

ESTIMATING BEVERAGE CONTAINER LITTER QUANTITIES AND CLEANUP COSTS IN MICHIGAN (April 2015)

This paper looks at litter cleanup efforts and associated costs in Michigan, and attempts to determine the proportion of litter composed of discarded beverage containers. A few studies have previously attempted to estimate cost savings from the reduced beverage container litter resulting from container deposit programs. However, the previous studies have looked only at roadway litter. Roadway litter is just one category of litter, and does not include litter at parks, beaches, creeks, business parking lots, or other types of locations. Roadway litter also does not consider the costs of litter cleanup for stormwater system cleanouts. Before looking at Michigan specifically, we will discuss what is known about litter composition and cleanup costs nationally, and in selected U.S. states. These national and state cost estimates are helpful for benchmarking as well as for filling in gaps in information for Michigan. As we discuss below, litter cleanup costs are widely dispersed among public, private and nonprofit entities. The scope and budget for this paper does not allow for the comprehensive amount of surveying and information gathering that would be needed to estimate litter cleanup costs for all entities in Michigan.

Litter Quantities and Composition: Nationally and in Selected U.S. States

In the last few decades, there has been only one study that attempted to estimate litter quantities nationally: Keep America Beautiful's (KAB) "National Litter Survey" in 2009. Its analysis included roadways and non-roadway sites. Results were presented in a lengthy report, and were summarized in a presentation document.¹

The KAB study estimated that 51.2 billion pieces of litter were deposited on U.S. roadways, although no time period was specified in regard to litter deposition rates or cleaning frequency. KAB found that about 30% of this litter consisted of plastic, glass, or metal—but that beverage container litter was only 2.7% of all roadway litter.² The estimate of 51.2 billion pieces of litter should be seen in this context as merely an estimate for roadway litter.

The KAB estimate of the proportion of beverage container litter may be a significant underestimate; many other litter studies have found much higher percentages of beverage container litter.

¹ "2009 National Visible Litter Survey and Litter Cost Study, Final Report." (KAB Study) MSW Consultants for Keep America Beautiful, Inc., Sept. 18, 2009.

² Glass, metal plastic: KAB study, Fig. ES-1. Beverage containers as 2.7%: KAB study, p. ES-5.

Litter Composition Data from State-specific Studies

We reviewed results from nearly two dozen studies of litter composition, and found that the proportion of beverage containers in the total litter stream ranged from a low of 4% to a high of 48%.

- For example, the American Beverage Association's Northeast 2010 Litter Survey found that littered beverage containers accounted for 6.4%, 5.6% and 7.9% of all litter in Vermont, Maine, and New Hampshire respectively. When container-associated packaging (caps, pull tabs and carriers) is included, the proportions are 8.8%, 7.5% and 10.6%, respectively. (Note the lower rates of container litter in deposit law states.)³
- Data from 2004 in New Jersey indicate an even higher proportion of beverage container litter. They found that beverage containers accounted for 10.5% of all visible litter, rising to 15.5% of visible litter when associated packaging (caps, pull tabs and carriers) are included.⁴
- The 2009 Texas Litter Study found still higher rates: This analysis reported that alcoholic and non-alcoholic beverage containers comprised 19% of all roadside litter by piece count, or 29% when cigarette butts were excluded.⁵
- The 2004 Ohio statewide litter study estimated that 27% by weight of all roadside litter is from beverage containers (alcoholic and non-alcoholic), representing the "largest single category in the litter weight analysis."⁶
- A review of 19 litter studies by DSM for the state of Rhode Island found that the proportion of beverage containers in litter ranged from a low of 4.4% to a high of 48%, with an average of 14%.⁷
- In Michigan, no data are collected on composition of litter, so the best educated guess (by MI DOT staff) is "the majority of items littered are fast food packaging, non-carbonated beverage containers, and other packaging materials."

