Final Report

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Final Report: Project WASTE (Waterway and Street Trash Elimination)

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Executive Summary

Project WASTE (Waterway and Street Trash Elimination) is a Citizen Science-based stewardship project focused on source reduction of trash pollution to reduce the volume and toxicity of floatable trash entering the Bronx River and surrounding waterways, engaging Citizen Science volunteers in hands-on trash collection and assessment, community advocacy, and development targeted outreach. Using trash booms to collect floatables installed at discrete locations along the river – at the border between the Bronx and Westchester counties and near the mouth of the river – we have been able to document the types, materials, quantities, brands, and sources of floatable pollution in the Bronx River.

Led by Alliance staff, from September 2016 to December 2017 we engaged 385 Citizen Scientists from 16 different organizations and 772 students and 158 teachers from 25 different institutions in 78 events throughout the Bronx, and reached an additional 475 students and 134 educators from 25 participating schools in Bronx and Westchester in outreach activities. The number of additional individuals impacted by the activities of our participants has not been quantified, but we anticipate that it is a much higher number considering the number of students and youth groups who participated. Our Education program has created an entire curriculum called, “What’s Floating?” to tailor data collection for school-aged children so educators can implement this project with their classrooms. They have monitored trash from their school grounds and from the street around their schools using the same protocols as our river-based assessments, working with 299 students and 147 teachers from 18 different institutions.

The total number of floatable trash pieces analyzed and removed from the Bronx River over the course of the study is 153,138, which corresponds to approximately 6700 pounds of garbage. When broken down into categories, Styrofoam constitutes 73% and plastic 19% of all trash encountered. Analyses indicate that levels of floatable trash in the river are strongly correlated ($r=0.86$) to river discharge (i.e., volume and rate of flow), meaning more trash enters the river during wet-weather events. Since all of the upstream communities are in municipal separate storm sewer systems (MS4) that allow stormwater to flow directly from stormdrains into the river, our study has documented the need for greater MS4 permit enforcement in Westchester County, particularly implementation of floatable trash containment structures placed in catchment basins or grates on stormdrains.

The most promising finding is that our removal efforts at the upstream boom and hotspots have had a significant impact on the total floatables collected by the downstream boom ($p=0.025$). All this information leads us to the conclusion that much of the accumulated trash that had been assumed to have originated in the Bronx actually may be from upstream in Westchester County.

Given the number of participants engaged and the volume of trash removed from the Bronx River and Long Island Sound, we feel confident that Project WASTE has had a significant community impact. Funding from NEIWPCC and the EPA has allowed us to develop and improve the methodology and program delivery to over a thousand local residents, students and educators, and partner organizations. We have been successful in continuing to fund this project and look forward to refining methodology, promoting community-level outreach, and inspiring continued data-driven advocacy through 2018.

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Bronx River Alliance staff participate in a boom clean-out event at Muskrat Cove, August 2016.

1 Project Synopsis

Project WASTE (Waterway and Street Trash Elimination) is a Citizen Science-based stewardship project focused on source reduction of trash pollution to reduce the volume and toxicity of floatable trash entering the Bronx River and surrounding waterways. Floatable trash are known pollutants threatening water quality in the Bronx River,[1] as well as the waterbodies that it empties into, including the East River, New York Harbor and Long Island Sound. Plastic trash that is discarded upstream in urban areas of Bronx and Westchester counties enter the Bronx River and are carried downstream to these other waterbodies, where they break down into microplastics[2] that are dangerous to marine life and have the potential to make their way up the food chain and onto people's dinner plates (Cole et al. 2011). In 2015 NY/NJ Baykeeper conducted a study of plastics (NY-NJ Harbor Estuary Plastic Collection Report) and found that at any given time, 165 million plastic pieces are floating in New York Harbor; the pieces that were large enough to identify were from single-use, disposable food and beverage containers.

Working with local organizations, agencies, and schools through this project, we engaged Citizen Science volunteers in hands-on trash collection and assessment, community advocacy, and development of a tailored outreach strategy with targeted messaging. Using trash booms to collect floatables installed at discrete locations along the river – at the border between the Bronx and Westchester counties and near the mouth of the river – we have been able to document the types, materials, quantities, brands, and sources of floatable pollution in the Bronx River. The associated education and outreach components of the project have engaged public officials, businesses, and students in creative ways to educate the public and address abatement solutions for this pollutant. The project has and will continue to reduce the volume of plastic trash entering the Bronx River, New York Harbor, and Long Island Sound by determining major local point-sources of the trash and by engaging Citizen Science stewards and students in participatory outreach and public education.

Because of this funding, we have been able to expand our initial pilot study to create Project WASTE, including development of robust Citizen Science programming around floatable trash in the Bronx River, one of our primary water quality impairments. Aspects of the project made possible were: formalization of our methodology and datasheet creation; QA/QC controls of volunteer-collected data, including the creation of a QAPP; community participation and engagement; and the development of curricula and associated service learning projects by the NYBG and our school partners.

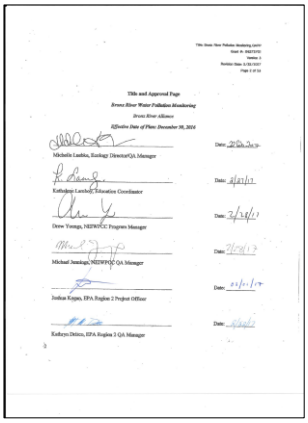
Led by Alliance staff, from September 2016 to December 2017 we reached 385 Citizen Scientists from 16 different organizations and 772 students and 158 teachers from 25 different institutions in 78 events throughout the Bronx. This systematic monitoring allowed us to better document the fate and movement of trash in the river. Our partners at the Natural Resources Group (NRG) of NYC Parks led four surveys at the hotspot at 182nd Street with an additional 12 volunteers and three surveys at Concrete Plant Park, while our partners at the New York Botanical Garden (NYBG) led five surveys at the Stone Mill, engaging an additional five volunteers. We partnered with four NYC agencies to extend their reach into the borough of the Bronx, including supporting eight different

[1] Bronx River/East River Watershed Waterbody Inventory/Priority Waterbodies List, assessed by New York State Department of Environmental Conservation: http://www.dec.ny.gov/docs/water_pdf/wiatllisbrer.pdf (revised 01/31/2017; accessed 12/22/2017)

[2] According to the National Oceanic and Atmospheric Administration's National Ocean Service, microplastics are small pieces of plastic, smaller than five millimeters in length, that come from larger pieces of plastic that have degraded over time (https://oceanservice.noaa.gov/facts/microplastics.html; accessed on 12/22/2017).

year-long service learning activities through our partnership with the Department of Education (DOE) and helping to distribute reusable bags, mugs, and bottles to local residents.

2 Tasks Completed



Task 1: QAPP Approval – approved 2/22/2017 (signature page inset right)

Task 2: Assessment

Citizen Science stewards remove and assess floatable debris at the upper trash boom in Muskrat Cove, June 2017.

