
#3-7 Plastics	Apex Trading	China
Mixed Rigid Plastics	APC Recycling	China
Tin	Mid City Scrap, Triple M, Tube City, Full Circle	Massachusetts, Canada, Pennsylvania
Newsprint	Potential Industries, International Forest Products, Ogo Fibers	China
Corrugated Cardboard	Rock Tenn, America Chung Nam	New York, China
Mixed Paper	Potential Industries, America Chung Nam, Pratt Industries	China, New York
Cartons	Fibrek	Canada

There is significant potential for development of a green manufacturing sector in Rhode Island that could use municipal recyclables as raw materials.

What can be recycled? Vs. What is recycled here? These are two very different questions. Theoretically, almost everything can be transformed into something else. So can any given product be recycled somewhere in the world now or somehow in the future? Probably. However there are some other questions we must ask before we determine if something is recycled here. The answers to questions like this determine why we do or do not recycle certain items in RI at any given time:

- Is there anyone willing to buy this material (i.e. is someone out there transforming this material into something else)? Note that we are always looking for new potential markets!
- If so, can we collect the volume that they require on the schedule they need?
- Does our current plant support the type of separation and baling that would produce the quality of the material they need?
- After the costs of collecting, hauling, sorting and bailing are we getting enough money back to at least break even?

Compost Operation

RIRRC is required by law (RIGL 23-19-3xx) to accept municipal leaf and yard debris (L&Y) at no charge up to a capped amount. When municipalities exceed their cap, they are charged the commercial rate of $25.00 per ton. However, the municipalities are also allowed to "share and borrow" cap. Every municipality is assigned L&Y cap, however not all use their entire cap and some don't use any. Municipalities that exceed their cap are allowed to borrow 50% of their original amount from another municipality that is willing to share. This essentially increases the cap of certain communities to 150%. Communities willing to share cap may share 100% of their allotted amount.

RIRRC processes about 40,000 tons of leaf and yard debris each year. However the Corporation is not licensed to take food scraps for composting. The yard debris is processed in a grinder then piled into long windrows. Materials are aerated using a windrow turner that straddles the piles and mixes the materials. This machine turns the pile from the inside out, creating a RI Class "A" compost, that is also certified for use in organic farming. The certification process is overseen by the RI DEM of Environmental Management. The finished material is sold to Casella Organics wholesalers, and to RI residents ($30/yard, ½ yard minimum for residents).

Landfill Gas Collection

Decomposing refuse in landfills continuously produces gases like methane and carbon dioxide. Gas produced at the Central Landfill Gas is collected through a system of pipes and wells, and is transformed into electricity in a power plant. Collection wells protrude from the ground around the landfill, with the fewest wells being in Phase I and the most in Phase IV. More are located in the newer phases because the peak of off-gassing happens early on in the decomposition process. Each year the power plant produces enough electricity to power 21,000 homes. Collecting these gases not only reduces the need

to burn fossil fuels for energy, but it also keeps these greenhouse gases from entering the atmosphere and contributing to global climate change.

The original Waukesha plant is in the path of landfill expansion and is slated for decommissioning. The new facility being constructed by Broadrock Renewable Energy (the company who owns the existing gas collection system and power plant) will be able to collect a greater amount of gas (enough power for 28,000 homes) and will also generate power from the steam used in the production process. The new facility will include a clean-up system to remove impurities like sulfur and siloxanes from the gas, and a waste-heat recovery system (referred to as "co-generation") that will make it much more efficient, creating nearly 50% more electricity than a standard plant.

Flares (which look like large candlesticks) are a safety mechanism. They ensure that the gas has somewhere to go if the power plant can't keep up with the rate it is being produced or if the power plant is down for emergencies. Flares burn excess gases in a safe manner to protect the environment and are also regulated by RI DEM and the USEPA. The original power plant can handle approximately 60% of gas produced, leaving about 40% to be flared off. The new power plant described above will be able to handle closer to 100%. Meters measure the flow of gases and leachate to facilitate testing and making adjustments to the systems.

Tipping Facility

In 2002 RIRRC constructed an on-site transfer station, known as the Tipping Facility, for haulers to tip loads of refuse on a concrete floor instead of driving directly to the working face of the landfill. The refuse would then be pushed through a large hole in the floor at the back of the facility, and down into a truck waiting below. The truck would then take the refuse to the working face. Eventually the Tipping Facility became a cost-negative operation, costing more to run than the Corporation was receiving in revenue for the use. It was decided in 2012 to turn the Tipping Facility into a commercial recycling operation, where selected loads would be directed for further sorting. This change in operation led to a decrease in capital expenses associated with the facility, provided a dedicated area to sort and stack mattresses for recycling, and allowed RIRRC to provide quick turnaround time for selected loads with high recyclable value, such as heavy cardboard or metal loads. Small residential vehicles with trailers and small haulers carrying commercial waste are the main users of the facility as of 2013, delivered mainly in small trailers and smaller roll-off type containers.

Loads are tipped onto the floor. Corporation employees (2 operators, 6-9 laborers) inspect refuse and look to separate out bulk scrap metal, wall board, bulky cardboard, clean wood, and rigid plastic. One bay holds sheetrock to be shipped to Gypsum America for recycling. Mattresses are sent to Conigiliaro Industries in Framingham, MA where they are disassembled and recycled. Remaining refuse is loaded into larger trucks and brought to the landfill.

Eco-Depot

Eco-Depot is the name of the free service for disposing of Rhode Island generated residential household hazardous waste (HHW) in an environmentally safe way. RIRRC assumed responsibility for the Eco-Depot program from the RIDEM in 2001 as part of a Supplemental Environmental Project (Program SEP).

Fulfillment of the SEP requirements occurred in 2005, and since that time RIRRC has continued the program, increasing the number of collections each year. Collections are held on select Saturdays throughout the year. To date, RIRRC has provided 409 collections and safely recycled or disposed of approximately 9 million pounds of HHW, including 12,000 pounds of mercury. In FY2013, there were 41 collections servicing 12,200 residents: 17 at the RIRRC facility in Johnston, and 24 collections spread across Rhode Island. Most communities are serviced on a three-year rotating basis; however certain communities are serviced each year (Middletown and Narragansett). RIRRC works in conjunction with the hosting municipality to determine the best location for the collection. RIRRC provides the local advertising of the event and manages the appointments. These off-site collections are viewed as a critical component to the popular program by bringing HHW collection services directly to residents in the community in which they live, making proper disposal convenient and reducing the danger of transporting potentially harmful material across the state.

