Policy Options for Plastic Bottle Legislation for a Trash Free Anacostia

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1. Acknowledgments

We want to thank Trey Sherard and Christine Burns of Anacostia Riverkeeper; J.T. Calhoun; Tom Fellona; Dr. Peter Linquiti of The George Washington University, and everyone we interviewed for this project for their guidance and support.

2. Executive Memo

Client: Trey Sherard and Christine Burns, Anacostia Riverkeeper

Background:

In Washington D.C., a large portion of waste entering the Anacostia River is plastic beverage containers which are causing damage to the environment, the health of residents, and environmental injustices across the city. The Anacostia River was once a thriving ecosystem historically abused by policymakers, mayors, and institutional neglect. From three river cleanups in July 2021 and in January and March 2022, 2,119 plastic beverage containers were recovered from the Anacostia. Overall, plastic beverage containers make up 60% by weight of all litter found in the river (T. Sherard & C. Burns, personal communication, 2021).

Research Question:

What is the optimal policy for D.C. to decrease plastic beverage container pollution in the Anacostia River?

Methodology:

We identified the problem after conducting bottle audits at different locations on the Anacostia River. After collecting data, a literature review was conducted on potential policy options, previous D.C. initiatives, and the plastic bottle industry. During the literature review, experts specializing in Bottle Bill policy, Sugar-Sweetened Beverage Tax policy, the current political landscape of D.C., and the Anacostia River were chosen for Semi-Structured Interviews (SSI). Using information gathered from the literature review and SSIs, we conducted case studies for a Bottle Tax, Bottle Bill, and Bottle Ban to determine defining elements. We then developed policy options and chose criteria to analyze the benefits of the alternatives. Finally, a Criteria Alternative Matrix analysis was conducted, which served as the foundation for a final policy recommendation.

Policy Options:

Plastic Bottle Tax: Places a $0.50 excise tax on distributors for each plastic beverage container distributed in D.C.
Bottle Bill: Encourages beverage container recycling through monetization of a rebate.
Plastic Bottle Ban: D.C. wide ban on the sale of all plastic beverage containers less than 17 ounces.
Shelf Space Percentage: Retailers required to phase out 75% of plastic beverage containers over 10 years.
Status Quo: No policy action to limit plastic beverage containers entering the Anacostia River.

Criteria: Maximize Efficacy | Maximize Administrative Feasibility | Maximize Environmental Equity | Minimize Cost to Relevant Private Stakeholders

Findings and Significant Recommendations:

After extensive background research and analysis, we conclude it would be best to implement a producer-run Bottle Bill policy in D.C. The Bottle Bill policy ranks first in the Environmental Equity criterion and second in Efficacy and Administrative Feasibility. The Bottle Bill aims to create equity among marginalized communities by providing the opportunity to rebate the additional cost of the beverage container. The Bottle Bill is expected to have high costs to private stakeholders, potentially leading to resistance from the bottle industry. While it will impose a relatively high cost on private stakeholders, the policy's efficacy, feasibility, and equity components will outweigh this tradeoff.

3. Introduction

3.1. Client & Needs

This project is conducted for our client, Anacostia Riverkeeper, with representatives Christine Burns and Trey Sherard. This analysis is intended to help Anacostia Riverkeeper decide which policies would most effectively reduce and prevent plastic beverage container pollution from entering the Anacostia Watershed.

3.2. *Scope of Research*

Due to the client's requests and the project's time constraints, this analysis does not include litter reduction policies. The client feels that litter reduction policies have reached their maximum effectiveness in the Anacostia River. In addition, this analysis does not consider the GreenHouse Gas emissions emitted by the plastic bottle and recycling industries.

3.3. Core Policy Questions (Research Puzzle)

After defining the scope of research with Anacostia Riverkeepers, we identified the core policy question for our project: *What is the optimal policy for D.C. to decrease plastic beverage container pollution in the Anacostia River*?

3.4. Research Questions

With our core policy question and our clients needs in mind, we created five questions to guide our research for this project. We started with broader questions and narrowed them down to fit the scope of D.C.

- What are current policies to decrease plastic beverage container waste in watersheds across the U.S.?
- What plastic beverage container reduction policies would be most effective in D.C.?
- What would be the cost to private stakeholders for plastic beverage container reduction policies in D.C.?
- How would low income communities be impacted by the policy alternatives?
- What is the administrative feasibility of the policy alternatives for plastic beverage container reduction for the D.C. government?

3.5. Outline of Analysis

This policy analysis evaluates several alternatives to reduce plastic beverage container pollution in the Anacostia River in Washington D.C. Our client, Anacostia Riverkeeper, has asked our team to focus strictly on plastic beverage containers. Therefore, we analyzed policy options that incentivize stakeholders, retailers, and consumers in the plastic bottle market. With this focus in mind, we seek to achieve our client’s goal of diverting plastic beverage containers from entering the Anacostia River. This project uses a standard policy analysis paradigm to evaluate alternatives and provide a final policy recommendation.

The policy analysis is laid out as follows:

- A background on plastic pollution and the plastic bottle industry in the U.S.
- An examination of plastic beverage container pollution in the Anacostia River and failed attempts by the D.C. government to rectify the problem.
- An explanation of the research methodologies used in the policy analysis.
- An explanation of the policy alternatives and criteria.
- A scoring of the policy alternatives against the criteria using an Analytical Hierarchy Process (AHP) model and Criteria-Alternatives Matrix (CAM).
- An assessment of the trade-offs between policy alternatives.
- A final recommendation and presentation of significant findings.

3.6. Problem Statement

In Washington D.C., a large portion of waste entering the Anacostia River is plastic beverage containers which are causing damage to the environment, the health of residents, and environmental injustices across the city. The river is roughly 8.5 miles long, beginning in Prince George's County, Maryland, emptying into the Potomac River in D.C. (Anacostia Riverkeeper, n.d.). The Anacostia River was once a thriving ecosystem that was abused throughout history by policymakers, mayors, and institutions. Plastic pollution in the Anacostia River has been a problem for decades. As surveyed by floating trash traps and shoreline specific cleanups by Anacostia Riverkeeper, plastic beverage containers make up 60% by weight of all trash in the Anacostia River (T. Sherard & C. Burns, personal communication, 2021). From just three river cleanups between 2021 and 2022, 2,119 plastic beverage containers were recovered from the Anacostia compared to 146 non-beverage containers, as seen in Chart 1. Previous initiatives have attempted to clean up plastic beverage containers in the river. However, they have not created significant progress, and a new policy is needed to solve the plastic beverage container pollution problem.

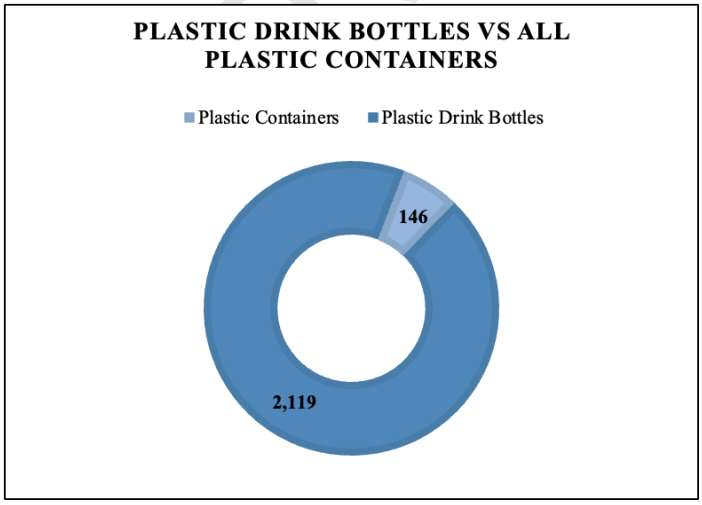


Chart 1: Three river cleanups done in July 2021, January 2022, and March 2022 on the Anacostia River produced a total of 2,265 plastic containers (everything from plastic beverage containers to laundry detergent containers). Of the containers collected 2,119, 94%, of containers found were plastic beverage containers.

History of Plastics and the Industry

For over 100 years, plastics have been ubiquitous in the market, from being used in World War II to finding their way into everyday products. Since the 1960s, the U.S. Environmental Protection Agency (EPA) has measured plastic bottle waste in Municipal Solid Waste Facilities. In 2018, the EPA found that out of 35,680 U.S. Tons of plastic bottle waste, only 8.7% was recycled, as seen in Image 1 (EPA, 2021). Additionally, in 2018, the U.S. sold 70.7 billion plastic water bottles. On average, only one out of four bottles are recycled, with the remaining bottles entering the waste stream as depicted in Image 2 (Romer, 2021; CRI, 2020). This means Americans did not recycle over 53 billion water bottles in 2018. These statistics do not account for other plastic beverage containers sold and recycled.

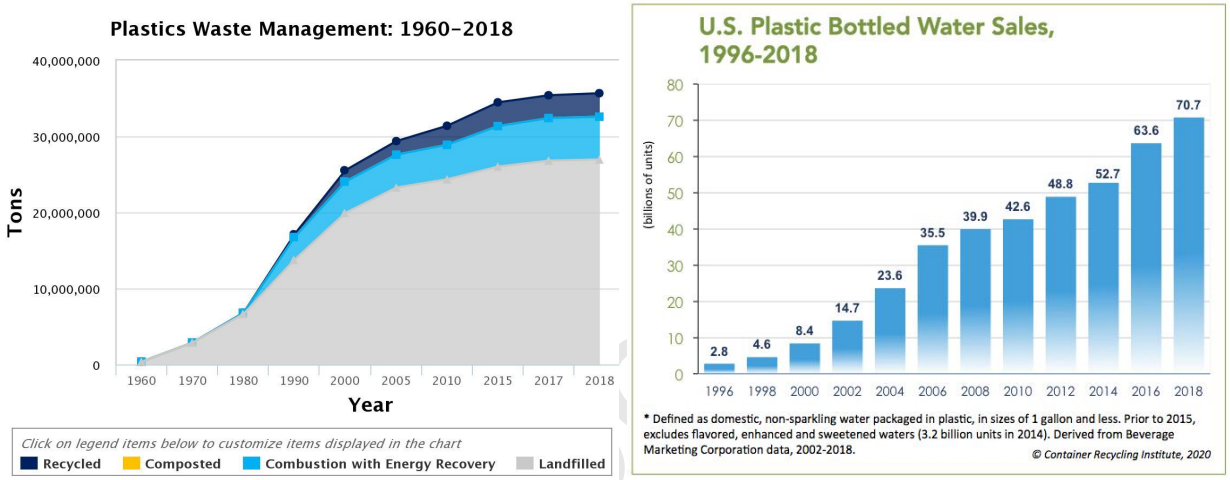


Image 1 (Left): Shows the amount of plastic that is sent to landfills compared to the amount recycled (EPA, 2021). Image 2 (Right): Shows the increase in water bottles sales from 1996 to 2018 (CRI, 2020).

The high prevalence of plastic in the U.S. economy has accelerated the mass production of plastic for everyday products. The U.S. Plastic Bottle Industry and their respective associations, such as The American Beverage Association, began to rely heavily on plastic materials due to their lower production costs, recyclability, and ease of design (Research and Markets, 2020; Mordor Intelligence, 2019). The industry continued to grow as consumers began to prefer plastic materials due to their portable nature and affordability. Consequently, plastic bottle production is expected to grow by 5.5% each year (Research and Markets, 2020). The industry has confronted legislation on plastic products for over 70 years and has invested heavily in lobbying campaigns against plastic beverage container regulation. (Tangpouri et al., 2022). They have also publicly opposed and successfully delayed bills that address plastic pollution.

However, as the general public is increasingly concerned about plastic pollution, large beverage brands have voluntarily committed to reducing plastic waste (Tangpouri et al., 2022). A recent popular approach to addressing the concerns has been investing and increasing the amount of recycled content and bio-based materials in plastic bottle production. Nestle has been the most progressive in using and buying recycled content, paying four times more than if they produced

with virgin plastic[1] (C. Dreizen, personal communication, March 4, 2022). However, virgin plastic continues to be used in the U.S. plastic bottle industry. Industry efforts are not effectively addressing or managing the increasing amount of plastic waste entering the environment and are externalizing pollution costs to consumers through higher prices for alternative materials. The following section further defines the problem with the mass production of plastic beverage containers in the U.S.