We proposed that during Project WASTE, BxRA staff (Ecology Director and Conservation Crew) and ten volunteer Stewards per event (160 total) would collect the trash accumulating in the upstream boom approximately every two weeks in fall 2016 and summer 2017, and describe and record its properties using a standardized trash assessment protocol. Trash assessments engage local Citizen Science Stewards by allowing them to participate in the data collection and discovery of types and quantities of trash in each boom. Stewards are recruited from NYC Parks' stewardship programs, green job program trainees, local residents, and community service organizations. Ultimately we held 17 events with 194 Citizen Science Stewards and 109 students and educators at the upper boom in Muskrat Cove. These were spaced farther than every two weeks because it was determined that the necessary frequency was every three-to-four weeks, depending on rainfall. Because we found that rainfall would increase the likelihood for trash to escape from the upper boom, we made the best effort to remove trash from the boom prior to storms if we had enough notice.

We originally proposed that every two weeks, fall 2016 and summer 2017, NYC Department of Parks and Recreation Natural Resource Group (NRG) would document trash caught at the fish passage in River Park, and New York Botanical Garden (NYBG) staff and volunteers would use the established assessment protocol to document trash caught at the Stone Mill hot spot on the river within the Garden, which is mid-river, and provide the data to the Alliance. However, we found that our efforts to remove floatables from the upper boom in Muskrat Cove eliminated the need for our partners to perform assessments this frequently. The only

Volunteers removed trash debris caught in the fishway at the 182nd St hotspot with partners at NRG, September 2017.

accumulation that occurred was following rain events if the upper boom released all or some of its contents related to increased river discharge. As a result, the NYBG and NRG staff completed five assessments and seven assessments, respectively.

Our final proposed location at the downstream boom in Concrete Plant Park was to use a visual estimate protocol to assess the trash captured in the boom, including marking a field map and counting trash in sections based on amount and distribution of floatable trash. Staff from NRG undertook assessments twice, but because of how this boom captures floatables, it was difficult to create an accurate count without missing or double-counting items. Instead, we focused on the marsh area downstream of the boom within the park and conducted 19 assessments with 414 students and educators.

Citizen Science stewards from Bangladesh celebrate their hard work removing nearly 3000 pieces of trash, filling 11 bags from the upper trash boom in Muskrat Cove, July 2017.

Task 3: Analysis

Data from the baseline and project assessments were analyzed by Alliance staff to determine the make-up of floatables in the river and provenance (Bronx vs. Westchester County) and identify businesses (e.g., foam cups from Dunkin Donuts, plastic bags from local grocery stores) whose products most frequently end up trapped in the booms. The total number of floatable trash pieces analyzed and removed from the Bronx River over the course of the study is 153,138, which corresponds to approximately 6700 pounds of garbage. When broken down into categories, Styrofoam constitutes 73% and plastic 19% of all trash encountered; the other categories combined amount to less than 10% overall (Figure 1). Data collected using standardized trash assessments in each of these boom locations allow us to better understand

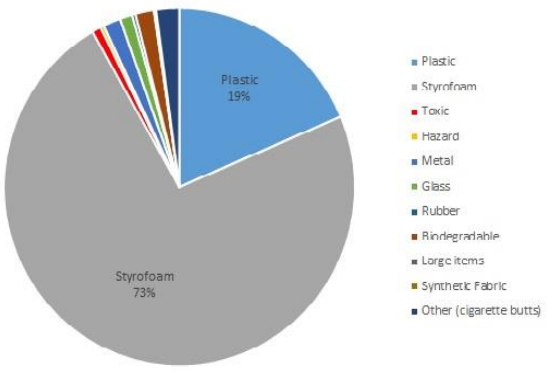


Figure 1: Breakdown of categories of trash collected from June 2016 – December 2017. Styrofoam represents 73% of all trash

what types of common floatables are the most persistent in our waterways, which are most likely to become broken down into smaller pieces and consumed by wildlife, and the quantities of floatables that pose the largest threat to human/wildlife health.

Although both Styrofoam and plastic are petroleum by-products and could be considered under the same general heading of plastic, they were separated to demonstrate how disproportionate both these categories are of the total trash encountered in our study. The “other” category made up slightly more than 2% of total garbage collected and included cigarette butts, which amounted to over 79% of the entire category.

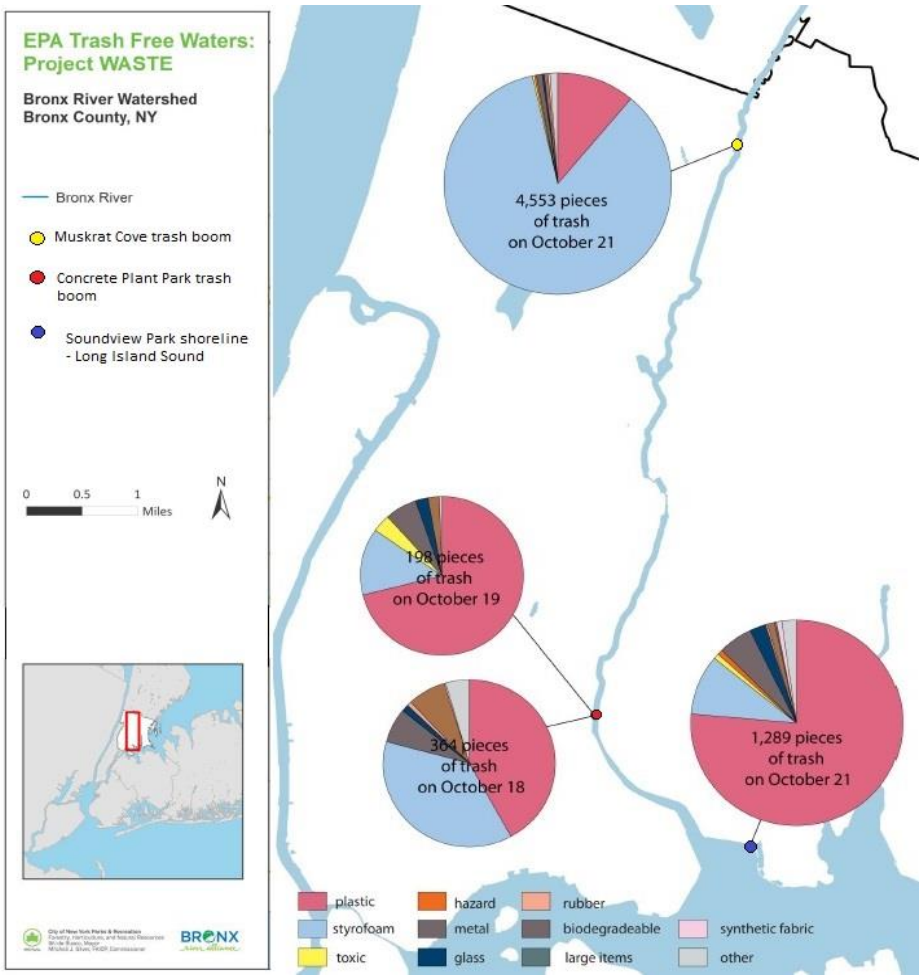


Figure 2: Spatial distribution of categories of trash collected in October 2017. The upper sample site is located at the Muskrat Cove upper trash boom and is representative of input into the Bronx River; the middle two graphs on 10/18 and 10/19 are located in the marsh at Concrete Plant Park, downstream of the trash boom, and the downstream-most sample site is at the mouth of the river, all of which were analyzing input from Long Island Sound.