The cost of the Eco-Depot program is dependent upon the materials collected. In FY2013, the program cost the Corporation $800,000. The program is paid for through the Corporation's operating budget with no additional fees assessed to residents.

Examples of accepted materials are car & rechargeable batteries, gasoline, oil-based paints & paint thinners/strippers/varnishes/stains, fluorescent bulbs, pool chemicals, fertilizers and pesticides, propane tanks, bug spray, anti-freeze, drain clog dissolvers, motor oil/filters, nail polishes, arts & crafts chemicals, charcoal lighter fluids, flea dips/sprays/collars, mercury thermostats, metal polishes, disinfectants, concrete cleaner, oven cleaner, rug/upholstery cleaner, moth balls, shoe polish, windshield wiper fluid.

Residents are asked to make an appointment for service in order to efficiently manage traffic flow for the event. There is a calendar of Eco-Depot events on the Corporation's website where residents can make the appointment themselves through an online reservation form, or they can locate the phone number for the Eco-Depot assistant and call to make the appointment. Each person making an appointment is addressed individually so as to verify the material being disposed, verify Rhode Island residency, and answer any questions they may have.

Disposal and recycling services are handled by a contracted vendor (in FY13, that vendor was Clean Harbors, Inc. of Braintree, MA). Flammables and other combustibles are sent to waste-to-energy facilities and are used to make electricity. Paint is remanufactured for industrial and commercial uses. Mercury is reclaimed for different purposes. Anything that can't be recycled or repurposed is safely disposed of in one of two special HHW landfills out-of-state (Chattanooga, TN, and El Dorado, AR). No HHW is landfilled at the Central Landfill.

Small Vehicle Area / Drop-Off Area

The Small Vehicle Area (SVA) is designed for residential and small business/contractor use. The purpose is to have a drop-off area available for those with larger loads of residential refuse where the customers can avoid the larger commercial vehicles hat travel to the working face or to the Tipping Facility.

Materials accepted at the SVA are:clean wood, cardboard, scrap metal, appliances, computers, TVs, tires, rigid plastic, motor oil, antifreeze, batteries, sheetrock, cooking oil, books, and clothing.Some materials dropped at the SVA are accepted free of charge, others carry a fee. Tires carry a fee for disposal. Approximately 25% of the tires are culled from the pile for reuse or re-capping. The remainder is sent to ReEnergy Holdings LLC, a tires-to-energy plant in Sterling, CT. White goods are accepted for a fee, with the fee collected as a pass-through payment in order to pay for the proper removal of chlorofluorocarbons (CFCs, trade name "freon"). Clean wood, mattresses, car batteries, and commercial E-waste all carry a disposal fee. All other recyclables are accepted free of charge. Refuse and L&Y accepted at the SVA are charged commercial rates.

Other RIRRC managed programs

ReStore Plastic Bag recycling

In 2005, The Rhode Island General Assembly passed RIGL 23-18.11 the Promotion of Paper Bag Usage Act, which created the retailer based plastic bag recycling program. The law requires all retail establishments conveying food or goods to the general public which occupy 10,000 square feet or more of retail or wholesale space or generate more than $8 million in sales to provide a collection container in their store for their customers to deposit unwanted plastic bags. As the markets have evolved, additional items were added to the ReStore program: newspaper sleeves, produce bags, bubble wrap, pellet bags, dry cleaner film, bread bags, bagel bags, shrink wrap, and product overwrap. Plastic bags are still not acceptable in curbside bins or SSR residential drop-off containers. There is currently no way to ensure the condition of the bags will meet customer specifications as they are mixed with the remaining recyclables in a collection vehicle. Segregated specialized collection provides the plastic film customer with the best possible product.

E-Waste

In 2008, the General Assembly passed RIGL 23-24.10, the Electronic Waste Prevention, Reuse, and Recycling Act. This law is a version of Extended Producer Responsibility (EPR), whereby the producers and manufacturers of televisions, computers, laptops, and monitors are required to pay for the collection and recycling of their products. RIRRC manages the "state program" with a small number of manufacturers opting to run an "independent program". E-waste collection or drop-off services are available in each county, with most municipalities having local drop-off options available to residents. The DEM is responsible for registering manufacturers, approving all plans, and notifying manufacturers of their financial responsibility. The DEM is also responsible for notifying retailers and the public of which e-waste brands are not eligible for sale in the state of Rhode Island.

Paint recycling

In 2012, the General Assembly passed RIGL 23-24.12, the Proper Management of Unused Paint Act. This law is a manufacturer financed recycling program whereby paint manufacturers are required to pay for the collection and recycling of certain architectural paint products sold in Rhode Island. RIRRC will not have program management responsibilities with this program, but will function as a participant drop-off location for consumers. The program will use the existing Eco-Depot infrastructure, and will also use

retail drop-off locations throughout the state to accomplish the collection targets. The DEM is responsible for overseeing the manufacturer group's plan and must revise regulations governing small-quantity generators of covered products.

Mattress recycling

In 2013, The General Assembly passed RIGL 23-90.1, the Responsible Recycling, Reuse, and Disposal of Mattresses Act. This law is a manufacturer financed recycling program whereby mattress manufacturers are required to pay for the collection and recycling of all mattresses sold in Rhode Island. The law will be managed by RIRRC, which was given regulatory authority in the statute to promulgate rules and regulations needed to enforce the law, and will also be responsible for oversight of the manufacturer program plans. This law will become effective in 2015.

2. Private Sector

Haulers

Private commercial waste haulers collect and transport virtually all of the commercial and most municipal refuse in the Rhode Island.

The commercial waste hauling industry is segmented into three types of entities. The major players which include the very large national companies (e.g., Republic Services and Waste Management), as well a couple larger local firms (i.e., Patriot Disposal and Waste Haulers); all of whom have some degree of vertical integration into transfer, processing or disposal markets. These major players provide all types of collection services but dominate the dumpster front-end loader market. These major players account for about **##%** of the commercial sector waste managed in RI. There are also another few smaller haulers who provide both dumpster and enclosed compactor container services to commercial customers, and may also provide subscription services to residential customers in some locations. These haulers are typically localized and account for **##%** of the RI commercial sector waste. The most prevalent serviced provided by commercial solid waste haulers are the open top roll-off service.. There are **## to ##** private commercial haulers that participate in a competitive roll-off container market largely driven by the construction industry. These smaller operators handle about **##%** of RI commercial sector solid waste. Finally, the handling of special wastes such as sludge, medical wastes, organics, and hazardous wastes are handled by companies that specialize in the management of such wastes.