Defining the Problem

The Anacostia River has a rich history of being a lifeline for the residents of D.C. However, environmental degradation and racism have long impacted its residents. In the 1940s, D.C. began building segregated public housing throughout the city. Following World War II, post-war development in cities was at the forefront of the Franklin Roosevelt administration. He enacted Title I of the Housing Act of 1949, known as the urban renewal or "slum clearance" program (LaVoice, n.d.). By the late 1950s, low-income, primarily black neighborhoods were demolished for federally funded urban renewal programs, displacing families to new expanded public housing east of the Anacostia River. The displacement of mostly black residents of D.C. for slum clearance continued through the 1960s, and the public housing on the east side of the Anacostia River became a refuge for low-income black residents (Shoenfeld, 2019). Today, the wards east of the Anacostia River, wards seven and eight, still feature the lowest income out of all eight wards and have the highest non-white population, as shown in Chart 2 (D.C.'s Economic Strategy, n.d.).

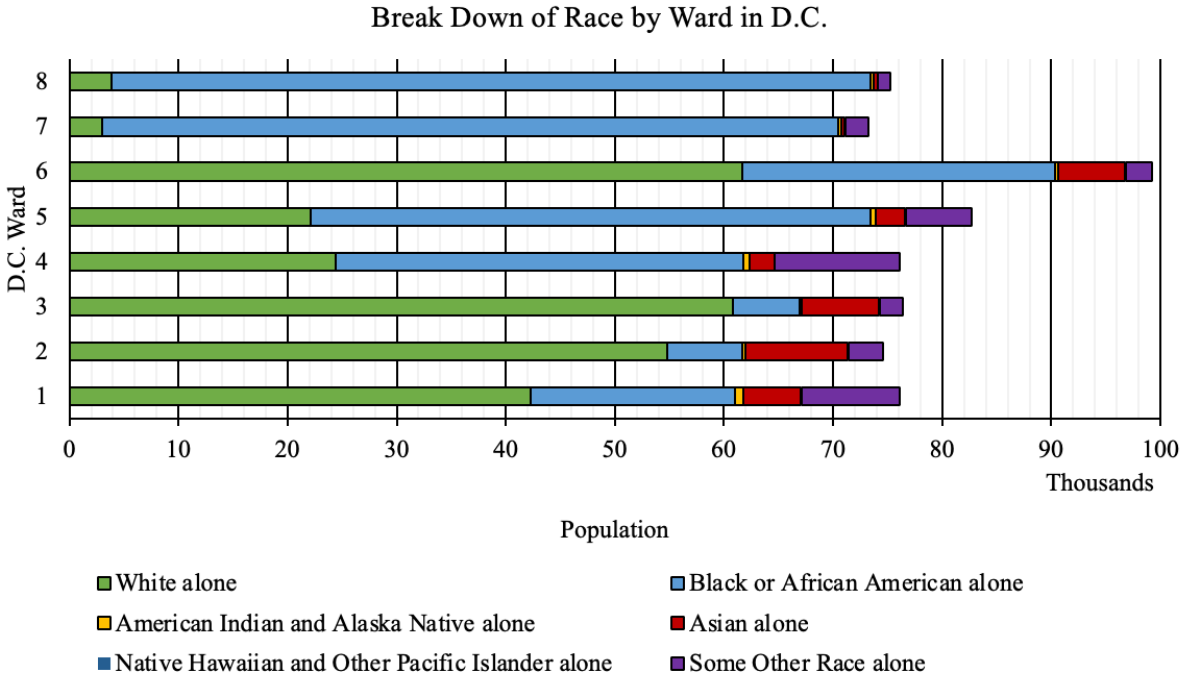


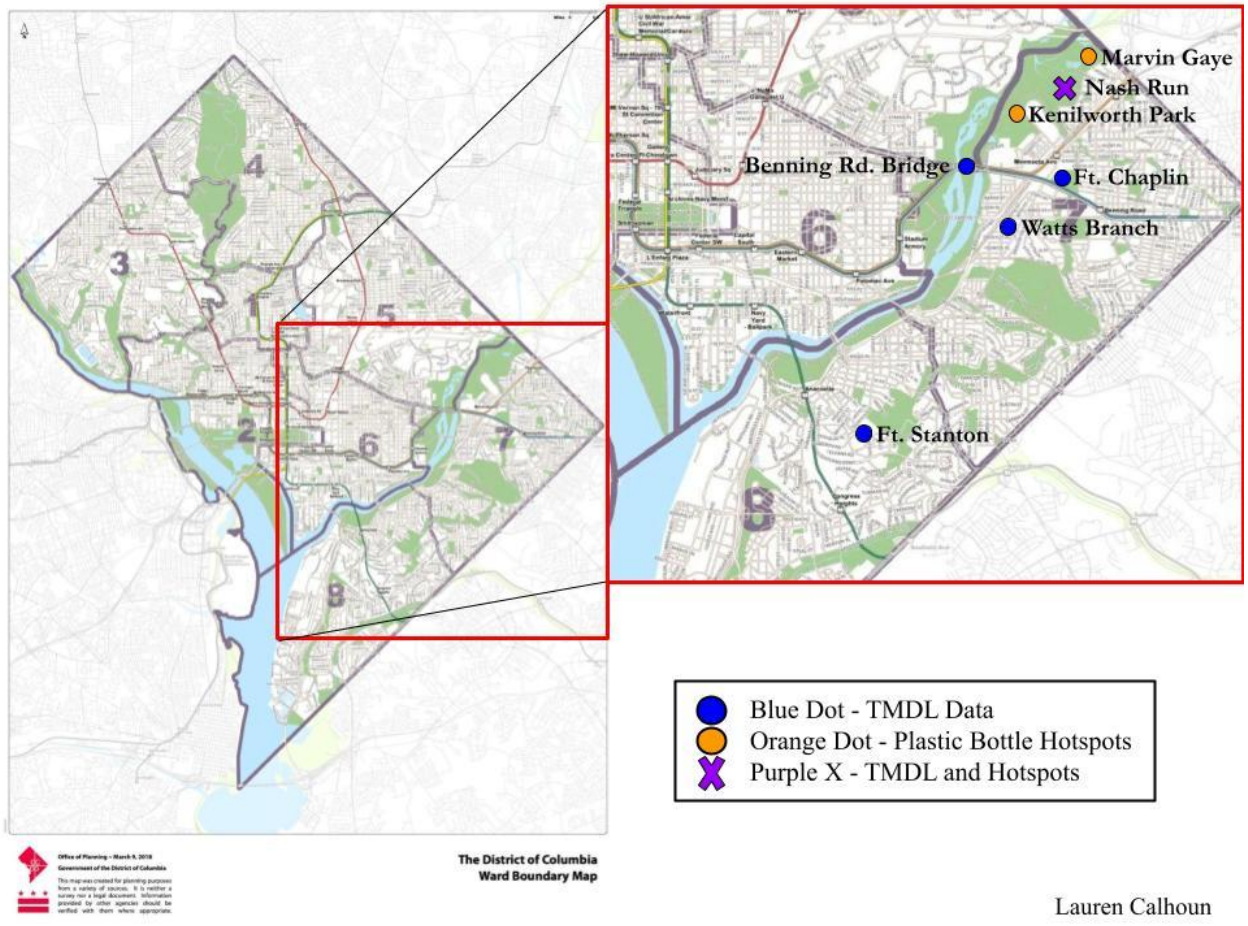
Chart 2: Shows the breakdown of race by ward in D.C. (D.C. Office of Planning, 2020).

[1] Virgin plastic is plastic that has been newly created without any recycled material.

Urban redevelopment projects in D.C. began mass urban sprawl, dramatically changing the city's landscape. New construction led to more people moving into the area fueling even more development. This increase in development grew impermeable surfaces in the area and increased trash flow into the Anacostia River (Powell, 2010). The Anacostia River is one of the only rivers in the United States that is designated as impaired with trash and is required to have a total maximum daily load (TMDL)[2] under the Clean Water Act (CWA) (O'Donnell, 2022). In conjunction with the Maryland Department of the Environment, the D.C. Department of Energy and the Environment (DOEE) was required to write the *Total Maximum Daily Load of Trash for the Anacostia River Watershed, Montgomery and Prince George's Counties, Maryland and the District of Columbia*, which the EPA approved in 2010 (EPA, 2010). The Anacostia River is still considered impaired by trash, with an average of 58 pieces of trash per 100 feet of river length (DOEE & MDE, 2010). The DOEE is currently working on a revised TMDL after the National Resource Defense Council (NRDC) won a lawsuit against the EPA in 2016, arguing that the 2010 trash clean up strategy was flawed (T. Wells, personal communication, March 3, 2022; LGWM, 2020).

The TMDL highlighted that the lower-income neighborhoods on the east side of the Anacostia are trash hotspots or areas with significantly more trash. In addition to the data from the TMDL, Anacostia Riverkeeper has found similar results for plastic beverage containers during clean up efforts around the city. Map 1 shows the outlines of the wards of D.C., with the dots representing trash hotspots. The blue dots are trash hotspots found in the TMDL, the orange dots are trash hotspots for plastic beverage containers, and the purple "X" is a hotspot for trash and plastic beverage containers. Map 1 highlights the problem that trash pollution is concentrated in wards seven and eight. The abundance of trash in these neighborhoods has harmful effects on the residents of those wards and D.C. as a whole.

[2] A TMDL is a regulatory term in the Clean Water Act under section 303(d) that sets an allowable amount of pollutant for an impaired body of water.



Map 1: This map shows the outline of each ward in D.C. with a zoomed in picture showing plastic beverage container pollution hotspots in D.C. (DOEE & MDE, 2010; T. Sherard & C. Burns, personal communication, 2021).

Plastic in waterways causes harm to the mental and physical health of D.C. residents. Interaction with nature is directly linked to happiness, intelligence, and economic success for humans (Schlyer, n.d.). In addition, an increase in interaction with clean nature has increased test scores in schools, reduced violence, and lowered crime rates (Schlyer, n.d.). However, multiple studies have found that litter can diminish the positive psychological effects of the outdoor environment. Specifically, litter stemming from the public, such as plastic beverage containers, impacted people's psychological well-being (Schlyer, n.d.). In D.C., plastic pollution's harmful mental effects disproportionately affect low-income, mainly black neighborhoods as their natural environment is the most polluted with trash. In addition to the mental effects of D.C.'s significant plastic pollution problem, these neighborhoods are also disproportionately affected by the physical health impacts.

Plastic in the natural environment poses ecological and health threats to our earth. The most harm comes from broken down pieces of plastic, known as microplastics. Research has shown that microplastics ingested by humans and aquatic organisms can cause health problems.

Certain chemicals in plastic, such as Bisphenol A (BPA) or phthalates, can leach into an organism's body once ingested and are known endocrine disruptors. These chemicals are associated with hormonal cancers, reproductive problems, metabolic disorders, and neurodevelopmental conditions (Campanale et al., 2020). Additionally, microplastics can contain heavy metals. The leaching of these heavy metals reduces the water quality and has been known to cause confusion and performance reduction among freshwater species. Globally, 70% of all freshwater fish have ingested microplastics, and those closer to urban areas, such as D.C., have higher ingestion rates (Sarijan et al., 2020). Humans are also consuming heavy metals through bioaccumulation, which cause similar health problems to that of BPA or phthalates.

Research into microplastics in the Anacostia River is new. However, recent sampling by Anacostia Riverkeeper found microplastics in four large tributaries: Bladensburg Waterfront Park, Watts Branch, Hickey Run, and Yards Park (O'Donnell, 2022). Table 1 shows the number of microplastics found during sampling in particles per liter (PPL). In comparison, the most microplastic polluted river globally is found in the River Thames in England, having over 1,000 microplastic PPL (Carrington, 2019). The Anacostia River has around half of that but is still considered highly polluted with microplastics.

Microplastic Pollution in the Anacostia River				
Particle Size	**Bladensburg Waterfront Park**	**Watts Branch**	**Hickey Run**	**Yards Park**
>10≤100µm	374.80	441.73	455.11	508.65
>100µm ≤500µm	40.16	107.09	66.93	147.24
>500 µm ≤1mm	13.39	13.39	<AS	13.39
>1mm≤5mm	13.39	13.39	<AS	26.77
>5mm	13.39	<AS	<AS	<AS
Total MPP/L	441.73	575.58	522.04	696.05

[1]1µm = .001mm
[2]MPP/L = Microplastic particles per liter
[3]AS = Analytical Sensitivity

Table 1: Shows the amount of microplastics in Microplastic particles per liter collected in samples from four main tributaries in the Anacostia River. It is broken down by size of piece of microplastic found, with a total at the bottom of the table (O'Donnell, 2022).