The wide variation in these percentages is an indication of the uncertainties involved in measuring beverage container litter as a proportion of the entire litter stream. There is no nationally standardized counting methodology; some studies conduct piece counts in which a cigarette butt is equivalent to a discarded tire, for example. Other studies measure litter by weight; and still others by volume. There is also no agreed-upon method for determining "deposition rates," or cleanup and counting frequency; litter surveys might be conducted a year after the last cleanup at a given site, or just a few days or weeks after. There also are a wide variety of areas and use patterns surveyed—from roadsides and rivers to beaches and parks. Even within a specific area category, other factors play a role, such as the differing

³"Northeast 2010 Litter Survey," by Steven R. Stein/Environmental Resources Planning LLC. for the American Beverage Association, 2010. Note that the percentage of beverage container litter in Maine, which has an expanded deposit system, is the lowest of the three, and the percentage in New Hampshire, which has no deposit system is the highest.

⁴Pp. 21 and 22, and Fig. 5 in "New Jersey Litter Survey: 2004: A Baseline Survey of Litter at 94 Street and Highway Locations." Gershner, Brickner & Bratton, Inc. and Inst. For Applied Research, January 28, 2005.

⁵Table A-7.3 in Texas Department of Transportation 2009 Visible Litter Study Final Report, April 2010.

⁶"Ohio Statewide Litter Study, Final Report," Davey Resource Group and Ohio Department of Natural Resources, June 2004.

⁷Table 10 in "Analysis of Beverage Container Redemption System Options to Increase Municipal Recycling in Rhode Island." DSM Environmental Services, Inc., May 2009.

traffic densities on urban and rural roads. Finally, the entities that fund the studies vary: for instance, while some studies are funded by nonprofit groups, others are funded by the beverage industry.

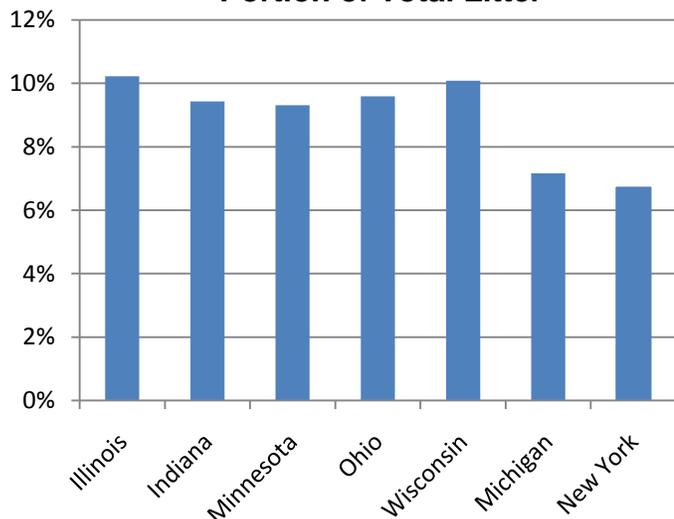
Despite these methodological variations, clearly the 14% average figure cited above is so far above the 2.7% that KAB reported nationally that the KAB rate could be seen as an anomaly or an outlier among litter studies. It is also worth noting that 18 of the 19 litter surveys reviewed by DSM were from states without beverage container deposit systems that serve as financial incentives not to litter. One of the 19 litter studies was from Iowa, a state with a container deposit on carbonated beverages, where the amount of beverage container litter reported to be 4.6% of total litter, by piece count. As mentioned previously, the ABA Northeast 2010 Litter Survey found that beverage containers comprised about 6% of all litter in two deposit states (Vermont and Maine), and about 8% when associated packaging is included. This is consistent with what the Alliance for the Great Lakes has found in its beach litter cleanups in Michigan (a state with a 10-cent deposit on carbonated beverages): that beverage containers comprise 7.2% of all litter picked up, and 12% when associated packaging is included.⁸ More information on the AGL cleanups is provided on the following pages.

The Great Lakes Adopt-a-Beach Litter Cleanups: 2013 Findings

The non-profit Alliance for the Great Lakes (AGL) conducts ongoing cleanups of hundreds of miles of beaches and coastal shorelines in Michigan and other Great Lakes states through their volunteer Adopt-a-Beach program. Thousands of volunteers participate in these cleanups; their efforts are turned into detailed data by counting litter piece by piece, then categorizing the litter into dozens of material and product types. CRI has obtained cumulative 2013 data on cleanups conducted in Illinois, Indiana, Minnesota, Ohio, Pennsylvania, Wisconsin, Michigan and New York.