(1) Front End
(2) Compactor
(3) Open Top
(4) Curbside
(5) Specialty
    (a) Medical
    (b) Organics
    (c) Hazardous

Transfer Stations

Almost **###K** tons of solid waste move through RI transfer stations, about 200K tons to out of state locations and the rest to RIRRC. Ownership of these facilities is a mixture of public and private, and some municipally owned transfer stations are operated by private sector contractors. The majority of RI transfer stations are relatively small, operated or owned by municipal governments, and intended to serve residential customers drop off collection of small quantities of refuse, recycling and special materials. These smaller facilities are predominantly located in rural communities that often do not provide for curbside collection of household refuse, or in municipalities that provide the drop-off facility as another service to residents.

The majority ofRI refuse transfer capacity is concentrated at a few larger facilities, primarily operated by private waste haulers. These larger transfer stations receive materials from both municipal and commercial collection vehicles to facilitate the transportation of wastes over longer distances.

Table 3. Permitted Rhode Island Solid Waste

Transfer Stations

Transfer Stations	Type	C&D (Tons Per Day)	Refuse (Tons Per Day)	Privately Controlled
Waste Haulers LLC Transfer Station (N. Smithfield)	Transfer		650	650
Blackstone Valley Regional Transfer Station (Woonsocket)	Transfer	50	600	600
Bristol Transfer Station	Residential		75	
Burrillville Transfer Station	Residential		60	
Charlestown Transfer Station	Residential		15	
Coventry Transfer Station	Transfer		100	
East Greenwich Transfer Station	Residential		8	
Exeter Transfer Station	Residential		40	
Glocester Transfer Station	Residential		35	
J.R. Vinagro Corp. C&D and Transfer Facility (Johnston)	Transfer & C&D	2000	500	500
Jamestown Transfer Station	Residential		36	
Little Compton Transfer Station	Residential		13	
New Shoreham Transfer Station	Residential		31	
Newport Transfer Station	Transfer	200	300	300
North Kingstown Transfer Station and Composting Facility	Residential		25	
Portsmouth Transfer Station	Residential		70	
Providence Transfer Station	Residential		150	
Prudence Island Transfer Station	Residential		4	
Richmond Transfer Station	Residential		50	
Service Transport Group Transfer Station (Woonsocket)	Transfer		30	
South Kingstown (Rose Hill) Transfer Station	Both		390	390

Transfer Stations	Type	C&D (Tons Per Day)	Refuse (Tons Per Day)	Privately Controlled
Warren-Barrington Regional Transfer Station	Transfer		75	
Waste Management Transfer Station (Pontiac Ave.)	Transfer		750	750
Waste Management Transfer Station (Warwick)	Transfer		1440	1,440
West Greenwich Transfer Station	Residential		7	
Westerly Transfer Station	Both		200	
	Total	**2,250**	**5,654**	**4,630**
	Tons Per Year (260 days)	**585,000**	**1,470,040**	**1,203,800**

C&D

As of September 1, 2013, aside from RIRRC's operation there is only one C&D processing facility permitted in RI, the J.R. Vinagro (aka, Patriot Hauling) facility in Johnston. This recently permitted facility accepts materials from the region including neighboring states, and segregates those materials that can be diverted from the waste stream such as cardboard, metal, wood, and concrete and other aggregates.

Other Private Sector Activities

In addition to the private sector waste haulers other private businesses play important roles in reuse of waste materials, recycling and the management of special wastes. Scrap yards and paper brokers have been an important part of the recycling industry long before the public sector began taking more responsibility of coordinated municipal recycling. Likewise, the reuse industry is dominated by both for profit and not for profit entities. Consignments stores, swap shops and refurbishing businesses all foster important reuse activities that help keep goods from being prematurely discarded. In addition there are numerous non-profit organizations (Goodwill/Salvation Army/Big Brothers, etc.) that facilitate the reuse through donation of clothing and other goods.

There are also numerous examples of private sector involvement in the management of organic wastes too. These include privately run composting facilities, including agricultural based operations.

Commercial

Food Banks

3. Municipal Sector

Tiverton landfill

Aside from the Central Landfill the Tiverton municipal landfill is the only other solid waste disposal facility in RI. However, this landfill serves exclusively Tiverton municipal refuse of about 3.5K tons of refuse per year. It is expected that the Tiverton landfill will be at capacity within five years.

Other Municipal Facilities

Compost operations

Table 3. Permitted Composting Facility Capacities

Composting Facilities	Operator Type	Permitted yd3/year	Estimated Tons/Year
Barrington Compost Facility	Municipal	25,000	6,250
Bristol Compost Facility	Municipal		
Burrillville Compost Facility	Municipal	3,500	875
Charlestown Landfill and Compost Facility	Municipal	4,000	1,000
Donnigean Park LLC Compost Facility	Private		-
East Providence Composting Facility	Municipal	30,000	7,500
Jamestown T.S. and Composting Fac. (see above)	Municipal	150	38
North Kingstown T.S. and Compost Facility (see above)	Municipal	2,000	500
Pascale Landscaping	Private	500	125
Pawtucket Compost Facility	Municipal	5,000	1,250
RIRRC (Central Landfill) Compost Facility (see above)	RIRRC	17,000	4,250
Richmond Sand & Gravel Compost Facility	Private	37,500	9,375
Site-Ready Materials and Recycling Compost Facility	Private		-
Smithfield Peat Compost Facility	Private	100,000	25,000
Swan Point Cemetery Compost Facility	Private		
Warren Compost Facility	Municipal	3,700	925
Warwick Compost Facility and MRF	Municipal	25,000	6,250
Total Permitted Yard Waste Composting Capacity		253,350	63,338

Recycling Centers

Municipally operated recycling centers are few, however those that exist are highly utilized. The cities of Warwick and Woonsocket provide the greatest level of service to their respective residents regarding how much material residents are allowed to drop off at one location in their community.

Food banks and food pantries perform a vital local service to underserved populations in Rhode Island. They are often recipients of excess locally grown food, which may otherwise be discarded. Additionally, food banks and food pantries receive donations from restaurants, public events, colleges and universities, and private businesses across the state, saving that material from disposal.

E. Current Programs (Initiatives?Rules?)

1. Recycling

Municipal

State

Industrial

2. Composting

3. Waste Prevention

4. Reuse

5. Public Recycling & Composting

6. Event Recycling & Composting

Municipal

Green Events

Ordinance requiring recycling at events as a permit requirement; Cities of Newport, Providence (?)