When analyzed spatially across the watershed, a number of interesting findings become readily apparent. More Styrofoam is removed from the upper boom in Muskrat Cove than from downstream areas that receive direct input from the Long Island Sound and East River (Figure 2). This may be because there is significantly more Styrofoam entering the river from Westchester County, or it might represent a sample bias because Styrofoam is easier to remove from a contained area than to pick up from the marsh at Concrete Plant Park or the shoreline at Soundview Park. Another explanation may be that river-borne trash has a different composition than marine debris that accumulate in embayments.

As evidenced by the images in Figure 2, trash assessment events held at the Muskrat Cove boom tended to remove larger quantities than assessment events held downstream. Again, this might be related to the ease in counting, tallying, and removing all the objects contained by the boom, or it could be that river-borne trash items are larger and easier to identify and remove than marine debris items. Our next analysis will include more direct comparison to marine debris to identify what may be attributable to sample bias versus what may be representative of the composition of the types of floatable trash.

Analyses indicate that levels of floatable trash in the river are strongly correlated (r=0.86) to river discharge (i.e., volume and rate of flow), meaning more trash enters the river during wet-weather events (Figure 3). Also in evidence is that the upper trash boom in Muskrat Cove was most effective when discharge was low; heavy rain events caused the boom to disengage and drop all of its contents as well as leak trash otherwise trapped when discharge was high enough to change river flow patterns at the site, both of which were personally observed. Since all of the upstream communities are in municipal separate storm sewer systems (MS4) that allow stormwater to flow directly from stormdrains into the river, what our study has documented is the need for greater MS4 permit enforcement in Westchester County, particularly implementation of floatable trash containment structures placed in catchment basins or grates on stormdrains.

The most promising finding is that our removal efforts at the upstream boom and hotspots have had a significant impact on the total floatables collected by the downstream boom (p=0.025), confirming prior reported anecdotes. All this information leads us to the conclusion that much of the accumulated trash that had been assumed to have originated in the Bronx actually may be from upstream in Westchester County. We have begun follow-up efforts with Westchester County and New York Department of Environmental Conservation officials to determine how best to address floatable pollution into the river, including discussion of floatables containment structures for storm drains and the installation of additional booms upstream to further identify point sources.

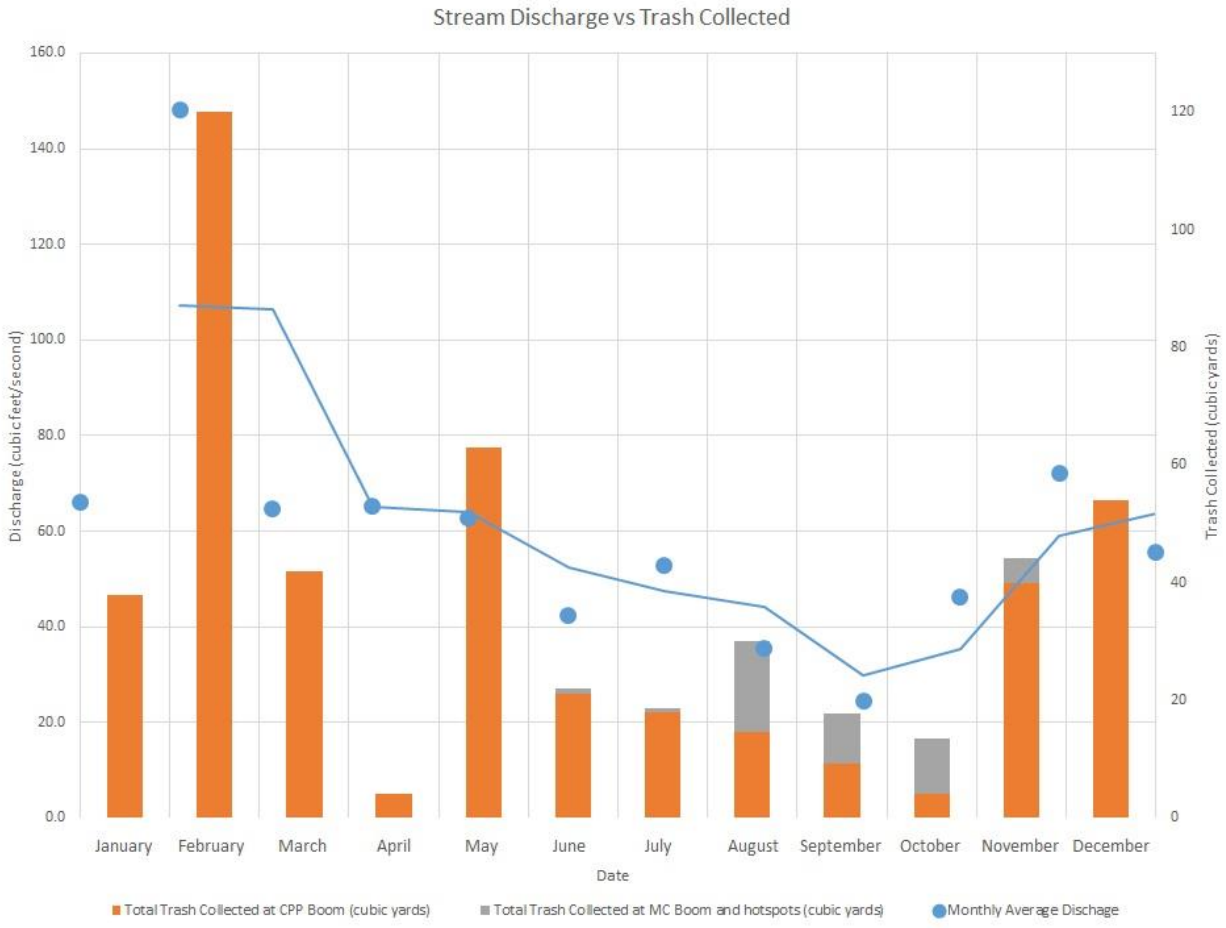


Figure 3: Strong correlation (r=0.86) between Bronx River discharge and floatable trash. The downstream boom at Concrete Plant Park (CPP) is depicted in orange, while the gray bars represent what was removed from the river at the upper boom in Muskrat Cove (MC). Note that the upper boom was in place between June and November 2016; data for the CPP boom not yet available for 2017.

Task 4: Outreach

We proposed that project staff would coordinate outreach to businesses selling identified brands to encourage the reduction of single-use, disposable trash, and to local officials who can support trash initiatives (e.g. availability of trash/recycle bins). BxRA staff (Education Coordinator, Ecology Director, Deputy Director) would work particularly with identified businesses and local officials to reduce inputs from the worst offenders by encouraging businesses to post messages or offer incentives to reduce/reuse/recycle and when not possible, to dispose of litter properly. In addition to corporations, we also proposed providing officials with information on resources needed to prevent trash pollution (trash bins, fencing, etc.). We also proposed that the Education Coordinator and Assistant would engage four High Schools in Westchester and the Bronx, educating students on the issue of floatable debris in the Long Island Sound, and engage approximately 20 students in each school (80 total) in developing communication and outreach strategies to reach residents, students, and workers in Bronx River watershed communities with messages about floatable debris. By supporting the students to develop their own outreach projects we tap their expertise on how to best communicate with their peers and the community, and deepen their commitment to stewardship of their local environment.