AGL volunteers catalog every single piece of litter collected by product category. The totals for each beach cleanup are weighed, but the individual litter categories are not weighed. In 2013, volunteers in Michigan collected

Figure 1. Beverage Containers as a Portion of Total Litter*



Source: Alliance for the Great Lakes, December 2014.

***Notes:**

1. Data by piece count. Beverage containers include plastic & glass bottles, and cans.
2. Cigarette butts, which comprise a quarter to one half of total pieces, are included.
3. Results from PA omitted due to the small size of the cleanup site (one state park).

⁸ "AGL study:" Data provided by the Alliance for the Great Lakes, reporting on Adopt-a-Beach™ volunteer litter cleanups conducted on beaches and coastal shorelines in Michigan and neighboring states in 2013. Personal communication, Jamie Cross, Alliance for the Great Lakes, Dec. 2014.

a total of 156,290 pieces of litter, of which 11,200 were cataloged as beverage containers, or 7.2% of the total, as Figure 1 shows. The breakdown by container type was 48% PET plastic bottles, 30% glass bottles, and 23% aluminum cans. This 7% stands in contrast to the higher percentages of bottles and cans AGL cleanup volunteers collected on beaches in neighboring states without beverage container deposit laws, as Figure 1 also shows.

Amount of beverage container and associated packaging litter: In addition to the 156,000 pieces of beverage container litter (bottles and cans), volunteers collected and recorded more than 14,000 pieces of 6-pack holders, caps and lids, some of which are certainly beverage-related. If we assume that 50% of the latter category is beverage-related, then the total beverage-related piece count is 18,396, or 12% of Michigan's total litter count, as Table 1 (page 5) shows. The 12% figure in Michigan is matched by the one other state with a container deposit law (New York) and by Minnesota. In three of the Great Lakes states without deposit systems (Illinois, Indiana and Ohio), the proportion of beverage-related litter is 16%-17% of the total.

Were the influence of cigarette butts removed, beverage-related litter would comprise 15% to 27% of total litter by piece count, with an average of about 22%.⁹

Note that the average beverage container litter percentage in the two container deposit states (MI and NY) is 7%, and the average in the states without container deposit laws is roughly 9.5%, for a difference of 2.5%. Both New York and Michigan have container deposit laws that are not all-inclusive. Their laws include carbonated beverages, and New York's law also places a deposit on bottled water. Michigan does not put a deposit on bottled water, and neither state covers wine, spirits, tea, flavored waters, energy drinks or sports drinks. Beverage container litter would likely be lower in Michigan and New York if the laws in these states covered all beverage types.

⁹CRI calculations based on AGL data. The question of cigarette-related litter is an interesting one, because in terms of actual mass or volume (as measured by weight or cubic yards of debris), this category is very small compared to that of beverage containers and other larger-sized items that are littered. But in terms of the labor costs of cleaning up cigarette litter, it's just as significant: the time required to bend over to pick up one piece of litter is the same whether it is a cigarette butt or a bottle or can.

Table 1. Beverage Container Litter on the Great Lakes Coastline

	ALL	Beverage Containers					Container Accessories (c)					Total beverage-related (e)	
State	All litter (a)	Plastic bottles	Glass bottles	Metal cans	Total (b)	As a proportion of total litter	Caps, lids	Pull tabs	6-pack holders	Subtotal	Beverage container accessory estimate (d)	Containers + accessories	As a proportion of total litter (f)
Illinois	144,166	4434	6411	3900	14,745	10%	18,400	1,253	225	19,878	9,939	24,684	17%
Indiana	39,433	1469	1065	1186	3,720	9%	5,634	278	35	5,947	2,974	6,694	17%
Minnesota	12,695	359	291	532	1,182	9%	731	30	19	780	390	1,572	12%
Ohio	86,502	4372	1713	2211	8,296	10%	10,623	444	67	11,134	5,567	13,863	16%
Wisconsin	59,420	2833	960	2200	5,993	10%	6,765	295	101	7,161	3,581	9,574	16%
Michigan	156,290	5331	3343	2526	11,200	7%	14,252	1,077	139	15,468	7,734	18,934	12%
New York	17,948	795	84	327	1,206	7%	1,669	45	15	1,729	865	2,071	12%
Total	516,454	19593	13867	12882	46,342	9%	58,074	3,422	601	62,097	31,049	77,391	15%