Plastic pollution is a considerable threat to the health and safety of D.C.'s ecosystem and residents. Previous initiatives in D.C., including the TMDL, have attempted to control plastic pollution in the Anacostia River, but none have been successful. The next section describes two previous initiatives by the D.C. government to curb plastic beverage container pollution in the Anacostia.

Washington D.C. Initiatives

D.C.'s only previous attempt at curbing plastic beverage container pollution was in the 1970s and 80s. Although The D.C. Council considered similar initiatives earlier, in 1974, they approved a bill requiring a five-cent refund and ban on pull tabs which the mayor ultimately vetoed (Clay, 1989). In 1986, advocates for plastic bottle reduction policy created *The District of Columbia Beverage Container Acceptance and Refund Act*, which had the same requirements as the 1974 initiative. Advocates began a campaign to get the required signatures to add the initiative to the ballot. Simultaneously, the industry began forming a coalition to oppose the initiative. The industry coalition spent an estimated $2 million throughout their campaign (Clay, 1989). They strategically reframed the problem as a recycling issue that a refund program could not solve and took advantage of concerns related to increased costs for low-income communities. The coalition conducted such a successful campaign that support for the initiative fell from 70% to 45% (Clay, 1989). The initiative failed, and there have been no further attempts by the D.C. Council to address plastic beverage container pollution (T. Wells, personal communication, March 3, 2022).

In 2014, D.C. implemented a Zero Waste Initiative under the *Sustainable Solid Waste Management Amendment Act* to divert 80% of the city's waste from landfills by 2032 (Department of Public Works, 2014). The initiative takes a multifaceted approach to waste reduction, focusing on waste sources, reusing, recycling, composting, and converting waste to energy. This initiative enlists multiple departments, including the D.C. Department of Public Works (DPW), DOEE, Department of General Services (DGS), and Department of Parks and Recreation (DPP) (*Zero Waste DC*, 2022). The program showed promising results in 2015 when a year after implementation, there was a 21% diversion of waste (DPW et al., 2016). However, by 2020 waste diversion had only increased to 25% (DOEE, 2020) (Zero Waste, 2021).

4. Methodology

The project is split into four major stages: Stage One-Background, Stage Two-Research, Stage Three-Analysis, and Stage Four-Our Recommendation. The flow of the four stages can be seen in Chart 3.

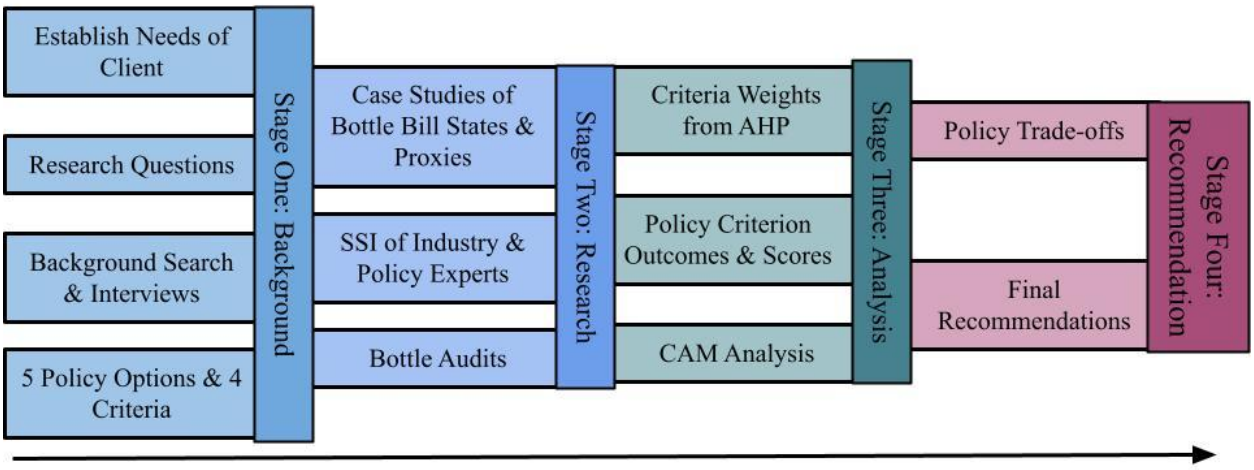


Chart 3: Flow chart demonstrating the methodological steps taken in the analysis to reach a final recommendation.

Stage One involved gathering background information, where we met with the client to learn what gaps exist in their current work and discuss how we can meet their needs. After discussing extensively with Anacostia Riverkeepers, we developed a "research puzzle" culminating in a problem statement and five detailed research questions. We later used the research questions to develop our criteria for the policy analysis. To fully understand the different policy options to best handle plastic beverage container pollution in the Anacostia River, we assessed the most frequent policy solutions to mitigate plastic pollution. After conducting background research, we met with several experts for educational interviews to get a better understanding of the problem and policy options for D.C. Using the information from the background search and interviews, we developed our five policy alternatives.

Stage Two was research and data collection. To better understand the extent of the plastic beverage container problem, we conducted Bottle Audits from three river cleanups. We used this information to determine what policies best fit D.C.'s unique needs. After deciding on our policy alternatives, we did deep dives into the literature on each alternative. During the literature review, we found policy and industry experts for each alternative to conduct semi-structured interviews (SSI). Using information gathered from the literature review and SSIs, we conducted case studies for a Bottle Tax, a Bottle Bill, and a Bottle Ban as proxies to determine defining elements and key takeaways for our alternatives. No case study was conducted for the Shelf Space Percentage policy as it was an original creation. By developing a solid understanding of the implication of policies and their proxies, we modeled our policy

options to fit the needs of D.C. Following our policy alternatives, we picked criteria relevant to D.C. to compare our policies against. We ultimately decided the most relevant criteria are environmental equity to minority and low-income populations in D.C., the efficacy of the policy to reduce plastic beverage containers, the administrative feasibility of the D.C. government to implement, enforce, and maintain the policy, and lastly, the cost to private stakeholders such as bottle and drink corporations affected by the policy.

Stage Three of our paper was the analysis section. This section consisted of our Analytical Hierarchy Process (AHP), which was developed from a survey given to the client to best assess the criteria weights and importance. Further analysis was conducted to measure the policy options against the criteria and assign scores and outcomes to each policy. With these scores in mind, we developed a Criteria Alternative Matrix (CAM) to organize and compare policy outcomes to inform our final recommendation.

In Stage Four, each policy was scrutinized against the individual criteria, and alternatives were given a score based on the criterion. A score of one means the policy does not fill the criterion, and a score of ten means the policy perfectly meets the criterion. With the criteria weights and policy scores, we entered the scores into a Criteria Alternatives Matrix (CAM) to calculate the final scores for each policy to assess trade-offs. All previous research and analysis culminated in a final policy recommendation.

5. Literature Review

5.1. Case Studies Overview

This section examines case studies from around the United States to help formulate the final analysis and policy recommendation. We conducted interviews with relevant stakeholders for each policy to better understand their elements.

Outside of the Bottle Bill, no policies within our analysis have been implemented at the state level. However, in this section, we use proxies case studies to formulate the Bottle Tax, Bottle Bill, and Bottle Ban analysis. We reviewed six states for the Bottle Bill: California, Maine, Massachusetts, Michigan, Oregon, and Vermont. These six states were chosen to be part of the case study because their unique implementation, framework, and bill history set them apart from other states. We selected the D.C. styrofoam ban for the Bottle Ban policy and referenced a withdrawn law from the City of Cape Cod that banned plastic beverage containers outright. Further, we referenced the Sugar-Sweetened Beverage Tax (SSB tax) from several cities: Albany, Berkeley, Oakland, and San Francisco, California; Boulder, Colorado; Cook County, Illinois; Philadelphia, Pennsylvania; and Seattle, Washington to assist in our analysis. As the authors of this paper created the shelf percentage policy option, there is no proxy case study or legislation to reference.

5.1.1. Bottle Tax Case Studies

This section discusses two taxes, an SSB tax and the D.C. Bag Law, used to formulate a plastic bottle tax for D.C. The SSB tax is the proxy case for our policy, and the section discusses the efficacy and market impact of the policy and why it is a good model for a plastic bottle tax. Following the SSB tax, the section explains how the D.C. bag law formulated the administrative procedures of our plastic bottle tax. Finally, key takeaways from both taxes are discussed.

5.1.1.1. Sugar-Sweetened Beverage Tax

Eight cities in the United States have implemented an SSB tax: Albany, Berkeley, Oakland, and San Francisco, California; Boulder, Colorado; Cook County, Illinois (repealed); Philadelphia, Pennsylvania; and Seattle, Washington (Leider et al., 2021). The SSB tax is an excise tax on any distributor who distributes sugar-sweetened beverages. An excise tax is a tax that is levied at the point of distribution instead of sale. The tax ranges from one to two cents per ounce, depending on the city (Leider et al., 2021). Although each city's tax is slightly different, this case study will use literature that examines the efficacy of each city's SSB tax as a group instead of individually. It is important to note that, as stated above, Cook County repealed its tax shortly after implementation. The city rescinded the tax primarily due to the revenue being used to decrease the city's

deficit and not for the community's benefit, creating public disapproval (Chriqui et al., 2020). Even though the city repealed the tax, it was still used in part of this analysis because relevant research includes Cook County in their studies.

Demand

A meta-analysis of 26 estimates from 19 studies found that the demand for sugar sweetened beverages fell by 20%, with a corresponding price elasticity of demand[3] of -1.5 after implementing the tax. There was still an 18% reduction in demand when considering cross-border shopping with a corresponding price elasticity of demand of -1.05 (Leider et al., 2021).

Labor Market Impact

A common argument against SSB taxes is that the tax will lead to job losses in industries that produce, distribute, or sell the taxed beverages. Industries have performed studies that show that an SSB tax results in job loss. However, Dr. Powell, the leading expert in the economics of SSB taxes, explained that those studies do not account for three essential elements of the SSB labor market: substitution for untaxed products, such as water, often produced by the same company; consumers reallocating their spending to other goods and services; economic activity by the government from tax revenue (L. Powell, personal communication, March 2, 2022). Additionally, they do not account for the historical decline in soft drink industry employment.

Peer-reviewed studies for the two states that have cities with SSB taxes, Illinois and California, found no net job loss. There was a reduction in employment in the beverage industry, but new jobs in the private and government sector offset the losses (Wada et al., 2014). However, another study in Philadelphia and a study for San Francisco found no significant job loss in potentially impacted industries such as supermarkets, drink manufacturers, or convenience stores (Marinello & Powell, 2021). Therefore, job loss from an SSB tax in any industry is minimal and can be easily offset by increased jobs in other sectors.

5.1.1.2. Washington D.C. Plastic Bag Tax

In 2009, the D.C. Council passed the Anacostia River Clean Up and Protection Act, commonly known as the Bag Law, which imposes a five-cent tax on any plastic or paper bag at the time of sale (DOEE, n.d.). The D.C. Department of Energy and Environment administers the plastic bag tax, and all revenue from the tax goes into The Anacostia River Cleanup and Protection Fund. Money from the

[3] Price elasticity of demand is the measurement of the change in demand for a product in relation to a change in the products price.

fund can only be used for the activities laid out in the Bag Law, such as Anacostia River clean-ups, stream restoration, and education. Revenue from the tax may also be used for any administrative costs to enforce the law (DOEE, n.d.). The D.C. Bag Law has successfully reduced bag pollution in the Anacostia River. Overall, there has been a 60% decrease in sales of single-use bags and a 75% reduction in bags found during clean-ups (DOEE, n.d.).

5.1.1.3. Key Takeaways

The first takeaway is that an excise tax is the most effective type of tax for reducing plastic beverage containers in the Anacostia River. In the case of sugar-sweetened beverages, an excise tax has effectively reduced a negative externality in the economy due to the health impacts of sugar-sweetened beverages by reducing consumption. Plastic beverage containers are producing a similar externality through harm to the environment. In the interview with Dr. Powell, she was confident that a plastic bottle tax would have a similar effect on demand as an SSB tax (L. Powell, personal communication, March 2, 2022).