What we were able to achieve through outreach efforts from Alliance staff activities impacted 453 participants; the number of additional individuals impacted by the activities of our participants has not been quantified, but we anticipate that it is a much higher number considering the number of students and youth groups who participated and the outreach document we have created (inset left). Additionally, our activities and information gathered has inspired another partner group, Westchester Parks Foundation, to propose purchasing additional booms to install in two different locations in Westchester County to replicate the methods of Project WASTE and further aid in isolating potential sources of floatable trash. We will be undertaking a train-the-trainer program in spring 2018 to ensure replicability of methods to obtain finer-scale data from upstream sources.

Our Education program has created an entire curriculum called, “What’s Floating?” to tailor data collection for school-aged children so educators can implement this project with their classrooms. They have monitored trash from their school grounds and from the street around their schools using the same protocols as our river-based assessments, working with 299 students and 147 teachers from 18 different institutions. We also created a Trash Bingo game where students use game play to advance their observation and study of litter in different areas (e.g., school grounds, neighborhood parks, Bronx Forest, and the unwadeable estuary portions of the river).

Through a partnership with the NYC Department of Education (DOE), for the past two years we have engaged eight environmental clubs at seven different schools in Manhattan, Queens, and the Bronx in year-long studies. Educators will guide students to create and carry out their own public awareness projects, developing communication and outreach strategies to reach residents, students, and workers in Bronx River watershed communities with messages about floatable debris. These clubs have used the data to create student-led projects, ranging from weekly stewardship clean-ups at the neighborhood park, a perception survey and blind taste test of tap

vs. bottled water,[3] and outreach to 311 and the NYC Department of Sanitation to address localized accumulation of cigarette butts from all the idling school bus drivers. By supporting the students to use data-driven advocacy and develop their own outreach projects, we tap their expertise on how to best communicate with their peers and the community, and deepen their commitment to stewardship of their local environment.

Citizen Science stewards from across NYC and Westchester receive reusable bags and mugs at a Project WASTE engagement event, August 2017.

We are currently in discussions with local business improvement districts to involve more local businesses in sustainable behavior messaging, and hope to create some branded, reusable bags to distribute locally that will help spread our message and reduce any possible disproportionate burden on low-income residents should the single-use bag legislation pass in NYC. Our partnership with the Mayor's Office of Sustainability through the Birdie program has enabled us to distribute 86 reusable coffee tumblers to program participants and signed up an additional 15 members of Alliance staff in exchange for their pledge to reduce their consumption of single-use items. In spring 2018, we will be continuing this relationship and signing up local businesses to participate in their B.Y.O. Bag and Mug campaigns.

Task 5: Action

Commensurate with outreach activities, NRG proposed to work with Parks' Maintenance and Operation Staff to install additional trash receptacles to provide more opportunities for park users to properly dispose of their trash. To ensure that the quantity and location of the trash receptacles will be effective, NRG will make recommendations based on the outcome of the trash analysis and meetings with Park managers and BxRA. This action has proceeded as far as support from the Bronx Borough Chief of NYC Parks; we currently are seeking a meeting to discuss installation of trash and recycle bins in our parks and responsibility for maintenance with a representative from the NYC Department of Sanitation. While this deliverable will not be met during the duration of the funding period of this grant, it is an action item we will continue to pursue beyond the length of this grant as part of our on-going advocacy efforts.

In addition to more garbage and recycling containers installed at parks, we have another project in development related to Bronx River trash abatement: a Bronx River trash wheel, similar to that which has been installed in the Baltimore harbor. We are currently involved in a feasibility study to determine if and where along the river a boom and wheel could be located to capture and assess trash that would have accumulated in the lower DEP-maintained boom in CPP. The current boom loses its contents at each high tide, often stranding the trash on the river banks as the tide recedes, and prevents boats from passing that point in the river, effectively cutting in half the portion of the estuary that is accessible to paddlers. Each year our Recreation program takes out over 1500 paddlers on the Bronx River, and another local organization devoted to youth programming, Rocking the Boat, adds an additional 3300. Increased access within the estuary portion of the river allows us greater flexibility in programming and the possibility of engagement of more paddling participants.

[3] Both teachers and students had indicated a preference for bottled water in the initial perception survey, but unanimously preferred tap water during the blind taste test.

3 Methodology

The upstream trash boom is located in Muskrat Cove Park, Bronx, NY, between the 233rd Street bridge and a crossing of the Metro-North railway (Figure 4). This location was chosen because of its proximity to the border between the Bronx and Westchester counties and vehicle access to transport people, equipment, and bags of trash following clean-out events. The downstream trash boom, maintained by the NYC DEP, collects floatables in the downstream estuary section of the river at Concrete Plant Park, which is approximately one mile upstream from the mouth of the river.