Notes and sources:

Data provided by the Alliance for the Great Lakes, reporting on Adopt-a-Beach volunteer litter cleanups conducted on beaches and coastal shorelines in Michigan and neighboring states in 2013. Personal communication, Jamie Cross, Alliance for the Great Lakes, Dec. 2014. 1. Results from Pennsylvania have been omitted from this analysis due to the small sample size of the cleanup site (one state park).

a) Sum of 50 categories of litter catalogued by piece count in the AGL data.

b) Sum of piece counts for plastic beverage bottles, glass beverage bottles, and metal beverage cans.

c) Piece counts for container packaging accessories.

d) We conservatively estimated that 50% of all container packaging accessories may be attributable to beverage containers.

e) Sum of beverage containers (plastic, metal, glass), plus 50% of container accessories.

Costs of Litter Abatement: Nationally and in Selected U.S. States

The KAB study also set out to estimate costs for “litter abatement expended by governmental entities, institutions, businesses and citizens.” They determined that it costs “approximately **\$11.5 billion per year** for litter cleanup, education and/or disposal programs,” and further noted that this is likely to be a large **underestimate**¹⁰ due to the failure of many entities and organizations to track and document their cleanup costs. If Michigan litter generation and cleanup costs are similar to the estimated national average, Michigan’s annual costs would be about \$361 million, as Table 2 shows below.

The KAB presentation did not mention the cost of street sweeping or storm drain cleanout, but in the companion study, the group estimated that 33% of all littered items found in storm drains were plastic, glass or metal, though the exact proportion of beverage containers was unspecified.¹¹ Clean up costs for storm drain catchments in Michigan are discussed on page 9.

Table 2. Litter Abatement Costs in the U.S. and Michigan

Entity Type	KAB Estimate of National Cost (million)	Michigan’s Proportional Cost (million)
States	\$363	\$11
Counties	\$185	\$6
Cities	\$797	\$25
Businesses	\$9,128	\$286
Educational	\$242	\$8
Non-governmental organizations (NGOs)	\$707	\$22
TOTAL	\$11,422	\$358

Source for U.S. numbers: Keep America Beautiful's "National Visible Litter Survey," and "Litter Cost Research Study, 2009, Presentation of Results," Steven R. Stein, Environmental Resources Planning LLC. Michigan costs were estimated using Michigan’s proportion of the US population (10 million of the national population of 319 million.)

The KAB study also discussed the indirect costs of litter in qualitative terms--such as declines in real estate property values, tourism and retail shopping habits. They cited a National Association of Home Builders estimate that the presence of litter reduced neighborhood property values by 7.4% or more.

A 2013 study by the Natural Resources Defense Council (NRDC) in California cited more public costs than other studies cited. The study found that California communities (cities) spend about **half a billion dollars annually** cleaning and combatting litter so that it is prevented from entering state waterways, including rivers, lakes and the ocean. This more

¹⁰For example, when researching litter cleanup costs for states, the report authors note that many states did not provide complete data, or did not track litter cleanup costs, or that costs were incurred by multiple agencies within state government. Some states provided data from prior years, and no adjustments were made for inflation. The results were similarly underestimated for similar reasons for the other categories of costs.