The second key takeaway is that an advisory board for distributing the tax revenue would not benefit D.C. A few cities with SSB taxes have advisory boards that have ended up being burdensome to the agency administering the tax (C. Goette, personal communication, February 28, 2022). Additionally, DOEE already has experience distributing tax revenue from the Bag Law and has successfully enforced the tax and distributed funds to reduce bags in the Anacostia River. Adding an advisory board would extend the implementation time of a plastic bottle tax and would overburden DOEE. Finally, the last takeaway is that the legislation needs to define the allowable usages of the tax revenue clearly. Cook County, Illinois's SSB tax was repealed because the tax revenue was going into a general fund, and the public did not have confidence that the tax was helping the community.

5.1.2. Bottle Bill Case Studies

5.1.2.1. What is a Bottle Bill?

There are currently ten states with Container Deposit Programs, or "Bottle Bills." Each state's bottle bill is different but works the same functionally. A deposit, usually around 5 to 10 cents, is placed on a beverage container upon consumer purchase. The consumer is then incentivized to receive their rebate by bringing the beverage container back to a retailer, or a redemption center for collection. Beverage corporations such as Pepsi are then required to collect returned beverage containers from these centers and transport them to recycling facilities (See Image 3) (TOMRA, n.d.).

Image 3: Shows how a deposit system works (TOMRA, n.d.).

Bottle Bills effectively capture recyclable material, especially single-use plastics like plastic bottles. These Programs can have up to 40% higher collection rates than other recycling programs, such as curbside recycling (How Do Container Deposit Schemes Work, 2018). Higher return rates have made Container Deposit Programs popular in some states. We specifically reviewed six of the ten Bottle Bill states to create our model: California, Maine, Massachusetts, Michigan, Oregon, and Vermont. These six states were chosen to be part of the case study because their unique implementation, framework, and bill history set them apart from other states. We did not include Hawaii, New York, and Connecticut because their Bottle Bills have no defining features from states already in the case study. Additionally, we did not include Iowa in this case study as the state legislature is currently dismantling their Bottle Bill, and we wanted to focus on working policies (One of Two Bloomfield Redemption Centers Closing, 2021; Breese, 2019). In this case study, we reviewed each state's definitions for similar terms to compare the last update to the Bill and the most recent deposit price. In addition, we conducted an analysis of what parts of the policy were successful, what did not work, and key takeaways from the bills that can be applied to a Bottle Bill in D.C.

5.1.2.2. California

What Worked:

California is unique from other states included in this analysis as they allow every person and private and public entity to take part in the deposit system. According to Mark Murry at Californians Against Waste, allowing curbside recyclers, such as recycling and waste management companies, to participate in the deposit system was a significant success while battling opposition to the bill. Another success within the Californian system is the high deposit rebate and acceptance of a broad range of beverage containers.

What Has Not Worked:

Currently, California's deposit is one of the highest in the nation. However, as seen in Chart 4, California only has an overall PET redemption rate of 62%. It sits nearly 20 percentage points below the 80% universal "success rate" of Bottle Bills. Mark Murray at the Californians Against Waste attributes this drastic drop in redemption rates to COVID-19, where California closed many redemption centers around the state (M. Murray, personal communication, February 25, 2022). While COVID-19 certainly played a role in the dramatic drop in redemption rates around the country, it is important to note that California has seen falling redemption rates years prior to COVID-19. Murray is confident that the maximum redemption rate, with the nickel as the highest return amount, the Bottle return rate is capped at 75% (M. Murray, personal communication, February 25, 2022). This cap hinders the ability of California ever to reach the efficacy level needed to run a successful program. As we developed our policy for D.C., we considered this fact and tripled the deposit to 15 cents.

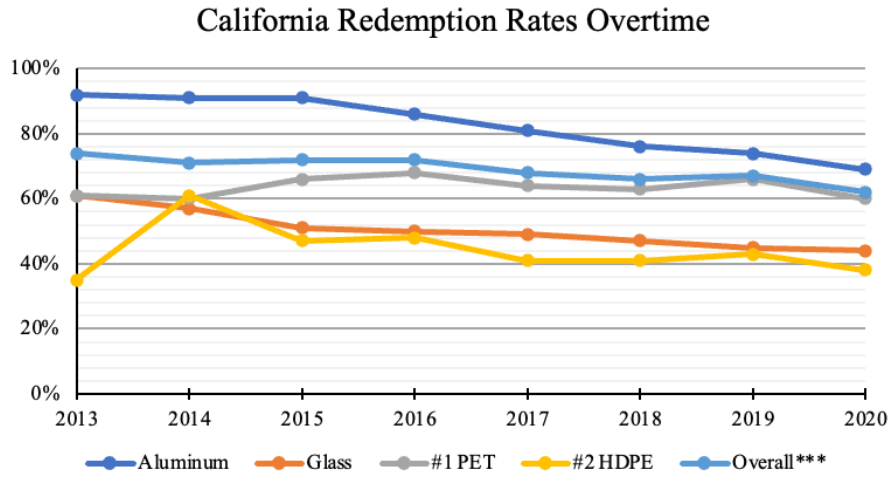


Chart 4: California container deposit bill redemption rates by material from 2013-2020.

Lessons Learned:

California is one of the only states that has allowed everyone to partake in the market. Subsequently, this has allowed for an increase in political feasibility, administrative feasibility, and reduced costs for all stakeholders involved. Allowing the market to be open to curbside recyclers and any other primary recycling entity in the D.C. area will decrease pushback and allow for a more feasible policy.

5.1.2.3. Maine

What Worked:

Enacted in 1976 and implemented in 1978, Maine has one of the oldest bottle bills in the U.S. It is currently operated by the Maine Department of Environmental Protection as demonstrated in Image 4. Maine's distributors have formed groups in

which members of the beverage industry have banded together to decrease handling fees, transportation costs, and sorting for redemption centers. This arrangement allows the commingling of beverage containers which generally have to be sorted and picked up by separate distributors (Maine, n.d.). In addition, it provides an incentive for distributors to join commingling groups due to lowered entry costs.

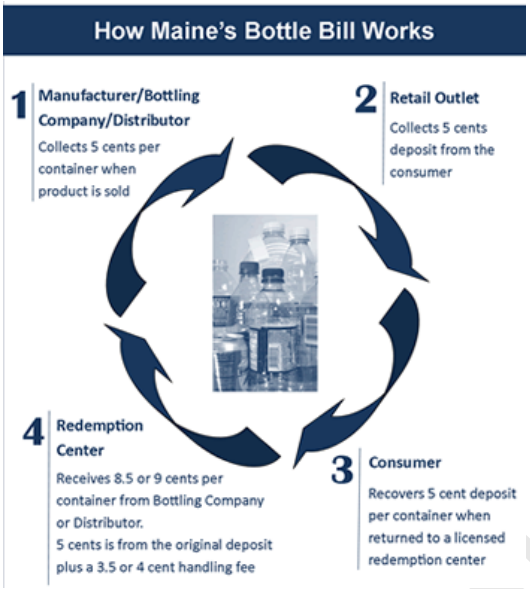


Image 4: Maine's Bottle Bill system as currently implemented by their Department of Environmental Protection.

Concern over the fraudulent return of bottles in the State of Maine has resulted in effective fraud control measures. Fraudulent return of beverage containers occurs when unlicensed bottles from out of state are returned for a deposit rebate, which takes money away from redemption centers and the overall Bottle Bill program (Maine, n.d.). When depositing more than 2,500 beverage containers at once, residents must provide their name, license plate number, and address to prove that they live in Maine to minimize the reception of fraudulent beverage containers (Maine, n.d.).

<u>What Has Not Worked:</u>

The longevity of Maine's Bottle Bill has caused challenges in maintaining success rates in the present. Redemption fees remain unadjusted for inflation and set at 5 cents per bottle (Maine, n.d.). A 2018 report from the Office of Program Evaluation and Government Accountability of the Maine State Legislature (OPEGA) described the difficulties in self-reporting of redemption centers which has created difficulty in gauging consumer compliance and the program's overall success rates (Maine, n.d.). Despite the Maine Beverage Association reporting an unofficial redemption rate of 84% in 2017, standardized reporting requirements were only implemented in 2020, leading to potential disparities in numbers and a lack of proof for success rates (Maine, n.d.).

Fear of fraud has limited the success of Maine's program as well. In 2011, several cases of bottle redemption fraud in York County Superior Court led to guilty

verdicts. In response, the former spokesman for the Maine Beverage Association, Newell Augur, announced that about $8 million in bottle redemption fraud occurs per year and is concentrated in cities next to the state's border (Bridgers, 2011). In 2019, pending a government review on fraudulent bottle returns, Maine's Bottle Bill was revised to prevent the Department of Environmental Protection (DEP) from issuing new redemption center licenses from May 2019 until 2020 (Maine, n.d.). While reviews of fraud can be beneficial to ensure there is no significant loss of funds in the program, restricting the ability of the DEP to license new redemption centers might hinder the ability of residents to have access to redemption centers.

Lessons Learned:

As D.C. borders several states, it is vital to minimize the potential for fraud and implement an efficient system to count bottles sold in D.C. A barcode requirement at redemption centers or reverse vending machines (RVMs) can allow easy scans and eliminate fraudulent bottles outside D.C. While returning significant amounts of bottles at once, a requirement for licenses and addresses can ensure that residents redeem bottles and minimize the potential opportunity for fraud. Higher redemption rates at 10 cents may encourage higher program success rates due to higher inflation rates in 2022. Furthermore, implementing reporting requirements in the initial Bill will create more precise measurements for consumer and distributor compliance rates in D.C.

5.1.2.4. Massachusetts:

What Has Worked:

With Massachusetts's redemption rates being among the lowest of any of the other states with Bottle Bills, there is not much working for Massachusetts. However, before Massachusetts let their Bottle Bill become dated, they had a successful program, as seen by high redemption rates attributed to the accessibility of redemption centers.

What Has not Worked:

The Massachusetts Bottle Bill is failing. Massachusetts used to have one of the highest redemption rates, around 71%. However, since 2010, redemption rates have been as low as 40% (S. Sylver, personal communication, 2022). Sean Sylver attributes low redemption rates too low rebate value and redemption center closures. It has been demonstrated that states with low deposit values consistently perform worse than states with higher deposits (Becker & Smith, 2021). Redemption center closure and low redemption rates have created a snowballing positive feedback loop for Massachusetts. As more redemption centers close due to lack of business, the harder it becomes for people to return their bottles. As it

becomes harder to return bottles, people would instead give up the 5 cents than deal with the hassle of finding a place to return their bottles. This makes redemption centers economically inefficient, making more sense for them to close down, continuing the cycle and the problems already mentioned with Massachusetts's Bottle Bill (See Image 5).

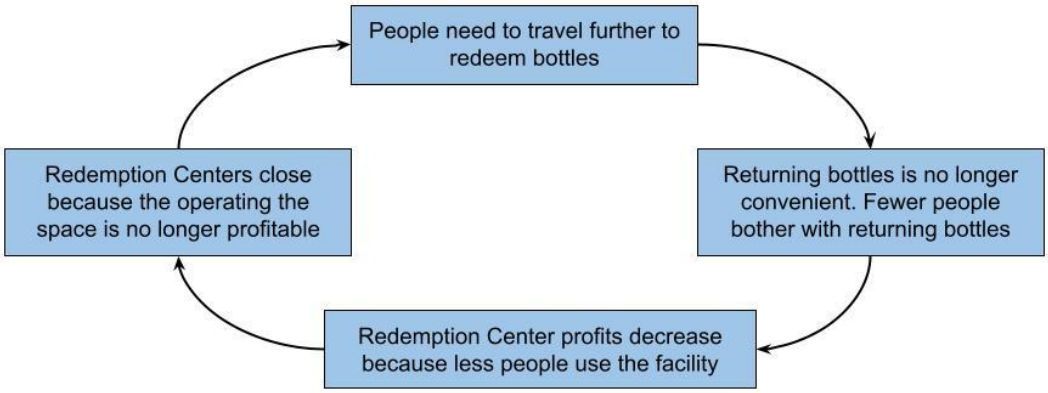


Image 5: Demonstrates the positive feedback loop of Massachuset's redemption centers.

In (6)(a) of the statute, dealers do not have to accept any more than 120 beverage containers per person. This is to ensure grocery stores are not overloaded with returned beverage containers. However, in our interview with Sean, Sylver mentioned how this severely limits specific groups of people who willingly bring back more bottles to retail locations, such as low-income and homeless people. Redemption centers do not have the same redemption limits as retailers, but redemption centers can be challenging to access. The trade-off of (6)(a) is that redemption centers would take back an unlimited number of bottles, but now with redemption centers closing, it makes it challenging to return large numbers of bottles at once (Mass. Gen. Laws).