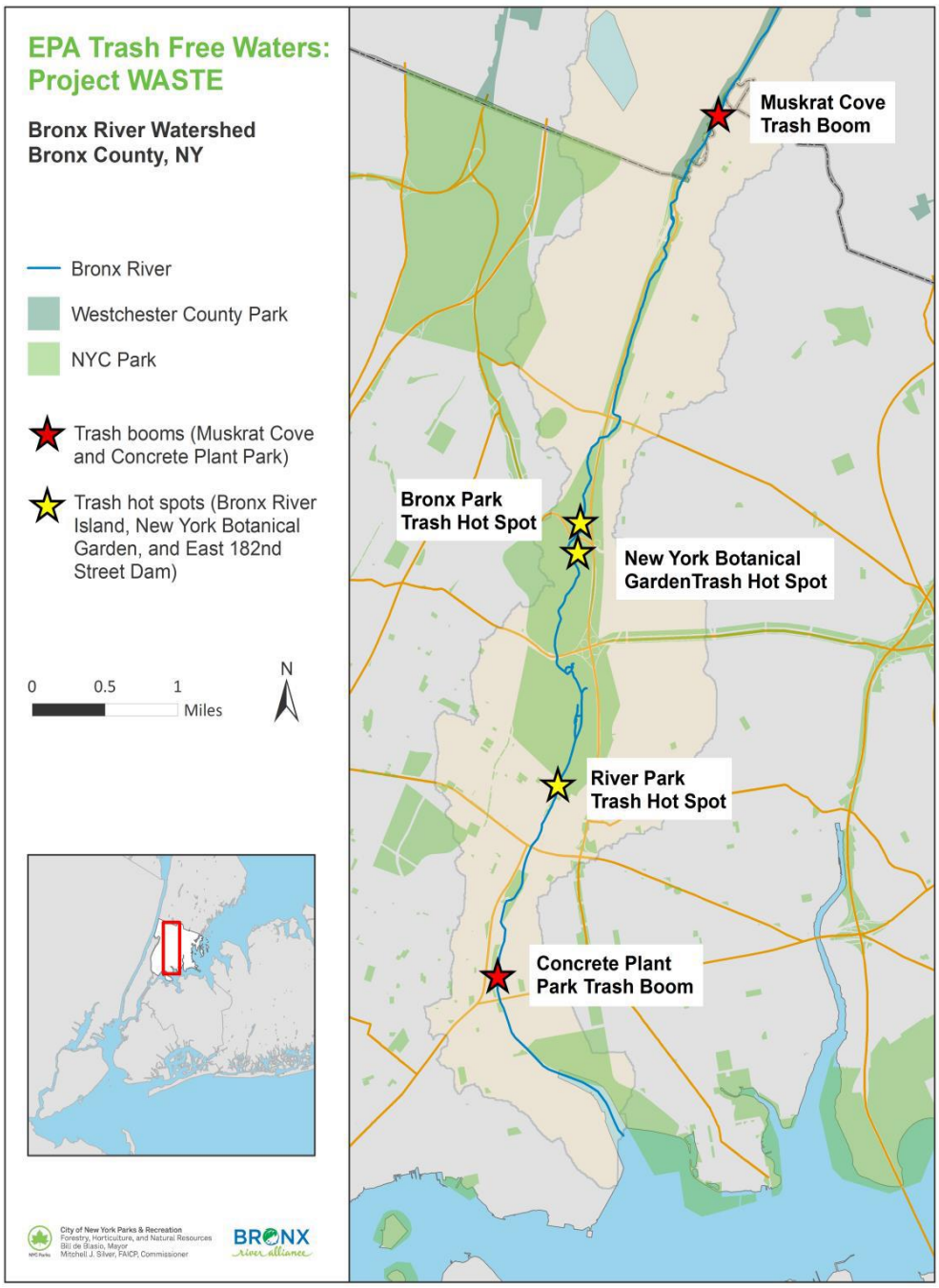


Figure 4: Map of Project WASTE study locations, Bronx, NY. Trash booms are indicated by the red stars, while hotspots are in yellow.

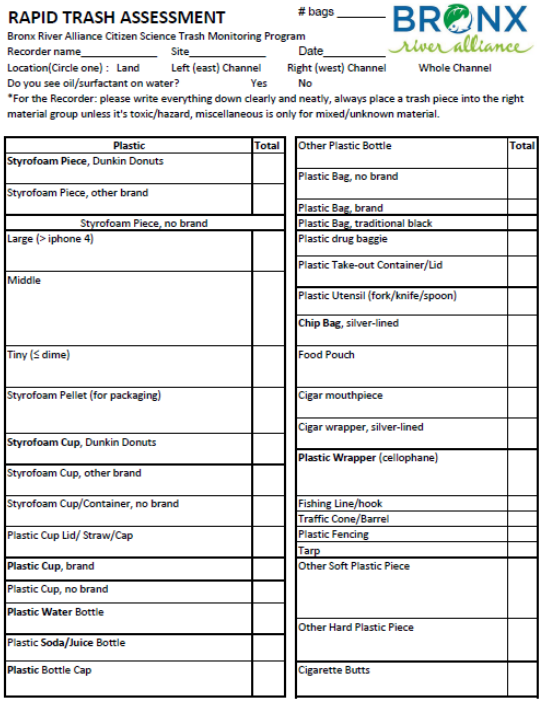
Hotspots are defined as locations where trash accumulates (i.e. blockages, bends, and bridge piers) and have been established between the two booms at the following locations (in downstream order): blockages in Shoelace Park, upstream end of the Island in the Bronx Forest, the Stone Mill at the New York Botanical Garden (NYBG), and the 182nd Street dam at River Park.

The purpose of Project WASTE is to address trash pollution in the Bronx River by documenting the quantities, types, materials, and brands of floatable trash found at key locations (Table 1). This study is designed to understand source inputs by separating the floatables that originate in Westchester County from those originating in the Bronx through the use of a floating trash boom installed at the border between the two counties.[4] All the wadeable sites – Muskrat Cove boom (Site 1, Table 1) and 4 hotspots (Sites 2-5, Table 1) – will include full removal of all litter and debris during boom/hotspot trash assessment events.

TABLE 1 – PROJECT WASTE STUDY SITES

Study Site #	**Study Site Name**	**GPS Coordinates**	**Channel location and type**
1	Muskrat Cove boom	40.894656, -73.862333	Whole channel – upstream boom
2	Shoelace Park	40.885057, -73.867163	Mid channel – hotspot
3	Island, Bronx Forest	40.868458, -73.873487	Mid channel – hotspot
4	Stone Mill at NYBG	40.861139, -73.875385	Left bank – hotspot
5	182nd Street dam, River Park	40.843204, -73.876656	Right bank – hotspot
6	Concrete Plant Park boom	40.825484, -73.884603	Whole channel – downstream boom

Data are tallied and recorded using a rapid trash assessment protocol (inset right; Appendix A) modified from the California State Water Resources Control Board's Rapid Trash Assessment protocol designed for the State's Surface Water Ambient Monitoring Program



RAPID TRASH ASSESSMENT # bags _____ BRONX river alliance

Bronx River Alliance Citizen Science Trash Monitoring Program

Recorder name_____ Site_____ Date_____

Location(Circle one) : Land Left (east) Channel Right (west) Channel Whole Channel

Do you see oil/surfactant on water? Yes No

*For the Recorder: please write everything down clearly and neatly, always place a trash piece into the right material group unless it's toxic/hazard, miscellaneous is only for mixed/unknown material.

Plastic	Total
Styrofoam Piece, Dunkin Donuts	
Styrofoam Piece, other brand	
Styrofoam Piece, no brand	
Large (> iphone 4)	
Middle	
Tiny (≤ dime)	
Styrofoam Pellet (for packaging)	
Styrofoam Cup, Dunkin Donuts	
Styrofoam Cup, other brand	
Styrofoam Cup/Container, no brand	
Plastic Cup Lid/ Straw/Cap	
Plastic Cup, brand	
Plastic Cup, no brand	
Plastic Water Bottle	
Plastic **Soda/Juice** Bottle	
Plastic Bottle Cap	

Other Plastic Bottle	Total
Plastic Bag, no brand	
Plastic Bag, brand	
Plastic Bag, traditional black	
Plastic drug baggie	
Plastic Take-out Container/Lid	
Plastic Utensil (fork/knife/spoon)	
Chip Bag, silver-lined	
Food Pouch	
Cigar mouthpiece	
Cigar wrapper, silver-lined	
Plastic Wrapper (cellophane)	
Fishing Line/hook	
Traffic Cone/Barrel	
Plastic Fencing	
Tarp	
Other Soft Plastic Piece	
Other Hard Plastic Piece	
Cigarette Butts	

[4] All trash accumulation in the upstream boom likely originated in Westchester County; these items are regularly tallied and removed. While it was originally assumed that any trash accumulation at hotspots and in the downstream Concrete Plant Park boom would have originated in the Bronx, through the study we have learned this is not a valid assumption due to loss of boom contents or total disengaging the upper boom during heavy rain events.