¹¹KAB study, Figure 3-25.

detailed study, which estimated costs for California cities at \$500 million, makes the KAB estimate of \$797 million for all cities nationwide appear far too low. Among other things, the study looked at waterway and beach cleanup, street sweeping and stormwater drain maintenance. The authors are careful to point out that actual costs of litter abatement are much higher, because they include litter cleanup costs incurred by county and state government, rather than municipal government, as well as recycling and solid waste management programs that prevent litter.¹²

Litter Cleanup Cost Estimates in Michigan

To validate these national estimates and their applicability to Michigan, CRI collected sample information from the state of Michigan and the AGL. Our review included three types of areas: roadsides (state costs only), stormwater catchment areas (state costs only), and beaches along Lake Michigan (AGL).

Roadside CleanUp Costs in Michigan

The Michigan Department of Transportation (MIDOT) has four mechanisms for picking up debris along the highways and roads it manages: the Adopt a Highway program, the Sponsor a Highway program, litter removal by “direct forces,” and litter collection by incarcerated people and community service workers. Each is discussed below with reference to Table 3.

Table 3. Roadside Litter Quantity and Collection Costs for Michigan State and County Roads, 2013

Program	# Bags collected	Labor costs (direct or avoided)	Miles covered	Collection frequency (times per year)	Road-miles cleaned per year	Costs per road mile
Adopt a Highway (a)	70,000	\$5,000,000	6,500	2	13,000	\$384.62
Sponsor a Highway (b)	3,500	\$250,000	60	12	720	\$347.22
State & county employees (c)	49,000	\$3,500,000	3,000	1	3,000	\$1,166.67
Incarcerated labor and community service (d)	4,900	\$350,000	300	1	300	\$1,166.67
Total	127,400	\$9,100,000	9,860		17,020	\$534.67

Source: personal communication with Tim Jones, Roadside Operations Specialist, Michigan Department of Transportation, Dec. 9, 2014; Feb. 18, 2015; Feb. 25, 2015.

a) Source data provided for bags collected by volunteers, and cost benefit of avoided labor. Cost per bag is derived.

b) Source data provided for bags collected; sponsored labor costs are derived based on \$71 cost per bag.

¹² “Waste in our Water: The Annual Cost to California Communities of Reducing Litter that Pollutes our Waterways.” Kier Associates for the Natural Resources Defense Council, August 2013.

c) Source data provided for direct and contracted labor costs. Bags collected derived based on \$71 cost per bag.

d) Hard data is not tracked at the state level. MIDOT staff estimate that the quantity collected is 10% of that collected by state & county employees.

1) Adopt a Highway: About two-thirds of the nearly 10,000 miles of roads and highways in Michigan are cleaned up through the Adopt a Highway program—including many rural areas that do not experience high traffic volumes. Under this program, labor is provided by volunteers, including individuals, businesses, student organizations such as college fraternities, and community and civic groups. Two-mile sections of roadway (both directions) are assigned to and tracked by a local DOT coordinator. Each group is issued a 2-year permit to do litter pickup, and must commit to taking part in at least 2 of 3 pickup periods: April, July and September. The local coordinator tracks volunteers, hours and quantities collected, and submits forms to the DOT. A benefit to the state is calculated based on volunteer labor value, which is roughly \$21.50 per person-hour plus benefits that would be paid if the state were paying its own employees for this labor. According to the DOT, 70,000 30-gallon trash bags of litter were collected in 2013, representing an avoided labor cost benefit to the state of about \$5 million, for a per-mile cost savings of \$384. According to the DOT, the majority of items littered are fast food packaging, non-carbonated beverage containers and other packaging materials.

*"In Michigan, we have a beverage container deposit law, so we don't get a lot of pop and beer bottles and cans on the road. We get a lot of water bottles and fast food containers and plastic that blows off semi trucks. Packaging material. Odds and ends. As far as weight, the majority would be fast food packaging, non-carbonated beverage containers, and other packaging materials. That is anecdotal, not based on a study."
--Tim Jones, Roadside Operations Specialist, MI DOT*

2) Sponsor a Highway: Under this program, participating companies, organizations and civic groups do not pick up litter themselves, but sponsor paid litter pickup through a private company that MIDOT contracts with: the Adopt a Highway Maintenance Corporation. At the present time, 61 sponsors pay this corporation to do monthly litter pickups on their behalf. However, since a sponsorship covers only one mile of roadway, the impact of this program is relatively minor relative to the others. According to MI DOT, the quantity picked up in 2013 was approximately 3,500 bags. Assuming the same cost structure as in the Adopt a Highway program, the value of this sponsored labor is approximately \$250,000. The per-mile cost savings is \$347, roughly equivalent to that of the Adopt a Highway program.