Private

7. Educational Efforts

RIDE

RIRRC

NGO

8. Outreach Activities

F. Markets for Disposal and Recycling - Yesterday, Today and the future

RI participates in regional markets for solid waste disposal. Recycled commodities recovered in RI are shipped not only regionally but also to national and global outlets. In fact, even the markets for compost, traditionally local in scope, are being shipped throughout the New England region. This section will review first the markets for recycled commodities and then for waste disposal in RI.

1. Recycling Markets

While scrap brokers and on farm composting have been around for ages, large scale municipally coordinated residential recycling and composting is relatively new in North America with the first programs beginning in the late 1980s here in RI. Since that time more and more communities in North America have implemented recycling and composting programs, and the markets for recovered commodities has grown.

Paper and Packaging Markets

While commodities markets have been evolving, like any new industry, prices for recycled commodities have been marked by short term periods of instability over the last two decades. In fact, at times the ability to move RIRRC MRF materials to markets has been difficult, with local recycling brokerscharging tipping fees for recovered cardboard from businesses.

Table 4 below provides commodity prices for commodities shipped from the RIRRC MRF. Paper, or fiber, prices drive the market basket value of paper and packaging recyclables recovered at the MRF. Like all commodities fiber markets are driven by supply and demand, and over the past decade the demand has come mainly from China. Metal fetches the most attractive prices per weight with prices following the scrap market. Plastic container recycling has been growing over the last decade and prices typically respond to oil markets as a competing source of plastic resin. While the middle of the last decade was marked by sluggish commodity markets, the years just prior to the economic crises saw prices rise to a peak. When the economy collapsed at the end of 2008, so did commodity prices. Before long prices for MRF outputs returned and eventually reached all-time highs in 2011. More recently, commodity prices have returned to the long run averages.

Stable markets for recycled commodities are necessary for the viability of the State's recycling efforts. For municipalities these revenues fund the MRF sorting operation and when profits are high provide significant profit shares back to municipal customers to help fund public municipal recycling programs. Stable prices for recovered commodities foster commercial recycling by providing certainty to businesses and institutions implementing and funding recycling initiatives. Furthermore, recycling collection programs cannot easily be turned on and off when markets crash for brief periods limiting the ability to sell recovered materials. What comes into the MRF must go out within a few The MRF does not have the luxury of stockpiling materials until markets improve. As a "just-in-time" facility, material is tipped, sorted, baled, and shipped within 48 hours of delivery to the MRF by haulers.

Table 4. Average Prices Paid for RIRRC MRF Commodities by Year ($/ton)

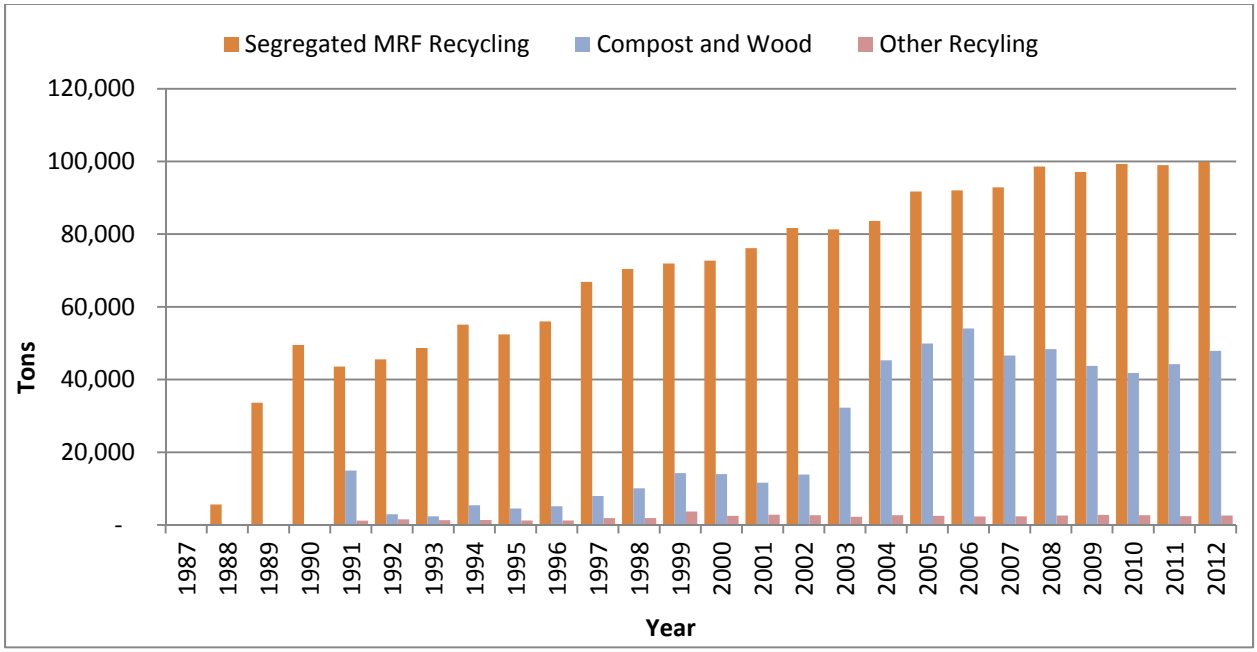
Year	Fiber	Metal	Plastic	Weighted Average
2005	$63.11	$343.68	$464.48	$110.12
2006	$56.73	$500.16	$379.15	$110.07
2007	$90.76	$511.07	$409.22	$145.01
2008	$108.52	$551.27	$442.02	$163.90
2009	$59.61	$277.11	$241.51	$89.74
2010	$99.99	$491.25	$419.46	$157.08
2011	$131.46	$605.05	$614.79	$208.39
2012	$86.94	$484.13	$383.23	$151.78
2013 (YTD July)	$84.02	$478.02	$395.58	$147.63
Weighted Average	**$86.56**	**$470.49**	**$416.94**	**$142.34**

The historical volume of recycling delivered to RIRRC has grown steadily since the program's inception through the 1990s until about the middle of the last decade (see table **Error! Reference source not found.**).Volumes grew through the 1990s as RI municipalities gradually implemented the State mandated recycling programfor paper and packaging. The program has been expanded twice

since its the original program inception to include additional materials such as mixed papers and plastics. Levels of recyclables recovery at the MRF have been relatively consistent over the last decade even though materials have been added and municipal collection programs improved. Stagnation in total weight recovered has occurred mainly because the relative shares of materials targeted in the municipal programs have changed significantly over the past two decades.