Lessons Learned:

Massachusetts's Bottle Bill case study shows the importance of implementing a system to ensure the Bottle Bill automatically stays up to date with new container materials and inflation. Including automatic updates into legislation would prevent Bottle Bills from becoming antiquated and keep redemption incentives high. Additionally, easy access to either redemption centers or retailers that accept a large number of returns is a crucial point to consider in the context of D.C. Ideally, retailers should take back more than 120 bottles per person a day if a redemption center is not accessible. However, D.C. is a city tightly constrained by space. Therefore, it may not be feasible to allow more bottles per person to be returned in a day.

5.1.2.5. Michigan:

What Worked:

Michigan requires retailers to act as redemption centers to increase accessibility to a broad audience. Bottled beverage containers are labeled with a barcode that allows retailers and RVMs to determine if they are returnable (Michigan Bottle Bill, n.d.). Michigan has also set its redeemable rate at 10 cents, resulting in a success rate of 73 percent in 2020 for their Bottle Bill program (Michigan, n.d.). Success rates are measured by the number of redeemable funds claimed versus unredeemed funds given to the government. Arguably a form of EPR, Michigan's Bottle Bill contributes twenty-five percent of unredeemed funds to retailers to fund the redemption program, while 75% of funds are allocated to a state trust fund dedicated to pollution cleanup and education (Michigan, n.d.). With a specific trust set up for pollution cleanup, the state can fund cleanups that might not have been addressed through regular state funding while providing retailers a financial incentive to maintain the deposit program.

What Has Not Worked:

In Michigan, dealers are not required to rebate empty returnable containers over $25 a day per person (Michigan Bottle Bill, n.d.). This requirement means dealers are only required to accept up to 250 bottles per day. A low redemption limit may pose an issue for residents who wish to return larger amounts of beverage containers per day.

Lessons Learned:

When applying a Bottle Bill to D.C., Michigan shows the importance of implementing a system with an upfront higher redemption rebate rate to increase program success rates. Though the utilization of retailers as redemption centers allows for easy access to beverage container deposits, limited space for retailers in D.C. may pose challenges in storing large quantities of redeemed bottles in smaller retail stores. Michigan's unique method of calculating the rebate rate through financial records of bottles returned versus physically counting bottles may be a feasible option to calculate the efficacy of a Bottle Bill in D.C. due to its simplified nature.

5.1.2.6. Oregon:

What Worked:

For the first forty-six years of the program, the Bottle Bill deposit was set at five cents. In 2017, the Bottle Bill deposit jumped from five cents to ten cents due to an 80% redemption rate in 2015 and 2016. As a result, the redemption rate in Oregon went from 62% to over 82% and is continuing to climb (Oregon.gov, 2022).

Oregon's Bottle Bill includes a deposit of 10 cents for glass, metal, or plastic beverage containers of 3 liters or less. The current Bill includes a Bottle Drop Program, which has seen relative success. Before implementation, redemption rates were below the 75%-80% threshold that many industry experts and the State of Oregon considered a "successful" (B. Weber, personal communication, February 28, 2022; Oregon.gov, 2022). Recycling nearly 2 billion containers a year, the current Bottle Drop Program operates on a $46.4 million budget and features nearly 2,500 retail redemption centers at no cost to the taxpayer. Oregon holds one of the best redemption rates among states with Bottle BIlls and has successfully transitioned the program from a government-run to a private industry run. This allows bottle companies and other players in the industry to have a say in the program.

What Has Not Worked:

In our interview with Eric Chambers at the Oregon Beverage Recycling Cooperative, an implementation concern that arose was fraudulent beverage container returns (E. Chambers, personal communication, February 25, 2022). Oregon has problems with residents from other states traveling to redeem large amounts of beverage containers. OBRC told auditors it believes the cost of fraud is about $10 million a year (OBRC.com, 2022). While this can be a problem for the system, the return rates of beverage containers still accomplish the ultimate goal of increasing recycling rate and reducing plastic waste.

The second lesson learned is that low deposit amounts discourage redemption. In fact, before 2017, their redemption rates fell to as low as 60%. There is strong evidence that the size of deposits affects beverage container return rates (Oregon.gov, 2022). While the current 10-cent deposit has seemed to curb the dropping redemption rate, this problem might again pose since Oregon has no automatic adjustment for inflation in its Bottle Bill.

Lessons Learned:

An analysis of Oregon's Bottle Bill reveals how it was outdated. The scope of the original bill was narrow, causing low redemption rates and preventing the Bottle Bill deposits from being updated to keep up with inflation. Finally, it did not consider the boom in the 1980s in single-use plastic. However, with several improvements in the expansion of bottle coverage, increasing the deposit, and creating the bottle drop program, the Oregon Bottle Bill has become a role model for the rest of the bottle Bill states to follow. If D.C. is to implement a successful Bottle Bill program, it will at the very least need to adopt the current base model Oregon has, if not expand upon it.

5.1.2.7. Vermont:

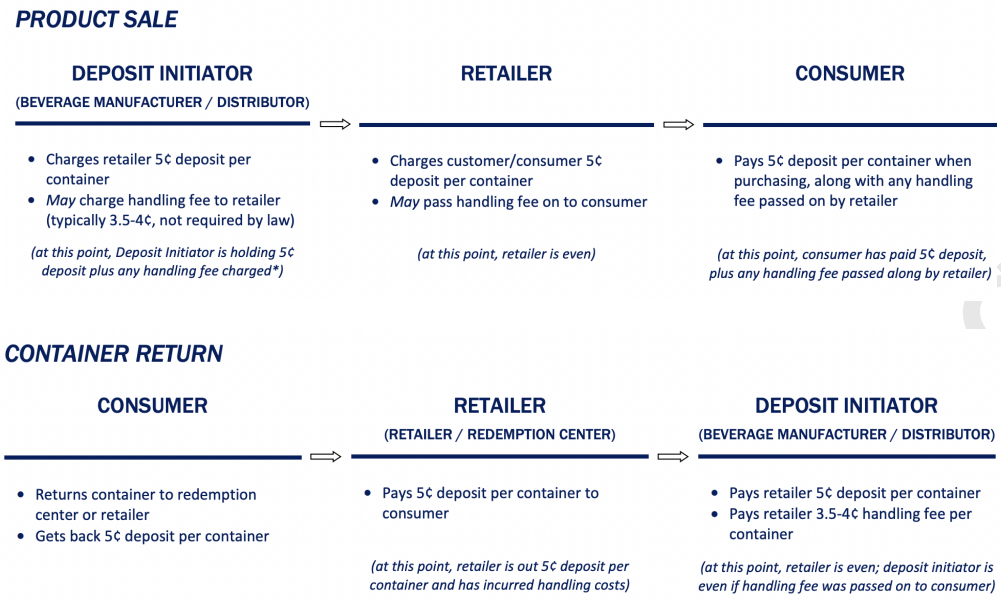


Image 6: Shows the flow of money in Vermont's Bottle Bill between distributors, retailers, and consumers.

<u>What Has Worked:</u>

Several factors play into Vermont's consistently high redemption rates. For one, liquor deposit values are 15 cents, 10 cents more than all other returns. This high deposit value on liquor containers under 50ml, glass or plastic, encourages people to bring back liquor bottles and entices consumers to bring back their other beverage containers simultaneously. Second, Vermont has a robust recycling culture that influences participation in the program. Residents of Vermont are motivated by more than the monetary value to return bottles. The strong recycling culture of Vermont has kept redemption rates high even though the bill has not been updated to increase deposit value or types of containers accepted. There is currently a bill, H.175, which is seeking to expand the material covered under the Bottle Bill to include water, wine, hard cider, and sports drinks, which would hopefully bring the redemption rate into the 90% range (M. Gallagher, personal communication, February 28, 2022).

<u>What Has not Worked:</u>

Small retailers have to take back brands they do not sell, which can be challenging when they do not have the space and staff large retailers and redemption centers have. In addition, Vermont is a rural state, and therefore, not all residents will be able to have retailers and redemption centers nearby. In cities such as Burlington, where most of Vermont's black population lives, access to redemption centers is minimal. According to Marcia Gallagher, there is only one

redemption center on the other side of the river from town and one grocery store that takes returns. This has limited the accessibility of returns for those that do not have cars to conveniently transport large volumes of bottles to the redemption center or grocery store. Vermont's second-biggest city, Montpelier, also faces a similar problem as Burlington (M. Gallagher, personal communication, February 28, 2022).

Lessons Learned:

Since D.C. has limited space, only requiring large retailers to accept bottle brands that they do not sell may increase the feasibility of implementing the policy, as seen in the case study of Vermont's Bottle Bill. However, implementing this collection method might pose an issue for citizens who do not live near large retailers and will therefore not have easy access to return bottles.

5.1.2.8. Key Takeaways

In light of our case studies, we have determined that the biggest takeaway is that Bottle Bills should be written to update deposits and container materials automatically to avoid bills becoming outdated and ineffective. In addition, there should be standardized reporting requirements for redemption centers, distributors, and producers that should be integrated into the bill to allow better transparency of the program's success. Another key takeaway is that easy access to return locations is crucial to Bottle Bill's success. D.C. should implement a bottle identification system to allow for easy returns and prevent fraud. For example, requiring barcodes on beverage bottles that can easily be scanned by RVMs or at redemption centers will allow for fast identification of bottles eligible to be redeemed in D.C.

5.1.3. Bottle Ban Case Studies

A Bottle Ban policy prohibits the production, sales, or purchases of single-use plastic beverage bottles. There has been no statewide or federal implementation of a bottle ban in the United States. However, some towns and cities have implemented a ban on the sales or purchases of plastic beverage bottles. Below are case studies for Bottle Bans across the United States. In theory, a bottle ban can encourage producers and consumers to switch to plastic alternatives such as aluminum, glass, paper, other bio-based inputs, or reusable bottles. Overall, a Bottle Ban has been proven feasible to implement on a large scale in a short time frame.

5.1.3.1. Case Study: Cape Cod

In 2019 Barnstable County in Cape Cod introduced the Municipal Plastic Bottle Ban, which bans the purchase of single-use plastic beverage containers by town governments, and the sale of single-use plastic containers on town property. By

2021, all 15 towns in Barnstable County had adopted the Municipal Plastic Bottle Ban (Sustainable Practices, 2020). Following the success of the Ban, Cape Cod initiated the Commercial Single-Use Plastic Water Bottle Ban in 2020. The Commercial Single-Use Plastic Water Bottle Ban prohibits the retail sale of plastic beverage containers less than one gallon.

5.1.3.2. Case Study: Plastic Styrofoam Ban

Similar to plastic beverage containers, expanded polystyrene, commonly known as styrofoam, has continuously polluted the Anacostia River. In 2014 the D.C. Council enacted the Sustainable D.C. Omnibus Amendment Act, which aims to address the effects of plastic waste products in D.C.'s waterways (Sustainable DC Omnibus Amendment Act of 2014, n.d.). In 2016, amendments to the Act banned businesses from using disposable styrofoam containers and required them to transition to compostable or recyclable containers (DOEE, 2016). Amendments passed in 2019 expanded the Ban to include the sale of foam containers and loose-fill packaging material by 2021 (DOEE, 2021). Despite industry opposition, these amendments received full committee support from government stakeholders, such as the D.C. Council, to address plastic pollution in the local environment (Keller & Heckman, 2020). This is significant because industry players have successfully rolled back legislation in the past in D.C. Therefore, we are seeing a shift in how the D.C. Government responds to industry opposition related to plastic pollution.

The regulation provides guidelines on how the Ban should be implemented and enforced in businesses in D.C. Currently, the DOEE funds the implementation and enforcement of the Ban. Trash levels in the Anacostia River are monitored, and businesses are regularly inspected for compliance (Mendelson, 2018). In the first five years after the Foam Ban came into effect, there was a decrease in foam entering the Anacostia, and 96% of the businesses inspected had successfully transitioned to non-foam alternatives (DOEE). Utilizing fines for retail businesses in violation of the Ban has been an effective way to decrease the amount of styrofoam sold in the District and, by extension, the amount of foam entering the Anacostia (DOEE). Over a 10-year period, the proportion of foam in the Anacostia decreased from 24% to 3% in 2020 (DOEE).