3) State and county employees: Litter removal is done by transportation maintenance workers who are direct employees of MI DOT, and by contract employees from the 63 Michigan counties that MI DOT pays to do mowing and litter pickup on about 3,000 miles of state roads and medians, many of which are located in and around metropolitan Detroit, where traffic volumes are high—as many as 250,000 cars per day—leading to litter deposition rates that are three times the average in the more rural Adopt a Highway areas. Litter removal expenditures under this program were \$3.5 million in 2013, for a per-mile cost of \$1,167.

4) Incarcerated labor and community service workers: Sheriffs throughout Michigan use county jail inmates, as well as individuals who have community service hours to perform, to pick up roadside litter. Utilization of these work details varies from county to county. Quantitative data, including person-hours spent, bags of litter collected or miles cleaned, may be tracked at the local level by the sheriffs, but there is no reporting required by the state, and therefore exact numbers are unavailable. According to a very rough estimate by MI DOT, these crews may pick up 10-15% of the amount that is collected by paid state and county workers. Using the more conservative 10% estimate would mean these forces are responsible for picking up almost 5,000 bags of litter annually, at an avoided labor cost of roughly \$350,000.

In sum, the direct and avoided labor cost of litter collection on Michigan state roads and highways is estimated to be more than \$9 million annually. The average cost of litter pickup is estimated to be roughly \$535 per road-mile cleaned.

This average masks a wide range of variability in costs due to both litter density (deposition rates), and frequency of cleanup. While the Adopt a Highway program requires participating sponsors to pick up litter 2-3 times per year, and the Sponsor a Highway requires monthly cleanups, there is no set schedule or requirement for the 3,000 miles of roads maintained by Direct Forces. Some might be cleaned once or twice per year, but according to the MI DOT, some areas do not get cleaned at all due to budget shortfalls—such as following heavy winters that use up available funds for snowplowing. So even this \$535 average does not represent the true cost of cleaning up litter on state roads in Michigan.

According to a study done by the state of Ohio, it takes an average of 39 person-hours to clean up one mile of roadside litter.¹³ That figure, multiplied by an hourly labor cost of \$21, yields a total labor cost of \$819 per mile of roadside cleaned: 56% higher than the average Michigan estimate. The study acknowledges that litter deposition rates vary widely by traffic density, as do the range of cleanup costs.

Cleanup Costs for Stormwater Catchment Areas in Michigan

The Michigan Department of Transportation is also responsible for removing litter and natural debris from culverts, drains and screens in stormwater collection areas. According to MI DOT, a total of \$5.3 million was spent in cleaning up stormwater litter and debris in 2013—which represents more than 11 thousand person-hours. The hourly costs of this removal are quite high, ranging from about \$300 to more than \$1,000, as Table 4 shows.

¹³“Ohio Statewide Litter Study, Final Report,” Davey Resource Group and Ohio Department of Natural Resources, June 2004.

MI DOT has said that while no data is officially collected on the composition of the material collected, anecdotally it is approximately 75% natural materials (sediment and organics including leaves and lawn clippings), and approximately 25% containers and other packaging. Anecdotally, the man-made trash portion consists of roughly 25% non-deposit beverage bottles and cans, with fast food wrappers, small boxes and disposable cups accounting for the remainder. In other words, approximately 6% of all material collected from Michigan storm drains is non-carbonated beverage containers, which would mean that more than \$330 thousand in litter cleanup costs is attributable to non-deposit bottles and cans. The stormwater cleanout costs in Table 4 are for Michigan state government only, and do not include costs for other governmental agencies, like cities and counties.