The most marked change in the composition of paper and packaging over the past decade has been the decrease in newsprint generated and recovered. Newsprint, once the staple commodity of municipal recycling programs, is being consumed and recycled less. Decreasing circulation and fewer pages being printed per issue have contributed to the decline in weight realized from this commodity the daily newspapers. USEPA estimates indicate that newsprint generation in the United States has fallen 38% from 2000 to 2011. The other major change in paper and packaging has been a shift from glass, steel and aluminum packaging to plastic containers. While glass, steel and aluminum containers combined have decreased by 16%, lightweight plastic container packaging has increased by almost 30% according USEPA figures.

Figure 4. Historical Recycling Received by RIRRC



Compost Markets

The market for composting segregated yard L&Y in RI is dominated by RIRRC's facility, a number of municipal operations, and a handful of commercial operations including agricultural composters (see Table # above). The annual volumes of compost received at RIRRC have increased dramatically in 2003. However, markets had little to do with this increase. RIRRC adopted a policy to eliminate the tip fee on yard waste from municipalities in order to encourage collection from residents. While no significant increase in collection of residential yard debris resulted, several municipalities diverted material from local and private sector composting operations to RIRRC's facility. Even though the volume processed by RIRRC has increased dramatically, the overall amount of yard waste composting in RI has remained relatively stable.

Markets for compost and wood landscape products are both local and regional. For smaller municipal sites finished compost is often provided for free or fora small fee to residents. Other sites will distribute to landscapers and end users directly and more compost is being marketed regionally through brokers that distribute to landscaping outlets and large site construction projects markets. Because compost products vary significantly by producer, feedstock and quality and location, valid average price data is not available.Generally, high-end composts can fetch $50 per yard retail. Whole sale prices paid to composters is typically much less. RIRRC sells some of its Class "A" compost at directly to users for $30 per yard, and makes approximately $5 per yard wholesale.As of September 2013 RIRRC has not been able to market the majority of its compost product.

Other Materials

Markets For other recovered commodities are a mixed story. Scrap metal and textiles have well developed markets that existed long before the expansion of coordinated municipal recycling. Markets

for other waste materials, such as electronics, mattresses, and tires, are developing, partly in response to EPR initiatives. The collection programs for these "non-MRF" materials must be further developed to encourage the growth of the respective industries.

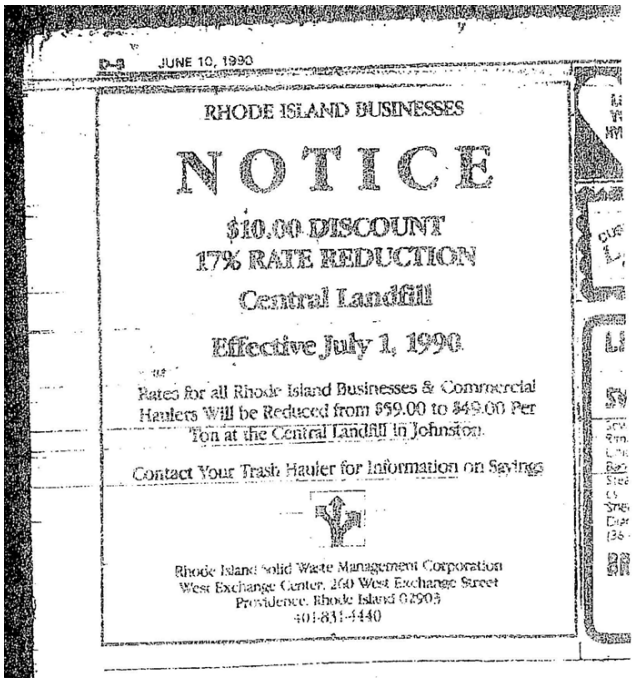
Solid Waste Disposal Markets

In RI, statute dictates that municipal refuse and recycling be sent to RIRRC for disposal. Therefore, disposal of municipal refuse has been more a function of waste collection undertaken by municipalities and the overall generation of refuse by residents. On the other hand, demand for commercial disposal at the Central Landfill is influenced greatly by regional disposal markets, the relative tip fees being charged and transportation costs. Regional disposal market are impacted by the economy, waste generation and recycling efforts.

Regional Disposal Market History

Figure 6. *Thirty Years of Refuse Delivered to RIRRC* provides important historical perspective to the RI commercial waste disposal market. Commercial waste disposal at RIRRC has peaked and then declined twice over this time. Because RIRRC is prohibited from accepting wastes from out of state, the peak years for disposal are a good approximation of the RI generated refuse disposed. The first dip in disposal demand at RIRRC occurred in the late 1980s and lasted into the early 1990s. This exodus of commercial waste from RI was the result of multiple changes in the regional market including: additional disposal capacity being developed in the region at WTE facilities, expansion of nearby landfills, and the impending closure of the Plainville, MA landfill, all coupled with an increase in pricing at the RI Central landfill. Commercial refuse volumes returned to RI in the middle of the 1990s in response to the closure of nearby landfills, and increased waste generation rates nationally;,coupled with competitive pricing along and put or pay contracts at the Central Landfill. Waste disposal at RIRRC continued to climb through much of the last decade along with national waste generation rates (US Environmental Protection Agency, 2013). During this period excess disposal demand in the NewEngland region was such that waste was being long-hauled and railed to distant disposal facilities, and robust revenues were realized by all disposal facilities in the region including RIRRC. The economic crash in 2008 brought disposal demand crashing down and resulted in an excess supply of capacity.In response, commercial disposal volumes at RIRRC dropped again to historic lows bringing lucrative commercial revenues to a halt.