5.1.3.3. Key Takeaways

Key takeaways from the Bottle Ban case studies include clearly defining products and businesses included or exempted from the policy requirements. Setting dates for when the policy goes into effect as well as inspections and fines are important enforcement mechanisms to ensure compliance. Addressing the affordability of

food service ware, specifying what to do in case of a lack of affordable food service ware, which is important when considering policy effects on lower-income communities. Overall, the Foam Ban is notable for its effectiveness in reducing waste in the Anacostia watershed within a short time frame after implementation.

6. Policy Alternatives

6.1. Policy #1: Plastic Bottle Tax

In this policy option, Washington D.C. will impose an $0.05 excise tax on distributors for each plastic bottle they distribute in D.C. The tax is imposed on the first non-exempt distributor of plastic beverage bottles brought into the city. The bottle cannot be taxed twice if there is a chain of distributors. If a distributor sells products from a producer whose annual worldwide gross revenue is $2 million or less, then those sales are exempt from the tax. The tax can be passed down to retailers and can then be passed down to consumers.

Tax revenue will be deposited in a new fund named the Anacostia River Plastic Bottle Reduction Fund. Funds are to be administered by the Office of the Director of the District Department of the Environment. Funds from the tax can only be used for the purposes of cleaning and protecting the Anacostia River, or ensuring D.C. residents have access to clean drinking water and reusable bottles. Funds are allowed only for these activities in order of priority:

- Funding community clean up events and other activities that reduce trash
- Purchasing and installing equipment to reduce trash pollution in the river, such as storm drain screens and trash traps
- Purchasing and installing equipment to ensure clean water to all residential and commercial buildings in D.C., such as paying for replacement of lead pipes on private property
- Administering reusable water bottles to D.C. residents, with priority on low-income residents
- Provide research grants to D.C. companies to develop low cost plastic alternatives
- Public education campaigns, to educate residents, businesses and tourists about the impact of plastic bottles on the environmental health of D.C.
- Paying for administration of this program[4]

6.2. Policy #2: Bottle Bill

In this policy option, within two years D.C., will mandate a Bottle Bill operated by beverage corporations. For the purpose of this policy analysis, beverage corporations will be defined as any business or person who bottles, cans, packages, or otherwise fills beverage containers for distribution and sale. Bottles accepted under this policy are as follows: any beverage container distributed in D.C. that contains any combination of metal, glass, and plastic. Beverage containers of dairy products and unprocessed cider are exempt from this program. To allow for access to bottle redemption centers, stores with more than 6,000 square feet will be required to have more RVMs and accept all bottle brands. Stores with less than 6,000 square feet will have at least one RVM and will only be required to

[4] Elements of this list were based on the D.C. Bag Law legislation (District of Columbia, 2012).

accept brands they sell. To prevent overflow of RVM's, the district will determine the number of bottles each RVM location can take back per person on a daily basis. When a consumer returns their bottle, their deposit can either be returned as cash, retailer store credit, or virtually through a money app managed by beverage companies Unredeemed deposits from beverage containers will be forfeited to the D.C. and then split with 25% going to retailers and 75% going into the Anacostia Pollution Reduction Fund. Retailers may use their funds for maintaining RVMs and bottle collection and storage. The Anacostia Pollution Reduction Fund may only use funds as described above in the Bottle Tax.

6.3. Policy #3: Plastic Bottle Ban

In this policy option, within three years D.C. will impose a District-wide ban on the retail sale of all plastic beverage bottles including: water, carbonated, and non-carbonated beverages. This ban excludes: dairy products in all vending machines, schools, retail, public, and restaurant spaces that are less than 17 ounces (IDSWATER, 2020). The policy effective date on the implementation and the enforcement phases, will be set by the DC Council within the final bill language. After the effective dates, the businesses will be required to abide by the requirements of the bill and the DOEE will issue warnings and fines for non-compliance. Exceptions will be given during states of emergency to allow for the distribution of water in plastic bottles. Additionally, the Mayor will define and provide a list of alternative materials that can be used for beverage containers in the District (*D.C. Law 20-142).* If no alternatives are available, the Mayor shall provide a list of exemptions . Producers of plastic beverage bottles will be required to bear the cost of using alternate containers for beverages. The cost is likely to be passed down to the consumer in higher prices, however, the policy could lead to a significant reduction in the amount of plastic bottles in the Anacostia River as has been seen with D.C. 's Foam Ban.

6.4. Policy #4: Shelf Space Percentage

This policy option is independently designed by members of this capstone team and will limit the percentage of plastic bottles that grocery stores are allowed to sell. Ten years after the enactment of this policy, retailers will be required to have 75% of all drinks stocked in their establishment be in a non-plastic container (aluminum, paper, etc.). Three years after the enactment of this policy, retailers will be required to have 10% of drinks stocked in alternatives to plastic containers. In the following three years, retailers will be required to reduce the percent of plastic bottles stocked in their store by 10% each year. In year 7 through 9 all retailers will need 60 percent of their stock of drinks to be plastic alternatives. By year 10, all retailers are required to have 75% of their drinks stocked to be in plastic bottle alternatives. The table below shows the timeline discussed. The timeline is based on previous legislation in Florida and California for the banning of polystyrene food containers. Random quarterly inspections will be mandatory for retailers to ensure they take appropriate measures to decrease plastic beverage bottles on their shelves.

Year	Required % of Plastic Bottle Alternatives
1	0
2	0
3	10
4	20
5	30
6	40
7	60
8	60
9	60
10	75

Table 2: Shelf Space Percentage Policy

6.5. Policy #5: Status Quo

In this policy option, Washington D.C. will make no policy change to managing plastic bottle pollution in the Anacostia River. Under these circumstances, the sale and purchase of plastic bottles will likely continue at the existing rate and increase across the U.S. in response to increasing demand, people will continue to purchase plastic bottles within or outside D.C., which they will eventually litter, recycle, or dispose of the bottle within D.C.'s waste stream where they can end up in the Anacostia Watershed. Thus, without policy intervention, plastic bottles will likely continue to enter waterways and leak harmful chemicals into the water that harm aquatic and human health.

7. Criteria to Evaluate Policy Alternatives

The following section describes the criteria for this policy analysis to evaluate the policy alternatives. To choose the best policy for the unique needs of Washington D.C., five policies will be assessed based on four weighted criteria: environmental equity, efficacy, administrative feasibility, and cost to beverage corporations. Criteria were chosen based on interviews with stakeholders and literature reviews. Weights are determined based on client preferences and calculated using an Analytical Hierarchy Process (AHP) model in section 9.1. Each policy will rank each criterion on a scale from one to ten. An explanation of each criterion and how it is measured is explained in detail below.

Initially, this analysis considered political feasibility one of the criteria to measure our policies. This criterion would have measured political support by relevant government and industry stakeholders. However, after an interview with Tommy Wells, a previous D.C. council member and current head of the D.C. Department of Energy and the Environment, we removed this criterion. Tommy Wells informed us that with the everyday makeup of the D.C. council, all of our policy options are equally politically feasible. As a political appointee, Wells's opinion is optimistic. However, his optimism is justified based on other interviews where organizations like PIRG see less pushback from drink manufacturers (M. Gallagher, personal communication, February 28, 2022). Therefore, all the policies would have ranked equally in political feasibility, and it would not provide us with meaningful insight.

7.1. Criterion #1: Maximize Environmental Equity

This criterion measures the equity of the policy across different income groups. When we looked at equity, we kept these three things in mind. The first is how the policy is expected to affect plastic bottled water prices and how price changes affect a family's monthly budget expenditure on water. Second, lead pipes are still being used to transport drinking water into homes, and D.C. is not paying for pipes to be updated going into private property. Third, many low-income families cannot afford to update their personal pipes, so the lead is leaching into their drinking water (Roeder & Montague, 2022). Therefore in some cases, plastic bottles could be the only form of safe drinking water for families in D.C. Finally, we considered how the policy reduces plastic bottles at the trash hotspots highlighted in the Anacostia River TMDL and Anacostia Riverkeeper. Therefore, an approach that receives one demonstrates low equity across different income groups, and ten demonstrates very high equity across income groups.

7.2. Criterion #2: Maximize Efficacy

The efficacy of policy alternatives is measured in reducing plastic bottles in the Anacostia River and is tracked by the number of plastic bottles found in the Anacostia River during Anacostia Riverkeeper Bottle Audits and Clean-ups. Additionally, the time needed to implement the policy is considered. Policy options will be measured using a

scale system from one to ten. For example, an approach that receives one demonstrates no reduction in plastic bottles in the Anacostia River and then a policy option that will leave no plastic bottles in the Anacostia.

7.3. Criterion #3: Maximize Administrative Feasibility

This criterion measures the likelihood that D.C.'s local government and departments can effectively implement the policy alternative. To maximize administrative feasibility, each policy option will be measured for its complexity and the time needed for D.C. to implement the policy. This can be increased labor for the policy, time for implementation, or the number of outside stakeholders involved. Policy options will be measured using a scale system from one to ten. A policy that receives one demonstrates a costly and complex program that would require too many resources, whereas a ten demonstrates a policy option that will require minimum input from the government to enforce and operate.

7.4. Criterion #4: Minimize Cost to Relevant Stakeholders

This criterion measures each policy option's overall cost in dollars to relevant stakeholders. A cost increase to stakeholders is usually in the form of a tax, additional cost, or price of plastic bottle alternatives. Relevant industry stakeholders include plastic bottle manufacturers, bottle distributors, bottle retailers, waste haulers, and recyclers. This criterion is measured on a scale from one to ten, one meaning there is a high cost to beverage corporations and ten meaning there is no additional cost.

8. Projected Outcomes

The following section will describe and rate the outcomes by naming the alternative and examining how they score for each criterion. Each outcome will be given a score between 1-10 based on how desirable the outcome is. As described in more detail for each criterion above, one represents the most undesirable outcome, and ten is the best possible outcome.

8.1. Plastic Bottle Tax

Environmental Equity

A plastic bottle tax should not significantly affect the affordability of plastic water bottles in lower-income communities in D.C. Based on data from the model for this tax, SSB taxes, it is likely that the price of a plastic bottle will increase by one cent (Marinello & Powell, 2021). We are aware that this can still impact low-income communities who do not have access to clean water or reusable water bottles and have to buy their water in plastic bottles. However, the allowed usage of the tax revenue will enable it to supply reusable water bottles to all residents in D.C., update lead pipes, and ensure that all of D.C. has clean and safe drinking water readily available. Therefore, the increased cost that would primarily affect low-income communities can be offset by investment in safe drinking water for all residents of D.C.

Score: 7

Efficacy

Based on aggregate data from SSB taxes across the country, the demand for plastic bottles should drop by around 20% and have a price elasticity of demand above one (Powell et al., 2021). Therefore, with fewer plastic bottles being sold in D.C., we will see less plastic beverage container litter in the Anacostia River. However, the reduction in demand for plastic beverage containers could be higher than 20% because the D.C. bag law has seen a 60% decrease in sales based on statistics from the D.C. bag law (DOEE, n.d.). Additionally, the plastic bottle tax will not have a long implementation time, and based on the bag law and SSB tax, noticeable changes in the sale and plastic bottles found in the river will decrease within a few years.

Score: 5

Administrative Feasibility

This policy would have high administrative feasibility because the DOEE already has the personnel and similar processes in place from the bag law to implement, enforce, collect and administer the tax. Additionally, the model policy, an SSB tax, is already implemented in multiple cities and can be easily mimicked.