Table 4. State of Michigan Stormwater Litter and Debris Removal Costs, 2013

	Hours	Total cost	Hourly Cost
Catch basin cleaning:	2,568	\$2,914,535	\$1,135
Ditch cleanout:	3,684	\$862,276	\$234
Culvert Cleanout:	5,157	\$1,541,981	\$299
Total (a)	11,409	\$5,318,792	\$466

Notes: Includes litter, sediment and leaves/grass. Tonnage disposed is not tracked, and types of debris are not further categorized. Anecdotally, MI DOT reports that approximately 6% of all the material collected consists of non-carbonated beverage containers.

Source: personal communication with Hal Zweng, Stormwater Management Program Manager, Michigan Department of Transportation, Dec. 9, 2014

Cleanup Costs for Beaches and Waterways in Michigan

AGL conducts volunteer litter cleanup efforts on hundreds of miles of Michigan beaches—including along Lake Michigan, Lake Superior, Lake Huron and the Detroit River. In 2013, 4,589 volunteers spent 10,857 person-hours cleaning up almost 12,000 pounds of litter along some 500 miles of beaches in Michigan. Were this time monetized at \$21.50 per hour (the labor rate used by the MI DOT), it would be valued at \$233,433. These costs are for one volunteer organization only.

The State of Michigan Department of Environmental Quality (DEQ) provides \$25,000 per year in grant funding for “Volunteer River, Stream and Creek Cleanup Grants,”¹⁴ and requires a minimum 25% match.

Cost Summary, Litter Cleanup Costs in Michigan

As Table 5 shows on the following page, the combined value of the paid, volunteer and incarcerated labor expended to remove litter along Michigan roads, highways and beaches and out of storm drains approached \$15 million in 2013.

¹⁴ http://www.michigan.gov/deq/0,4561,7-135-3307_3515-314495--,00.html

Table 5. Cost Summary, Litter Cleanup in Michigan, 2013

Entity Type or Location	Person-Hours	Total Cost Estimate
Roads, State and County		
Adopt a Highway	232,558	\$5,000,000
Sponsor a Highway	11,628	\$250,000
State & county employees	162,791	\$3,500,000
Incarcerated labor and community service	16,279	\$350,000
Stormwater (MI DOT)		
Catch basin cleaning	2,568	\$2,914,535
Ditch cleanout	3,684	\$862,276
Culvert cleanout	5,157	\$1,541,981
Beaches		
Volunteers (Alliance for the Great Lakes)	10,857	\$233,433
State of MI DEQ waterway cleanup grant		\$25,000
Cities, using MI's proportion of KAB estimate		\$25,000,000
Businesses, using MI's proportion of KAB estimate		\$286,000,000
Educational, using MI's proportion of KAB estimate		\$8,000,000
Total	445,522	\$333,702,225

Notes and sources:

Roads and Stormwater: Michigan Dept. of Transportation (see Tables 2 and 3).

Beaches: Hours spent: Alliance for the Great Lakes. Value calculated at \$21.50/hour.

Above we referenced the NRDC study that estimated California communities (cities and towns) spend half a billion dollars annually on litter abatement. If this figure is adjusted for Michigan's population (which is about 27% that of California), it would mean that Michigan municipalities are spending about \$133 million annually on litter abatement—far more than the \$14.6 million expended by MIDOT and by community volunteers (and not including expenditures by private businesses and homeowners).

Other Litter Impact Cost Estimates

The DSM study for Rhode Island cited a 2003 Washington State study¹⁵ that found litter cleanup costs were approximately \$1,200 per ton (equivalent to \$1,544 in 2014 dollars); DSM extrapolated that the implementation of an "expanded" beverage container deposit law in

¹⁵DSM study, citing J. Morris, B. Smith and R. Hlavka, *Economic & Environmental Benefits of a Deposit System for Beverage Containers in the State of Washington*, April, 2005

Rhode Island (one that includes non-carbonated and carbonated beverages) could reduce litter collection costs by 9%. However, the “total” litter collection costs were for “roadside litter mixtures.”