Figure 5 1990 Rate Reduction Notice


D-3 JUNE 10, 1990

RHODE ISLAND BUSINESSES

NOTICE

$10.00 DISCOUNT
17% RATE REDUCTION
Central Landfill

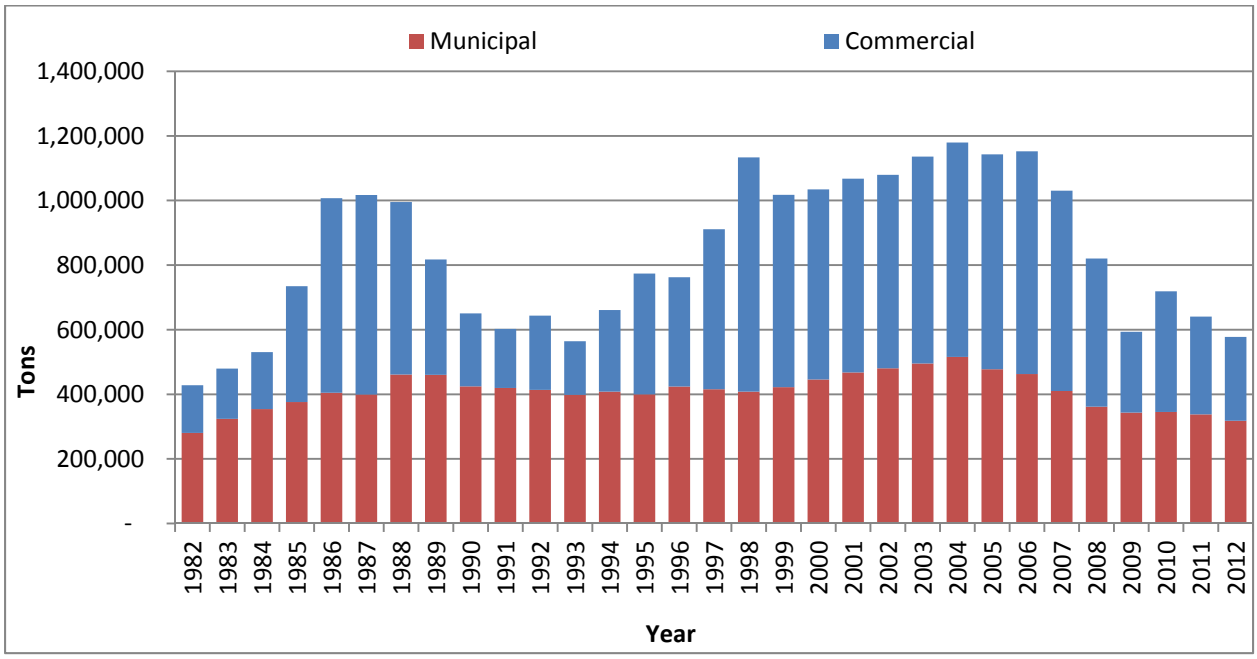
Effective July 1, 1990

Rates for all Rhode Island Businesses & Commercial Haulers Will be Reduced from $59.00 to $49.00 Per Ton at the Central Landfill in Johnston.

Contact Your Trash Hauler for Information on Savings

Rhode Island Solid Waste Management Corporation
West Exchange Center, 260 West Exchange Street
Providence, Rhode Island 02903
401-831-4440

Figure 6. Thirty Years of Refuse Delivered to RIRRC



Current Disposal Market

As demonstrated by recent history, the southern New England market for waste disposal is sensitive to large changes in waste generation. Based on RIRRC volumes and anecdotal evidence, estimated waste generation in the region fell more than 15% for households and over 20% in the commercial sector. The regional supply of waste disposal capacity is dominated by WTE facilities that must continue to operate at maximum capacity in order to meet power generation obligations and stay profitable (see Table 4. Rhode Island Market Dominated By WTE below). Therefore, WTE operators are in the short term willing to drop their prices well below average costs in order to attract waste from a larger waste-shed that includes RI commercial waste.

Table 4. Rhode Island Market Dominated By WTE

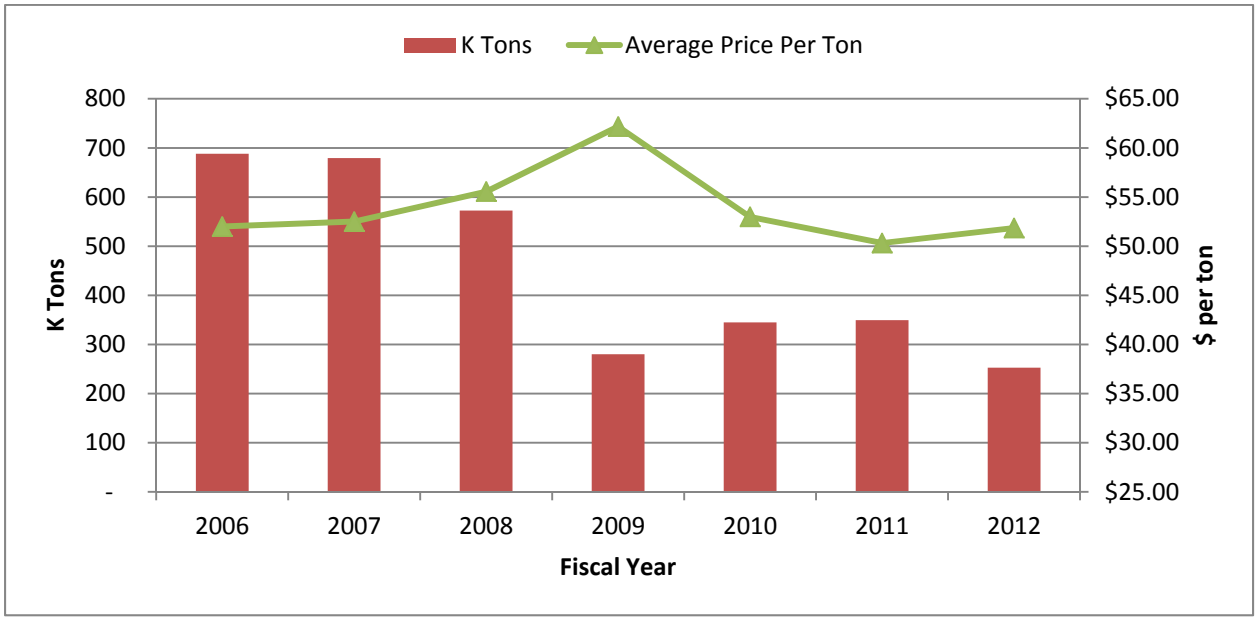
	Number of Incinerators	Percent Incinerated	National Rank
Connecticut	6	65%	1
Massachusetts	7	34%	2
United States	87	7%	N/A

Table 5.New England Solid Waste Disposal Capacity (Annual Tons)

Year	Landfill	WTE	Supply Total	Demand	Excess Capacity
2008	5.9M	6.7M	12.6M	~ 12.6M	None
2015E	5.0M	6.7M	11.5M	~ 10.0M	+1.5M

Estimated regional waste generation is about 10 million tons per year with a current supply of disposal capacity at approximately 11.5M tons, resulting in a significant over supply of capacity in the region. This over capacity will keep pricing unstable for the foreseeable future. Currently, waste disposal is a buyer's market. Figure 7. Recent RIRRC Commercial Refuse Disposal and Pricing below provides commercial volumes and pricing for the last several years and demonstrates that while prices are at all-time lows the volumes have not returned even in part. Haulers that handle large volumes and control transfer capacity can shop their waste around the region and command favorable pricing even when factoring in the cost of transportation. Therefore, there is no opportunity to raise RIRRC's commercial disposal prices atthis time.