(SWAMP).[5] Modifications are slight, adjusting for perennial flow conditions causing accumulations at in-stream blockages, like booms and dams, rather than dry-weather conditions that might distribute trash along a dry streambed. Thus, rather than assess a 100' reach, we assess the entire contents of a boom or an established hotspot and record the dimensions of the accumulation. As in SWAMP's protocol, photos are taken before and after assessment events at each site to provide a visual archive and to compare to tally results to refine analytical comparison among visual trash assessments.

Sampling teams will be composed of BxRA Staff, Citizen Science stewards, community groups, and interested individuals. In order to maintain consistency of data collection methods throughout the project, there will be at least two trained BxRA Staff responsible for conducting a brief overview and training at the beginning of each event to all participants. They will have sample items and photos depicting the various categories of trash types in the protocol to answer any questions before the assessments begin. When possible, returning volunteers will be paired with new volunteers to better instruct and answer any questions. All questions in the field should be referred to the most senior BxRA staff member present; any other questions should be referred directly to Michelle Luebke, the QA Manager.

Participants count the contents of the boom/hotspot, recording the items in the appropriate category on the Rapid Trash Assessment datasheet. At least one experienced BxRA Staff or volunteer should have a tally sheet and assist other tally-takers to correctly record the various trash items and categories collected by the other participants. As the trash is tallied, it is removed from the upper boom and put into bags. At the end of the assessment, all bags are brought up to the staging area and counted before being disposed at Ranaqua, the Bronx Borough headquarters for NYC Parks. Volume is calculated according to the total volume of each bag and how full it is, allowing us to not only correlate the volume with the tally of the contents, but also compare total volume removed to any change in volume recorded at the downstream boom, as measured by the NYC DEP.

These trash assessment clean-out events at the upstream boom (Site 1) should occur 1-2 times per month, except in the winter months when danger of freezing may occur that would damage the boom or be dangerous for participants that requires the boom to be removed (December – February). Hotspots will be observed and when accumulation is sufficient, will be assessed with full removal, indicating the time period between events (i.e. frequency), total volume of trash removed at each event, and individual tally totals for trash pieces.

NYC DEP skimmer boat cleaning out the CPP trash boom, November 2017.

The Concrete Plant Park (CPP) boom (site 6) is located within the estuary section of the river, which is not wadeable, preventing clean-out assessments. Visual assessments are conducted here, led by NRG staff, including the photo documentation procedure and binoculars for determining the contents of the boom. This boom site is maintained by NYCDEP and requires mechanical harvesting from a boat to remove debris. Frequency and volume of floatables in the Concrete Plant Park boom are recorded by the NYCDEP during these mechanical clean-out events, and data are shared with NYC Parks and the Alliance.

[5] www.waterboards.ca.gov/sanfranciscobay/docs/swampthrashreport.pdf

NYC DOE educators conduct an assessment in the marsh at Concrete Plant Park during a professional development event, October 2017.

Analysis of the boom and hotspot data occurred during the winter when trash assessment events are postponed. Data will be tallied and compiled into quantities of categorized trash items to determine the most common and/or persistent, into common brands found at given locations to identify possible source(s), and into easy-to-understand information to incorporate into outreach and education materials. Data from the NYCDEP about CPP boom clean-out frequencies and volumes will be used to analyze pre- and post-boom conditions, and calculate the effects our removal efforts are having on the quantity of floatable trash in the river. They also were compared to rainfall data to see if patterns in debris accumulation are correlated to weather conditions. Using project data, NRG will determine where in riverfront parks additional trash and recycling bins would make the biggest trash reduction impact, and coordinate the placement and maintenance of the bins. Trash assessment data directly inform the outreach and education messaging, encouraging participation in continued trash assessments, thus generating more data in an iterative and dynamic opportunity to evaluate effectiveness of project activities.

4 Quality Assurance Tasks Completed

For our quality control measures, we primarily relied on standardized trash assessment protocols being used at all hotspot and boom locations in the same manner. This was ensured either by staff documenting the trash items on the tally sheets or by training a participant to use the tally sheet and standing next to them to ensure correct tallying. A before and after photo of the site was always taken for all boom and hotspot cleanout events.

We used the same Rapid Trash Assessment tally sheet at both booms and hotspots to ensure comparability among locations and over time. Because of the difficulty in ensuring accurate data at the downstream boom using visual assessment tools only, we have proposed in future grants to perform periodic QA checks using boats to groundtruth the visual assessment data to improve accuracy and comparability.

5 Deliverables Completed

Outcome	Activity	Metric	Result
Reports	Reporting on the 10th of Jan, Apr, July, Oct; final in Jan 2018	4 quarterly reports + final report	5 completed + final
Trash Assessments at Muskrat	BxRA staff and volunteers collect trash accumulating in the upstream boom	~16 events (every 2 wks, spring + summer 2017)	23 events 243 CS stewards

Cove (upper boom)		- 10 CitSci Stewards/event = 160 total	149 students + teachers **392 total participants**
Trash Assessments at hotspots	BxRA staff and volunteers collect trash accumulating at other hotspots (Forest, Shoelace, River Park, etc.)	~16 events (every 2 wks, spring + summer 2017) - 10 CitSci Stewards/event = 160 total	26 events 125 CS stewards 367 students + teachers **492 total participants**
Trash hotspot assessment by partner orgs	NRG documents trash hotspot at fish passage in River Park	~16 events (every 2 wks, fall 2016 + summer 2017)	5 events 12 participants
	NYBG staff and volunteers document trash hot spot at the Stone Mill dam	~16 events (every 2 wks, fall 2016 + summer 2017)	5 events 5 participants
Trash Assessments at CPP (lower boom)	BxRA/NRG staff assess trash at CPP boom (downstream) with youth groups	~16 events (every 2 wks, fall 2016 + summer 2017) - report large accumulation to DEP	19 events 414 students + teachers
			78 total events **385 CS stewards** **930 students + teachers** **1315 total participants** **302.5 bags *22lbs/bag = 6655 lbs.**
	Stewards recruited from NYC Parks stewardship programs, green job program trainees, local residents, and community service organizations		Ongoing
	Quality Assurance Project Plan	Approved QAPP	Approved on 2/22/17
Analysis	Data analyzed by BxRA and NRG staff	- Identify the make-up of floatables in the river and provenance (Bronx vs. Westchester County) - identify businesses whose products end up in the booms	Completed December 2017
Outreach	BxRA staff work with businesses and local officials encourage businesses to reduce source inputs	- 4 HS in Westchester and the Bronx - engage ~20 students in each school (80 total) in developing communication and outreach strategies	475 students and 134 educators from 25 participating schools in Bronx and Westchester 56 tote bags and 46 reusable mugs distributed 15 additional people signed up to take the Birdie pledge

			Created outreach flyer December 2017
Action	NRG work with Parks' Maintenance and Operation Staff to install additional trash receptacles		Will continue to pursue with NYC Dept. of Sanitation after funding ends

6 Conclusions

Given the number of participants engaged and the volume of trash removed from the Bronx River and Long Island Sound, we feel confident that Project WASTE has had a significant community impact. Funding from NEIWPCC and the EPA has allowed us to develop and improve the methodology and program delivery to over a thousand local residents, students and educators, and partner organizations. We have been successful in continuing to fund this project and look forward to refining methodology, promoting community-level outreach, and inspiring continued data-driven advocacy through 2018.