A study conducted by Tellus Institute for the Great Lakes Protection Fund found several studies that documented litter reduction following implementation of container deposit programs. According to these studies, container deposits were tied not only to reduced costs for litter cleanup but reduced injuries to children from littered glass containers as well as reduced damages to farm operations (livestock injuries and tractor-tire damage). Tellus estimated these monetary benefits at \$2.95 per capita (in 2000 dollars). Applying Michigan’s population of 9.9 million and assuming 36.3% inflation from 2000 to 2015 yields a cost savings estimate of \$4,574,135 in addition to other litter cleanup cost savings discussed in this paper.

Summary

Impact of Beverage Container Deposit Programs on Reducing Litter

Beverage container deposit programs have two complementary features that can act to reduce the prevalence of beverage container litter. The first is that some people will be less likely to litter beverage containers because they realize that the containers have a monetary value when returned for redemption. The second is that, if a beverage container is littered, another person might pick up the container, collect it and return it for its redemption value.

The collection of beverage containers after they have been littered is mainly a pedestrian activity and mainly occurs in areas that are easily accessible. In most places it is illegal, dangerous or inconvenient to walk on highways or interstates, so it is unlikely that littered beverage containers in those locations would ever be recovered by bottle and can collectors, unless we are merely considering the on-ramps and off-ramps of highways. This is an important fact to consider when reviewing litter statistics that are based on studies of *roadside* litter.

Regarding cost estimates, we found that all available cost estimate studies acknowledged that they underestimated costs, mainly due to lack of complete data collection, or lack of responses to cost surveys. The cleanup cost estimates provided in this paper should therefore be considered lower bound estimates.

CRI estimates that all entities in the state of Michigan are collectively saving at least \$8.3 million based on the lower bound cost estimates for litter cleanup and a reduction of beverage container litter of 2.5%, based on the AGL data for various states. In addition, we estimate potential savings of \$4.6 million from injury prevention and reduced farm damage. The sum of these is \$12.9 million per year in Michigan. The current deposit law in Michigan only covers carbonated beverage containers, so greater cost savings would be achieved if the law were expanded to include non-carbonated beverages.

Who Pays for Litter Cleanup?

Based on the data from the KAB survey, America's businesses are spending approximately \$9.1 billion each year to clean up litter. This is 80% of total litter spending. Government pays the next largest share, 12%, or \$1.3 billion. KAB estimated \$707 million, or 6% of the total, was spent annually by nongovernmental organizations (NGOs) using the dollar value of the hours invested by volunteers conducting cleanups. However, that estimate only includes KAB, KAB affiliates, the Ocean Conservancy and the Adopt a Highway organization, and does not include the work of hundreds of state, regional and local NGOs working across the country.

Moreover, there is one important stakeholder missing from KAB's discussion of cleanup costs, and that is the producers (or brandowners) of the littered materials. The makers of commonly littered products, including beverages, fast foods and cigarettes, are not included in the list of entities paying the most to clean up litter. These corporations donate to KAB and the Ocean Conservancy, as well as to other organizations, but their contributions seem to amount to less than one percent of overall cleanup costs.

The Real Costs of Litter Cleanup are Unknown

Several of the studies we reviewed emphasized the fact that counting and estimating beverage container litter on roadsides as a percentage of total litter on roadsides is systematically underestimated. When bottles are broken, the items are counted as "glass pieces" instead of a "glass bottle." This decreases the percentage of "glass bottles" by a large factor, because each bottle can be broken into many smaller pieces. Similarly, many studies referred to small pieces of all materials that are created when roadsides are mowed. Again, these materials are counted as "pieces," which significantly decreases the apparent percentages of the original, unbroken items.

Lastly, the word "cost" used throughout this paper is really a misnomer. Most litter cost studies refer to the inability to gather all available data. Even if we knew about total expenditures from all sources, we would only know what is currently being spent, and current spending is limited by budget constraints. We did not find any evidence that cleanup organizations, including governmental agencies and NGOs, were able to clean up outdoor areas and keep them clean 100% of the time. Cleaning up litter is a constant battle, and agencies and NGOs are struggling merely to contain the problem. The real costs of cleaning up litter, and ensuring that harmful items are being kept out of waterways, is completely unknown.