Figure 7. Recent RIRRC Commercial Refuse Disposal and Pricing



G. Economics of managing waste

The management of solid waste is largely driven by economics. Markets, logistics, and technology all impact our options for managing waste materials. The solid waste management industry is comprised of a vertically integrated mixture of services and commodities. Waste materials flow from the generation sources, through hauling service providers, then onto processors and disposal facilities. Materials from processing facilities can be further refined or sold as commodities for manufacture to process into new goods. Process waste residues from recycling, composting and waste to energy operations are sent to disposal facilities. In RI, like most of the world, the waste management industry has both private and public sector participants, as described above. While markets play a large role, federal, state and local policy decisions also have a major influence on the fate of our wastes. The decisions made regarding waste at all levels are ultimately based on the costs of the options available, individual knowledge and preferences, and the set of incentives facing all the actors involved in the flow of waste materials to its ultimate fate.

The overall direct cost of waste recycling and disposal is comprised of collection, transportation, and fees for disposal and processing. Sometimes the costs associated with collecting and segregating recyclable materials are offset by the sales of materials. For the casual observer, it is often puzzling why more recycling doesn't occur when recovered materials are worth money and waste costs money to dispose. The fact is the cost of separating, collecting and transporting additional materials quite often does not cover the net difference in revenue from the sale of recovered materials and the savings from avoided disposal fees. Also, for many small businesses, logistics and space constraints can make separation of materials impractical.

Collection and Transportation Costs

Source separation Logistics

Strategies for recovering materials from the refuse stream can involve varying degrees of source separation of recycling. Most residents and businesses can adapt to some degree of sorting recycling when provided with the proper containers and education. However, in many cases and particularly for small businesses, space constraints

Recycling collection costs are related to the program's set out requirements (i.e., how material is to be sorted—for example, separate containers for glass, paper, and cans), frequency of collection, and level of community participation. By adjusting the variables that affect collection costs, communities can lower these costs.

In general, the per ton or per household costs of collecting recyclables:

Increase with the number of separately segregated commodities. Single-stream is the least costly to collect, followed by two-stream, etc.

Increase with the frequency of collection. Collecting half as frequently (e.g., every other week instead of weekly) can reduce collection costs by approximately 25 percent, assuming traditional two-stream set outs.

Decrease as more materials are collected by the program. If few households participate in the program and the program does not collect many commodities, the per household cost soars, as it is costly to drive a recycling truck past household after household that has not set out recyclables.

(US Environmental Protection Agency)

often hinder opportunities to source separate recycling. More important is the impact that multiple material sorts at distributed sources has on the over-all cost of recycling collection.

Collection Costs

Generally speaking collection costs by customer or per volume handled are largely dependent on the amount of material collected at each stop. Costs increase when more materials require separate collection. This is why adding separate recycling collection services ends up being so costly, and why RIRRC converted its MRF to a single stream facility, providing municipalities the opportunity to significantly reduce the cost for collecting recyclables. Likewise, reducing the frequency of collection reduces costs, and every other week collection of recycling is being adopted in some communities. For collection services provided to multiple customers per route, the density of stops will also plays a factor in costs.

Collection costs can vary greatly depending on the type of customer served but typically they make up the majority of the cost associated with the management of solid for households and small business. Commercial customers serviced via high volume compaction containers and C&D open top roll-off collection containers have the lowest collection cost per ton. Collecting refuse and recycling from commercial and multi-unit residential customers provided with dumpster service costs more per ton but still less than collecting curbside from households.

Transfer and Transportation costs

Transportation is a major factor in waste management costs. Logistics dictate that the more material that can be transported per load will lower the transportation cost per ton. Collection vehicles of all types tend to be limited in volume, with the largest running about 30 cubic yards. When the destination for collected materials is far (greater than 30 miles), it often is more cost effective to utilize transfer facilities and aggregate waste into large (100+ cubic yard) tractor trailers, creating transportation efficiency and allowing more time for collection vehicles on route collecting. In addition, transfer facilities offer an opportunity to screen waste, provide flexibility in choice of disposal destination, and provide an opportunity for convenient public drop-off for refuse, and for the collection of special wastes.

Rhode Island transfer stations play an important role in the efficient management of our wastes. One major economic consideration for RI is that solid waste transfer stations are necessary for commercial haulers to move significant amounts of waste to neighboring states. Control of RI transfer capacity allows the larger private haulers the ability to shop for the best prices for their RI commercial wastes. Or, as in the case of Waste Management, guarantee that their vertically integrated WTE facilities are provided adequate feedstock. The private firms that control RI's transfer capacity also have an opportunity to attract other haulers and compete directly with RIRRC for RI's commercial waste load. Given that the existing RI solid waste transfer capacity of 1.4M tons approximates the statewide total waste generation, the potential for additional commercial sector waste to move to our neighboring states exists in this time of regional over- supply.

Processing and Disposal Costs

Another noted component of waste management costs are those associated with processing and disposal. Processing waste and recyclables takes many forms: WTE, refuse derived fuels, mixed waste processing to separate organics and inorganics, anaerobic digestion, sorting of segregated papers and packaging, and composting, to name a few. Disposal takes the form of WTE processing, and land disposal.

Just about any form of processing is costly. Although, the more value that is added through separation at the source the less costly the processing, with lower amounts of residual waste resulting. Typically mixed waste and recycling processing costs are off-set by revenues from the sale of recovered materials and energy. But for most processing operations for mixed wastes and organics, tip fees are needed as well to ensure profitability.

Sorting operations for paper and packaging and C&D have typically been labor intensive. Over the past decade these operations have more increasingly relied on automation, requiring high up-front capital costs. Processing that converts waste and segregated organics to energy have even higher capital costs to initially develop. Therefore, when such facilities are commissioned it is essential that they run at capacity and receive sufficient tip fee revenues to cover these fixed costs.