A few important lessons have been learned, including a challenge to our assumption that all trash in hotspots and the lower boom in Concrete Plant Park originated in the Bronx. Rainy weather caused events to be cancelled and/or caused floatables to escape the boom, so it was determined that downstream hotspots caught on snags cannot be quantified as emanating from the Bronx as much of the material probably washed out of the boom during these events. Anecdotally, the NYBG noticed an increase at their hotspot following a number of rainy events from the release from the Muskrat Cove boom or in the winter after the Muskrat Cove boom had been removed. Much of the material collected was still recorded, but likely came from upstream, not from adjacent land use, Garden visitors, or outfalls.

NRG's 2017 trash assessment season at both the 182nd Street hotspot and the Concrete Plant Park trash boom was a pilot season, and thus fewer trash assessments were able to be completed than originally expected. Given staff turnover within NRG, a full-time staff person for this project did not come on board until August, resulting in surveys starting later than expected. Additionally, the rapid trash assessment protocol needed to be applied differently given the site conditions, so it took additional time to test the protocol before Citizen Science stewards could be involved in assessments.

Due to difficulty seeing and accurately recording the trash in the Concrete Plant Park trash boom from the bulkhead, we will be conducting future assessments from boats in the water. We are coordinating with a local group that has the potential to conduct visual trash assessments with community stewards by boat next year. Students from Rocking the Boat led by NYC Parks and NRG Staff will perform periodic boat-based assessments of a proportion of the boom contents, dividing the trapped material into 1 m2 quadrats and ground-truthing the contents of randomly-selected sections. In addition, DEP's unpredictable cleaning schedule at the Concrete Plant Park trash boom made planning visual assessments prior to cleanouts challenging, so we recommend that the Alliance and NRG continue to communicate with DEP to try to get this schedule in advance next season.

During the winter months we have been engaged with the NY Soil and Water Conservation District staff and KCI, a Baltimore-based consulting firm assisting with the design and implementation experience to install trash wheels in estuaries. We anticipate that this structure will be located near the mouth of the river in Starlight Park or Concrete Plant Park and will replace the existing trash boom. These structures have a paddle wheel- or solar-driven conveyor belt that would pull trash up out of the river and deposit it into dumpsters. This would allow access to the contents of the

current lower boom and could improve quantification of floatable materials in a manner that would make the data more comparable to the upper boom and hotspot assessments.

7 References

Cole, M., Lindeque, P., Halsband, C., Galloway, T.S. 2011. Microplastics as contaminants in the marine environment: A review. Marine Pollution Bulletin 62:2588

NY/NJ Baykeeper. 2016. NY-NJ Harbor Estuary Plastic Collection Report. http://nynjbaykeeper.org/wp-content/uploads/2016/02/NYNJBaykeeper-Plastics-Report-February-2016-2.pdf

Students from Pan American International High School participate in a trash assessment and removal event at the marsh at CPP, March 2017.

8 Appendices

8.1 Appendix A – Rapid Trash Assessment data sheet

RAPID TRASH ASSESSMENT # bags _____

Bronx River Alliance Citizen Science Trash Monitoring Program

Recorder name_____ Site_____ Date_____

Location(Circle one) : Land Left (east) Channel Right (west) Channel Whole Channel

Do you see oil/surfactant on water? Yes No

*For the Recorder: please write everything down clearly and neatly, always place a trash piece into the right material group unless it's toxic/hazard, miscellaneous is only for mixed/unknown material.

Plastic	Total
Styrofoam Piece, Dunkin Donuts	
Styrofoam Piece, other brand	
Styrofoam Piece, no brand	
Large (> iphone 4)	
Middle	
Tiny (≤ dime)	
Styrofoam Pellet (for packaging)	
Styrofoam Cup, Dunkin Donuts	
Styrofoam Cup, other brand	
Styrofoam Cup/Container, no brand	
Plastic Cup Lid/ Straw/Cap	
Plastic Cup, brand	
Plastic Cup, no brand	
Plastic Water Bottle	
Plastic **Soda/Juice** Bottle	
Plastic Bottle Cap	

Other Plastic Bottle	Total
Plastic Bag, no brand	
Plastic Bag, brand	
Plastic Bag, traditional black	
Plastic drug baggie	
Plastic Take-out Container/Lid	
Plastic Utensil (fork/knife/spoon)	
Chip Bag, silver-lined	
Food Pouch	
Cigar mouthpiece	
Cigar wrapper, silver-lined	
Plastic Wrapper (cellophane)	
Fishing Line/hook	
Traffic Cone/Barrel	
Plastic Fencing	
Tarp	
Other Soft Plastic Piece	
Other Hard Plastic Piece	
Cigarette Butts	

Balls/Toys	Total
Tennis Ball	
Soccer/Basketball	
Golf Ball	
Base/Soft Ball	
Plastic Ball	
Nerf Dart	

Toxic	Total
Oil container	
Paint Container (Spray or not)	
Aerosol Can (not paint)	
Lighters	
Small Battery	
Other	

hazard (Do not touch, only record)	Total
Syringes	
Other Mediacal Waste/Container	
Personal care materials	
Condom	
Tampon Applicator	
Human waste	
Dead Animal	
Pet Waste	
Other	

Biodegradable	Total
Paper cup, Starbucks	
Paper cup, brand	
Paper cup, no brand	
Paper sheet	
Paper piece	
Cardboard	
Cork	
Lumber	
Food Waste/Offering	
Other	
Fabric and Cloth	**Total**
Synthetic Fabric	
Natural Fabric	
Can't tell	

Metal	Total
Aluminum Can	
Aluminum Foil	

Glass (If broken, do not touch)	Total
Glass Bottle or Piece	
Large (50% > regular)	
Regular (snapple drink bottle)	
Small (50%< regular)	
Other glass container	

Rubber	Total
Rubber gloves	
Rubber boot/flip flop	
Ear Plug	
Balloon	
Other Synthetic Rubber	
Other Foam Rubber	

Metal (cont'd)	Total
Metal Bottle Cap, Beer Cap	
Wire	
Hanger	
Auto Part	
Bike/Scooter	
Other Soft Metal Object (bend)	
Other Hard Metal Object	

Miscellaneous (cont'd)	Total
Pen	
Shoes (not rubber)	
Light Bulb	
Furniture (mixed material)	
Mattress	
Ceramic Pot/Piece	
Bag of Trash	
Other Miscellaneous	