Score: 8

Cost to Relevant Stakeholders

This policy imposes a relatively small tax of five cents on distributors of plastic bottles. However, this cost will likely be passed down to consumers at higher prices. In an analysis of SSB taxes across the country, distributors passed 70% of the taxes to consumers (Marinello & Powell, 2021). Therefore, we expect this tax will not significantly impact distributors and retailers.
Score: 7

8.2. Bottle Bill

Efficacy

Well-managed and updated Bottle Bills are consistently shown to decrease litter rates, diverting 40-60% more waste than curbside recycling programs alone (CAW, n.d.; Pforzheimer, 2020). By implementing a Bottle Bill that incorporates various bottle types, a higher than average deposit cost of 15 cents, and accessible return locations, we assume that D.C. will experience high redemption rates. Theoretically, it can be inferred that the percentage of bottles redeemed would be the percentage of bottles not entering the Anacostia River. Anacostia River Keepers bottle audits can continuously measure bottles in the river.
Score: 7

Administrative Feasibility

The strength of this policy is there are already 10 states with Bottle Bills, so D.C. has multiple examples for the implementation and administration of the policy. In addition, as retailers are responsible for collecting and redistributing the deposit fee, this burden would not fall on the D.C government. A potential administrative strain is that there are currently only two transfer centers within D.C. However, if bottle redemptions were to outpace the processing capabilities of the two transfer centers, beverage corporations would need to invest in expanding the transfer stations or building new ones and coordinate to add RVMs to retail centers. However, all potential challenges can be mitigated by proper implementation and planning. Even though not all of these challenges are the responsibility of the D.C. government, they must be involved in the process of helping retailers and producers adjust to the new policy.
Score: 8

Environmental Equity:

This policy requires D.C. to have redemption centers and RVM's within 1 mile of any residential area, so all D.C. residents can conveniently redeem their deposit. Therefore, the slight price increase can be offset when the bottle is returned. Additionally, the unredeemed funds go into the Anacostia Pollution Reduction Fund. Funds from the program are used for updating D.C.'s drinking water infrastructure, so all residents have free, safe tap water and cleanups of trash hotspots along the Anacostia River.

Score: 8

Cost to Relevant Stakeholders

Private stakeholders will incur a significant cost burden from this policy. For example, beverage corporations are responsible for funding redemption reports, transportation of redeemed bottles, installing RVMs in eligible retail locations, providing bottle drop locations to areas not serviceable by RVMs, and designing barcodes onto plastic bottles sold in D.C. to prevent fraudulent redemption. Additionally, retailers will be responsible for maintaining RVMs and may apply for money from the Anacostia Pollution Reduction Fund to help with maintenance costs.
Score: 4

8.3. Plastic Bottle Ban

Efficacy

Plastic bottles will no longer be sold in D.C., so plastic bottle pollution will significantly decrease in the Anacostia River. However, plastic bottles will still be sold in Maryland, so bottles can still enter the D.C. portion of the Anacostia River from upstream.
Score: 9

Administrative Feasibility

DOEE has existing employees from the Sustainable D.C. Omnibus Act trained to administer the plastic bottle ban. However, this policy option would require heavy coordination among the D.C. Government, retailers, beverage corporations, and other relevant stakeholders to remove the sale of plastic bottles in D.C.
Score: 5

Environmental Equity

A bottle ban would raise the price of water because plastic alternatives are generally more expensive than traditional plastic beverage containers (Gray, 2018). Therefore, low-income residents will need to spend more of their monthly budget on bottled water. Additionally, the policy does not provide any funding to create clean drinking water in D.C., so some residents will have to continue purchasing bottled water at a higher price. However, because of the very high efficacy of this alternative, the trash hotspots in wards seven and eight will be greatly reduced, creating a better natural environment for those communities.
Score: 4

Cost to Relevant Stakeholders

Producers will be required to switch to bottle alternatives with higher production costs for packaging and transportation. This increased cost can then fall onto the retailer, requiring them to pay more for bottled beverage containers. Additionally, plastic alternatives have an increased distribution cost because they weigh more, making producers, distributors, and retailers pay more if they cannot sell plastic beverage containers.
Score: 3

8.4. Shelf Space Percentage

Efficacy

Efficacy of the Shelf Space Percentage policy will not have immediate implications as retailers are not required to start reducing the percentage of plastic on their shelves until year three. However, by year 10, this policy will reach its maximum efficacy point and decrease the number of plastic bottles sold on the shelves by retailers in D.C. by 75%. By extension, fewer plastic beverage containers potentially entering the waterways will reduce with fewer plastic beverage containers sold and purchased. However, this policy is limited to D.C. and cannot control the flow of bottles from border states into D.C. waterways. Therefore the reduction rate of plastic bottles will cause the efficacy to be lower than if the policy included border states.
Score: 6

Administrative Feasibility

As this policy has never been implemented, it is expected to have low administrative feasibility. This policy will require high levels of oversight to ensure retailers are following through with reducing plastic bottles on their shelves. To maintain beverage bottle reduction levels, DOEE will need to hire new inspectors to monitor retailers in D.C. and conduct random quarterly inspections.
Score: 3

Environmental Equity

The Shelf Space Percentage Policy is not projected to impact the accessibility of bottled drinking water significantly. At the end of 10 years, the shelf percentage reduction allows for 25% of bottles on the shelves of retailers to remain plastic. This will enable water bottles to be available in emergencies or if drinking water quality in households is unsafe (DC Water, 2021). Water will also be available in beverage containers made from alternative materials to plastic. However, these materials might be more expensive than plastic beverage bottles and increase the grocery bills of low income families. In addition, this policy does not provide funding for the removal of lead pipes in D.C., so some residents will be required to incur the increased cost and forfeit more of their income.

Finally, it does not address trash hotspots along the river, so it is expected that the plastic bottles that are still sold in the city will remain mainly in these areas.
Score: 5

Cost to Relevant Stakeholders

As the Shelf Percentage Policy is newly created, unforeseen costs unmentioned in this analysis may need to be addressed. This policy will feature high upfront costs for beverage corporations to start selling beverages in alternative packaging. Such costs include labeling, production, and transportation of materials to recycle. However, as beverage corporations and retailers only have the responsibility of phasing out plastic beverage containers and not getting rid of beverage containers entirely, in the long term, these stakeholders should not expect to see a significant decrease in profits.
Score: 4

8.5. Status Quo

Environmental Equity

The status quo will continue to heighten the environmental equity problems that D.C. currently faces. In lower income wards such as seven and eight in the Anacostia, there will continue to be a disproportionate amount of litter impacting the ecosystem, living conditions, and the health of residents. The status quo does not update the drinking water systems in D.C. However, it does not increase the cost to consumers.
Score: 1

Efficacy

Under this policy option, there would not be a significant reduction in plastic beverage bottles in the Anacostia River. The production of plastic beverage bottles is expected to continue rising, causing no change in the number of plastic beverage containers sold or dumped in D.C. However, current trends show that beverage corporations have been voluntarily switching to bio-based alternatives or plastic beverage containers with recycled content (C. Dreizen, personal communication, March 4, 2022). Consumers are also choosing to switch to plastic bottle alternatives, so there could be a slight decrease in the number of plastic bottles in the Anacostia River without policy intervention.
Score: 2

Administrative Feasibility

In this policy option, D.C. would not have to make any administrative changes to how it operates.
Score: 10

Cost to Relevant Stakeholders

In maintaining the status quo, beverage corporations would not incur additional costs. They may have costs associated with their voluntary switch to alternative bottle material, but that cost is minimal.

Score: 9

9. Policy and Criteria Analysis

9.1. AHP Model Break Down

To eliminate personal bias in weighting the criteria and meet our client's needs, we decided to calculate the weights of each criteria using an Analytical Hierarchy Process (AHP) model. In the first step of creating the AHP model, we designed a survey based on the Pairwise Comparison Matrix in Table 3, asking Anacostia Riverkeepers to rank criteria on a scale of importance from each pairwise comparison. The survey instructed the clients to use a true ratio scale from one to nine for the criteria ranking. A one means that the criteria in the pairwise comparison are of the same level of importance, and a nine would mean the criteria are nine times more important than the other criteria in the comparison. Once the client completed the survey, we entered the responses into the Pairwise Comparison Matrix (Table 3). The survey, client's survey responses, and a justification for the answer are located in Appendix F. The model itself is read from row to column, and abbreviations for the tables are found in Appendix E. For example, efficiency is five times more important than administrative feasibility. The opposite pairwise comparison is given the inverse of the score calculated in the survey. For instance, for efficacy and cost to beverage corporations, efficacy was rated nine times more important than cost. The inverse score cost to efficacy is .11 (one divided by nine) (see green cells, Table 3).

Pairwise Comparison Matrix (Input from Survey)				
	E	AF	EV	CS
E	1.00	5.00	1.00	9.00
AF	0.20	1.00	0.11	4.00
EV	1.00	9.00	1.00	9.00
CS	0.11	0.25	0.11	1.00
Sum	2.31	15.25	2.22	23.00

Table 3: Pairwise Comparison Matrix for AHP model. Read from row to column.

Calculating Weight of Criteria					
	E	AF	EV	CS	**Weight %**
E	0.433	0.328	0.450	0.391	**0.40**
AF	0.087	0.066	0.050	0.174	**0.09**
EV	0.433	0.590	0.450	0.391	**0.47**
CS	0.048	0.016	0.050	0.043	**0.04**
				Total	**1.000**

Table 4: shows the final calculations to determine the criteria weights using AHP.

For the next step in calculating the weights, each pairwise comparison rank is divided by the sum to find the number shown in Table 4. These numbers are then summed across the row to calculate the weight for the criteria. All weights are summed to add up to 100%. Based on the

number from Table 4, the score for each criterion is as follows: environmental equity is 47%, efficacy is 40%, administrative feasibility is 9%, and cost to beverage corporations is 4%.

9.2. Criteria Alternatives Matrix Analysis

The score from the projected outcomes for each policy alternative and criteria has been inserted for the CAM Analysis. We found the score for the policy alternatives by using the weights calculated from the AHP model to multiply each cell across the row, then sum each column down. The formula for this matrix is located in Appendix D.

	CAM Policy Alternatives Analysis					
		Alternatives				
Criteria	**Weight (%)**	**Plastic Bottle Tax**	**Bottle Bill**	**Bottle Ban**	**Shelf Space Percentage**	**Status Quo**
Maximize Efficacy	**0.40**	**5**	**7**	**9**	**6**	**2**
Maximize Administrative Feasibility	**0.09**	**8**	**8**	**5**	**3**	**10**
Maximize Environmental Equity	**0.47**	**7**	**8**	**4**	**5**	**1**
Minimize Cost to Relevant Stakeholders	**0.04**	**7**	**4**	**3**	**4**	**9**
Weighted Total	**1.00**	**6.29**	**7.44**	**6.06**	**5.17**	**2.56**

10. Assessing Trade Offs

According to the CAM, Bottle Bill scored the highest (7.44). The Bottle Bill scores so well overall because of its highest score on efficacy (7) and environmental equity (8), the two most important criteria. The Bottle Bill also scores high in administrative feasibility (8) but scores low on the cost to private stakeholders (4). Unlike the Bottle Bill, the Bottle Tax scores well in cost to private stakeholders (7). The limiting factor in the likely success of a Bottle Tax policy is its efficacy score (5). These factors make the Bottle Tax an excellent second choice policy alternative. Efficacy is the second-highest weighted criterion, and policies need to score well in this criterion to meet the client's needs. The Bottle Ban is noteworthy as it provides the highest efficacy (9) out of the five policy alternatives, though it scores low (5 or below) on all other criteria. It is also worth noting that the Status Quo scored higher than the Shelf Percentage Policy because of the Status Quo's high administrative feasibility (10) and cost to beverage corporations (9) compared to the Shelf Policy. However, the Status Quo provides the lowest efficacy out of all the alternatives.

11. Significant Findings and Recommendations

After extensive analysis of policy alternatives, our team concluded that implementing a Bottle Bill in D.C. will optimize the four criteria: efficacy, administrative feasibility, environmental equity, and cost minimization, to reduce plastic beverage container pollution in the Anacostia Watershed. Based on our Bottle Bill case studies, potential limitations to a Bottle Bill policy include resistance from the beverage industry and lobbying groups. These groups have historically shown an aversion to plastic reduction bills, and 1974 prevented the passage of the previous Bottle Bill in D.C. (Clay, 1989). Further limitations include high upfront for the beverage industry costs to purchase and install RVMs and operate transfer stations throughout the city to aid in the collection and sorting of bottles. Space is limited in D.C., especially for small retailers, so optimizing the collection and storage of redeemed bottles is essential.

To ensure the long-term success of the policy, periodically updating the Bill allows it to avoid becoming outdated. Every five years, the redemption price will automatically increase by two cents. In addition, every five years, the D.C. Council should be required to review any new container materials and, in consultation with DPW, determine if the Bottle Bill shall be expanded to include the new bottle materials. Reports on bottle redemption rates should be required every year by beverage corporations. An independent party will conduct random audits every five years to ensure the reliability of reported redemption rates. These reporting requirements will aid in tracking the program's success so it can be modified as needed. Identification systems, such as a barcode on all redeemable beverage containers, will ensure beverage containers were purchased in D.C. and minimize concerns over fraudulent returns from neighboring states. Allowing stakeholders such as municipal recycling organizations, government departments such as DPW, and retailers to be involved in the decision making process is projected to limit the opposition to the Bottle Bill. D.C. can also negotiate with surrounding jurisdictions to take coordinated action on creating bottle bills to minimize the potential for fraud.