Relatively speaking burying unprocessed solid waste in a landfill is a financially inexpensive method of disposal in a facility of proper size to capture sufficient economies of scale. However the economics of landfill disposal differ from processing in that landfills are non-renewable resources of a finite capacity. The upfront costs to construct a landfill and the construction costs to cap and close a landfill once full are amortized over the entire capacity of the facility and remain constant for each ton landfilled, regardless of the loading rate of waste. However, in addition to these upfront costs there is a large fixed cost associated with operating a landfill. This includes much of the personnel, machinery, leachate collection and gas management costs. While some of these costs can be adjusted over the long term in response to changes in loading others cannot. Typically, the period of time a landfill cell is open and accepting waste results in higher operational costs in order to manage leachate, gas and erosion control. Once a cell is capped these costs gradually decline. Therefore, as loading rates increase, the average cost per ton for landfilling decreases. From the stand point of minimizing, cost over the life of a landfill, all the better to fill it up, cap and close as quickly as possible.

Obviously, such a short sighted view neglects to consider the demand, and revenues, for disposal today and in the future. There is a trade-off between revenue today and the future. While RIRRC could lower its tip fees further and attract more waste for disposal in the current period, it would come at the cost of higher revenues per ton in the future. A more thorough examination of this trade-off and how best to utilize-the limited remaining landfill capacity in RI is taken up in the next sections.

Financing Facilities, Planning and Flow Control

Given the high cost of developing WTE, waste processing and recycling facilities, large amounts of capital needs to be raised to fund such projects. Unless project developers, such as RIRRC, can

demonstrate the ability to maintain sufficient source of incoming materials at an adequate tip fee to cover the debt service, such projects will not be funded. Furthermore, planning integrated solid waste management systems that seek to maximize diversion from disposal over the long term is facilitated by certainty in demand for capacity. Since the 1970s more and more jurisdictions have utilized solid waste flow control to fund such projects and plan integrated solid waste management systems.

"Flow controls are legal authorities used by State and local governments to designate where MSW must be taken for processing, treatment or disposal. This waste management approach requires waste to be delivered to specific facilities such as waste-to-energy (WTE) facilities, materials recovery facilities (MRFs), composting facilities, transfer stations and/or landfills. The facilities can be either publicly or privately owned. One of the direct effects of flow control is that designated facilities are assured of receiving a guaranteed amount of refuse and/or recyclable materials. If the designated facilities charge a 'tipping fee' for receipt of the refuse/recyclables, flow control assures a source of revenue to meet their capital and operating costs." (Flow Control and Municipal Solid Waste (EPA 530-R-95-008), 1995).

Over the last two decades there have been key legal challenges to flow control provisions that brought into the question the legal viability of such provisions under the commerce clause of the U.S. Constitution. However, in 2007, the U.S. Supreme Court heard its first solid waste management case in 13 years, *United Haulers Association vs. Oneida-Herkimer Solid Waste Management Authority*, and clarified that a local ordinance that directs locally- generated wastes to publicly- owned waste facilities does not discriminate against interstate commerce.

Rhode Island statute RIGL § 23-19-10(40) specifically provides RIRRC authority over where all RI refuse and recycling may be delivered for processing and disposal, and RIRRC has maintained and exercised control over municipal sector waste and recycling. However, challenges against flow control provisions in other states in the 1990s brought into question the validity of such flow control provisions on RI commercial wastes. Therefore, even though specific flow control regulations were adopted by RIRRC in 1991 that would give RIRRC authority over commercial sector wastes, this authority has yet to be enforced.

Given the recent Supreme Court ruling and the emphasis on waste diversion in this plan a reconsideration regarding the role of flow control on commercial sector is warranted. The applicability of this mechanism will be explored further in the following sections.

External Costs

In addition to the direct costs associated with managing solid wastes, there are costs to society that are not recognized on financial statements or by disposal markets. These costs, known to economists as external costs, arise from factors such as odor, litter, air pollution, the risk of potential ground water contamination, and various other environmental and social impacts. While pollution abatement and environmental protection efforts at the Central Landfill continue to expand, there may be some degree of air pollution emissions or the risk of some future ground water contamination, common risks associated with the operation of any landfill. In fact, WTE, composting, and even recycling operations

have associated externalities of some sort. Quantification of such external costs is difficult but not impossible. Certainly, policy-makers should recognize the existence of such costs and where possible obtain estimates of the magnitude of external costs associated with different waste management options.

Participants and Incentives

An understanding and recognition of all the participants in solid waste management and the incentives faced is needed to develop sound policies and plan for integrated waste management systems.

The options facing generators of waste at the source are constrained by the programs and services offered by local governments and private service providers. While municipalities have a critical role in the level of service provided to residents and how it will be paid for, the specific materials that can be collected for recycling at the typical household is dictated by State level policy makers. Likewise, waste haulers and recycling service providers can only provide collection of segregated recycling if there is access to processing capacity and markets for recovered goods.

For many households and businesses waste prevention and recycling is done because it is "the right thing to do", with little consideration of the associated costs or level of effort required. For others, participation in recycling is a response to government directives and collective pressure. For many households the main motivators for participating in available recycling programs is whether their neighbors do it and whether it is enforced. For businesses, requirements to recycle and the threat of enforcement are motivations as is the desire to be "eco-friendly". Similarly, municipal program managers, policy makers, and waste service providers implement programs and often provide services for recycling to satisfy mandates and the public pressure to be environmentally responsible. However, all participants respond to costs and price signals and long term sustainable diversion of solid wastes from land disposal will require that recycling collection, processing and alternative disposal technologies be cost effective.

Costs are distributed differently to households and businesses. For most RI households the cost of recycling and disposal collection is not paid directly, but paid collectively by the municipality through tax revenues. Therefore, most residents do not internalize the costs of their waste generation. There are some municipal programs that charge households for disposal based on the amount of waste generated, while providing recycling collection for no charge to incentivize participation in recycling and encourage waste prevention. Regardless, for most residents the actual costs of waste management programs are recognized by the local municipal program managers and policy makers tasked with providing a set of public services and faced with a budget constraint. The level of effort by municipal waste managers to provide and promote recycling services is a function of the associated costs, mandates from the state, and political pressure to be "eco-friendly".

Because commercial waste generators pay for the waste and recycling services directly, like the municipal manager, their level of recycling effort will depend largely on the net costs, but also mandates, and the desire to be environmentally responsible. Commercial haulers will provide recycling services when revenues from materials can offset the additional costs for recycling, or when businesses

are willing to pay extra for such service. However, in most instances waste hauling firms have very little incentive to promote waste reduction or the segregated collection of recyclables to their customers.