Accessibility to redemption centers is key to recovering higher rates of beverage containers and preventing them from entering the Anacostia Watershed. To address this issue, it is recommended that beverage corporations provide as many RVM and express Bottle drop off locations as possible within D.C. to allow all residents to return bottles conveniently. Fewer bottles ensure that less harmful chemicals are released into the water from PET plastics. Less plastic bottles will also improve the living conditions of residents in marginalized communities living in the seventh and eighth wards along the Anacostia River. While a Bottle Bill Policy comes with limitations, it has the potential to significantly reduce the number of plastic beverage bottles entering the Anacostia Watershed and improve the health and lives of D.C. residents physically, mentally, and economically.

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13. Appendixes

13.1. Appendix A: Semi Structured Interviews Conversation Guide

1) Has the X bill reduced plastic pollution in the waterways in your area? Why do you think it has reduced plastic bottle pollution?
   a) How have you measured the reduction of plastic bottles?
2) From your point of view, do you think most residents would support changes to the bottle bill legislation? What sort of changes? Why would they support such changes? To what degree have recent amendments been supported by other stakeholders (government, industry)? Why? Why not?
3) What challenges did you face while trying to negotiate your (insert EPR/ Bottle Bill amendments/Recycled Content Bill/Soda Tax)? Can you describe the negotiation process? If you had it to do over again, what would you do differently?
4) How have industry and government stakeholders responded to plastic pollution and plastic bottle legislation in your state? Have those responses helped or hindered program success? Why? Why not?
5) What issues has the state or municipality faced in implementation, oversight, and regulation of this program? What do you think are the pros and cons of your state's bottle bill?
6) When analyzing our policies for feasibility, what stakeholders should we keep in mind beyond government officials and the plastic/drink industry?
7) What resources could you point us towards that would be useful in our policy analysis?
8) What has been the state X bill's socio-economic impact?
   a) Any specific concerns about Environmental Justice?
9) To what degree has program X been a cost-effective program for consumers and producers?
10) Is there anything I haven't asked you about that would be relevant to DC's consideration of policies to reduce plastic bottle pollution in its waterways?

13.2. Appendix B: Bottle Bill Statute Breakdown by State

State (Enacted)	Statute	Deposit/ Handling Fee (HF)	Beverages Covered	Container Covered	Unredeemed Deposits
California (1986)	Cal. Public Resources Code §§14501 - 14599	Deposit:5¢ (<24 oz.) 10¢ (≥24 oz.) HF: 1.046 cents	Beer, malt, wine, and distilled spirit coolers; all non-alcoholic beverages, except milk. Excludes vegetable juices over 16 oz.	Any container composed of aluminum, glass, plastic, or bi-metal; Exempts refillables	Property of program; Used for program administration
Maine (1976)	Me. Rev. Stat. Ann. tit. 38, §§3101 - 3118	Deposit:15¢ (wine/liquor) 5¢ (all others) HF:4¢ for brand-sorted returned containers/ 3.5¢ cents for returned containers that are part of a commingling agreement	All beverages except dairy products and unprocessed cider	Any sealed container of four liters or less composed of glass, metal or plastic	Returned to the state
Massachusetts (1981)	Mass. Gen. Laws Ann. ch. 94, §§321 - 327	Deposit: 5¢ HF:1¢ for reusable containers returned to a bottler/2.25¢ for containers returned to a distributor/3.25 ¢for containers returned to a redemption center	Beer, malt, carbonated soft drinks, mineral water	Any sealable bottle, can, jar, or carton composed of glass, metal, plastic, or a combination; Excludes biodegradables	Property of state general fund
Michigan (1976)	Mich. Comp. Laws §§445.571 – 445.576	Deposit: 10¢ HF: None	Beer, wine coolers, canned cocktails, soft drinks, carbonated and mineral water	Any airtight container under one gallon. Can be composed of metal, glass, paper, or plastic	75% to state for environmental programs; 25% for retailers
Oregon (1971)	Or. Rev. Stat. §§459A.700 – 459A.740	Deposit: 10¢ 2¢ (standard refillable) HF: None	Beer, malt, carbonated soft drinks, bottled water (will cover all beverages except wine, distilled liquor, milk, milk substitutes, and infant formula by 2018).	Any sealed bottle, can, or jar composed of glass, metal, or plastic	Retained by distributor and bottlers

Vermont (1972)	Vt. Stat. Ann. tit. 10, §§1521 - 1529	Deposit: 15¢ (liquor) 5¢ (all others) HF: 4¢ for brand-sorted returned containers/ 3.5¢ for returned containers that are part of a commingling agreement	Beer, malt, mixed wine, liquor, carbonated soft drinks.	Any bottle, can, jar, or carton composed of glass, metal, paper, plastic, or a combination; Excludes biodegradables	Retained by distributor and bottlers

13.3. Appendix C: Bottle Bill Terminology

Distributor		
State	**Term used by State**	**Definition**
California	Distributor	Any person who engages in the sale of beverages in beverage containers, including any manufacturer who engages in these sales. Distributor also includes any person who imports beverages from outside of California for sale to dealers or consumers in California.
Maine	Distributor	Any person engaging in the sale of beverages in beverage containers to a dealer in Maine. Distributors also include manufacturers who engage in such sales (Manufacturers, Distributors and Dealers of Beverage Containers, 1977).
Massachusetts	Distributor	Any person who engages in the sale of beverages in beverage containers to dealers in the commonwealth including any bottler who engages in such sales.
Michigan	Distributor	"A person who sells beverages in beverage containers to a dealer within this state, and includes a manufacturer who engages in such sales" (Michigan Beverage Container Deposit Law, 1976).
Oregon	Distributor	Every person who engages in the sale of beverages in beverage containers to a dealer in this state, including any manufacturer who engages in such sales.
Vermont	Distributor	Means every person who engages in the sale of consumer products in containers to a dealer in this State including any manufacturer who engages in such sales. Any dealer or retailer who sells, at the retail level, beverages in containers without having purchased them

		from a person otherwise classified as a distributor, shall be a distributor.

Retailer		
State	**Term used by State**	**Definition**
California	Dealer	"Defines a distributor as any person who engages in the sale of beverages in beverage containers to a dealer (retailer) or consumer in California, including any manufacturer who engages in these sales. Distributor also includes any person who imports beverages from outside of California for sale to dealers or consumers in California" (PRC14511).
Maine	Dealer	"A person who sells, offers to sell, or engages in the sale of beverages in beverage containers to a consumer, including, but not limited to, an operator of a vending machine containing beverages in beverage containers" (Manufacturers, Distributors and Dealers of Beverage Containers, 1977).
Massachusetts	Dealer	Any person, including any operator of a vending machine, who engages in the sale of beverages in beverage containers to consumers in the commonwealth.
Michigan	Dealer	A person who sells or offers to sell residents of Michigan a beverage in a beverage container. Potential dealers also include any operators of vending machines that contain a beverage in a beverage container (Michigan Beverage Container Deposit Law, 1976).
Oregon	Dealer	Every person in this state who engages in the sale of beverages in beverage containers to a consumer, or a full-service redemption center approved under ORS 459A.735.
Vermont	*	*Retailers are not distinct from distributors

Bottle		
State	**Term used by State**	**Definition**

California	Bottle	Beer, malt, wine coolers & distilled spirits coolers, all non-alcoholic beverages, except milk. Excludes vegetable juices over 16 oz; Aluminum, glass, plastic, and bi-metal.
Maine	Beverage Container	Includes all sealed beverages including glass, metal, plastic beverage containers licensed in the state of Maine under the Dept. of Environmental Protection. Excludes: "milk and dairy-derived products, Maine-produced apple cider, and blueberry juice, seafood, meat or vegetable broths or soups, instant drink powders, products designed to be consumed in a frozen state, and liquid syrups, concentrates or extracts" (Manufacturers, Distributors and Dealers of Beverage Containers, 1977).
Massachusetts	Beverage Container	Any sealable bottle, can, jar, or carton which is primarily composed of glass, metal, plastic or any combination of those materials and is produced for the purpose of containing a beverage. This definition shall not include containers made of biodegradable material.
Michigan	Beverage Containers	Any combination of metal, glass, paper, or plastic materials in an airtight container under 1 gallon. Includes: soda drinks, soda water, carbonated natural/ mineral water, nonalcoholic carbonated drinks, beer, ale, etc. (Michigan Beverage Container Deposit Law, 1976).
Oregon	Bottle	Beverages in cartons, foil pouches, drink boxes, and metal containers that require a tool to be opened do not have a rebate value. Beverages in growlers and crowlers do not have a rebate value because they are not factory sealed. Only beverages in sealed glass, metal, or plastic bottles and cans are included in the Bottle Bill.
Vermont	Container	Means the individual, separate, bottle, can, jar, or carton composed of glass, metal, paper, plastic ,or any combination of those materials containing a consumer product. This definition shall not include containers made of biodegradable material.

Producer

State	Term used by State	Definition
California	Bottle Manufacturer	Beverage manufacturer" means-the person who fills the beverage container and who sells, offers for sale, or distributes the filled beverage container in the state.
Maine	Distributors	Means a person who engages in the sale of beverage bottles or containers to a dealer in the state, and includes manufacturers that engage in such sales.
Massachusetts	Bottler	Any person filling beverage containers for sale to distributors or dealers, including dealers who bottle or sell their own brand of beverage.
Michigan	Manufacturer	"A person who bottles, cans, or otherwise places beverages in beverage containers for sale to distributors, dealers, or consumers" (Michigan Beverage Container Deposit Law, 1976).
Oregon	Distributor	Means any person who engages in the sale of beverages in beverage containers to a dealer in a state. This includes any manufacturer who engages in sales.
Vermont	Manufacturer	Means every person bottling, canning, packing, or otherwise filling containers for sale to distributors or dealers.

13.4. Appendix D: CAM Math Breakdown

$$Weighted\ Policy\ Total\ =\ \Sigma\ (Weight\ of\ each\ criteria\ *\ Score\ for\ each\ Criteria)$$

13.5. Appendix E: AHP Abbreviation Key

Abbreviation Key Criteria	
Efficacy	E
Administrative Feasibility	AF
Environmental Equity	EV
Cost to Stakeholder	CS

13.6. Appendix F: AHP Survey Response

1. Efficacy (number of bottles reduced in the Anacostia River) ↔ __5_ time(s) more important than ↔ Administrative Feasibility.
    a. Reasoning: The most important thing we can do is prevent more bottles from entering the Anacostia River. While we are happy to advocate for policies that push the administration outside of their comfort zone, pushing for a policy that can pass and be implemented is extremely important.

2. Efficacy ↔ _1_ time(s) more important than ↔ Environmental Justice/Equity.
    a. Reasoning: Environmental Justice/Equity has been ignored for two long in the Anacostia. We need to advocate for policies which work for the communities of our watershed inherently requiring a focus on environmental justice. Bottles are primarily found in EJ communities therefore these are inherently linked.

3. Efficacy ↔ _9_ time(s) more important than ↔ Cost to private stake holders (bottle corporations, drink corporations, etc).
    a. Reasoning: Private corporations have profited for decades because there were no restrictions so now, they can afford to pay for these things. As a bonus, it is something many companies are starting to use as a marketing strategy.

4. Administrative Feasibility ↔ _9_ time(s) more important than ↔ Environmental Justice/Equity.
    a. Reasoning: Equity is mandatory.

5. Administrative Feasibility ↔ __4_ time(s) more important than ↔ Cost to private stake holders (bottle corporations, drink corporations, etc).
    a. Reasoning: I think these are likely to be tied together as the administration are not likely to do something that private companies just will not stand for. I think having a policy option that the administration can get behind, is extremely important because the more they are excited about the policy the more likely it is to happen and happen well.

6. Environmental Justice/Equity ↔ _9_ time(s) more important than ↔ Cost to private stake holders (bottle corporations, drink corporations, etc).
    a. Reasoning: As we've mentioned before, this watershed has historically been the victim of environmental racism and injustice and as the Anacostia starts to get cleaned up, doing so in a way that protects the communities that have lived in this watershed is critical.