RAPID TRASH ASSESSMENT CONDITION CATEGORY

BRONX river alliance

Trash Assessment Parameter	Optimal	Sub Optimal	Marginal	Poor
				
Level of Trash	On a first glance, no trash visible. Little or no trash (<10 pieces) evident when streambed and stream bank are closely examined for litter and debris, for instance, looking under leaves.	On first glance, little or no trash visible. After close inspection small levels of trash (10-50 pieces) evident in stream bank and stream bed.	Trash is evident in low to medium levels (51-100 pieces) on first glance. Stream, bank surfaces, and riparian zone contain litter and debris. Evidence of site being used by people: scattered cans, bottles, food wrappers, blankets, clothing.	Trash distracts the eye on first glance. Stream, bank, surfaces, and immediate riparian zone contain substantial levels of debris (>100 pieces). Evidence of site being used by people: scattered cans, bottles, food wrappers, blankets, clothing.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Actual Number of Trash	0-10 trash items found based on a trash assessment of a 100-ft reach.	11-50 trash items found based on a trash assessment of a 100-ft stream reach.	51-100 trash items found based on a trash assessment of a 100-ft stream reach.	Over 100 trash items found based on a trash assessment of a 100-ft stream reach.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
				
Threat to Aquatic Life	Trash, if any, is mostly paper or wood products or other biodegradable material.	Little or no (<10 pieces) transportable, persistent, buoyant litter such as: hard or soft plastics, Styrofoam, balloons, cigarette butts. Presence of settleable, degradable, and non-toxic debris such as glass or metal.	Medium prevalence (10-50 pieces) of transportable, persistent, buoyant litter such as: hard or soft plastics, Styrofoam, balloons, cigarette butts. Larger deposits (>50 pieces) of settleable debris such as glass or metal. Any evidence of clumps of deposited yard waste or leaf litter.	Large amounts (>50 pieces) of transportable, persistent, buoyant litter such as: hard or soft plastics, Styrofoam, balloons, cigarette butts; toxic items such as batteries, lighters, spray cans; large amounts of settleable glass or metal.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

RAPID TRASH ASSESSMENT CONDITION CATEGORY

BRONX river alliance

Threat to Human Health	Trash contains no evidence of bacteria or virus hazard such as medical waste, diapers, pet or human waste. No evidence of toxic substances such as chemical containers or batteries. No ponded water for mosquito production. No evidence of puncture and laceration hazards such as broken glass or metal debris.	No bacteria or virus hazards or sources of toxic substances, but small presence (<10 pieces) of puncture and laceration hazards such as broken glass and metal debris. No presence of ponded water in trash items such as tires or containers that could facilitate mosquito production.	Presence of **any one** of the following: hypodermic needles or other medical waste; used diaper, pet waste, or human feces; any toxic substance such as chemical containers, batteries, or fluorescent light bulbs (mercury). Medium prevalence (10-50 pieces) of puncture hazards.	Presence of **more than one** of the items described in the marginal condition category, or high prevalence of any one item. (e.g. greater than 50 puncture or laceration hazards).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Illegal Dumping	No evidence of illegal dumping. No bags of trash, no yard waste, no household items placed at site to avoid proper disposal, no shopping carts.	Some evidence of illegal dumping. Limited vehicular access limits the amount of potential dumping, or material dumped is diffuse paper based debris.	Presence of **one** of the following: furniture, appliances, shopping carts, bags of garbage or yard waste, coupled with vehicular access that facilitates in and out dumping of materials to avoid landfill costs.	Evidence of chronic dumping, with **more than one** of the following items: furniture, appliances, shopping carts, bags of garbage, or yard waste. Easy vehicular access for in and out dumping of materials to avoid landfill costs.
SCORE	10 9	8 7 6	5 4 3	2 1 0
Illegal Littering	Any trash is incidental litter (<5 pieces) or carried downstream from another location.	Some evidence of litter within creek and banks originating from adjacent land uses (<20 pieces).	Prevalent (10-50 pieces) in-stream or shoreline littering that appears to originate from adjacent land uses.	Large amounts (>50 pieces) of litter within river and on banks that appears to originate from adjacent land uses.
SCORE	10 9	8 7 6	5 4 3	2 1 0
Accumulation of Trash	There does not appear to be a problem with trash accumulation from downstream transport. Trash, if any, appears to have been directly deposited at the stream location.	Some evidence (<10 pieces) that litter and debris have been transported	Evidence that (10-50 pieces) trash is carried to the location from upstream, as evidenced by its location near high water line, siltation marks on the debris, or faded colors.	Trash appears to have accumulated in substantial quantities at the location based on delivery from upstream areas, and is in various states of degradation based on its persistence in the waterbody. Over 50 items of trash have been carried to the location from upstream
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Total Score: _____

Site Name: _____

Date: _____ Recorder: _____

8.2 Appendix B – Project WASTE Outreach flyer

Project WASTE

BRONX river alliance

Water And Street Trash Elimination

Project WASTE engages volunteers in hands-on trash collection and assessment on the Bronx River. Documenting the types, materials, quantities, brands, and sources of floatable trash has helped us to develop community-driven education, outreach, and advocacy programs focused on reducing trash pollution into the Bronx River.

How does Project WASTE work?

Source: NYC Dept. of Environmental Protection

Since the summer of 2016, volunteers have been assessing floatable trash that is collected from two trash booms at different points in the Bronx River. The upper boom in Muskrat Cove catches trash coming downstream from Westchester County into the Bronx, and the lower boom in Concrete Plant Park catches everything else before it can pollute the East River and Long Island Sound.

By engaging over 1,300 students, educators, and interested residents, we have removed over 3 tons of garbage from the Bronx River! We hope through our actions we are able to improve the health for our neighbors and wildlife living in or near the Bronx River.

Students pose in their waders before and after a Project WASTE event at the upper trash boom in 2017.

Bronx River Alliance • One Bronx River Parkway • Bronx • NY 10462 T718.430.4665 F718.430.4658 • www.bronxriver.org

Styrofoam is the #1 problem!

In the past two years, **volunteers have helped us to remove over 153,000 pieces of trash**, most of which is Styrofoam (73%) and plastic (18.5%).

Of the Styrofoam cups, 54% are from Dunkin' Donuts and represent over 96% of identifiable brands. Most of the plastic items are water, soda, or juice bottles, bags, or drinking straws.

Styrofoam and plastic are harmful to aquatic life because they do not biodegrade (i.e. decompose naturally); instead they break down into tiny particles that look like food to fish and other wildlife.

Most of the trash comes from streets

We found that **a significant portion of the floatable trash in the river originates in Westchester County** and is linked to rainfall, likely because of storm drains without screens. This shows just how important it is to dispose of items properly in trash/recycle bins or to use reusable items instead! We are working with local community organizations, municipal officials, businesses, and schools to address trash sources and launch an outreach campaign informed by our data.

Project WASTE participants pose with their reusable bags and mugs, August 2017.

What can you do?

Contact volunteer@bronxriver.org to join a Project WASTE event

Bring reusable coffee mugs and bags with you when you leave the house! Take the Birdie pledge at www.nyc.gov/greenyc

Check out Project WASTE on our website at www.bronxriver.org for more ideas!

This project was funded (under agreement I96275701) by the United States Environmental Protection Agency to the New England Interstate Water Pollution Control Commission (NEIWPCC) in partnership with the Bronx River Alliance.

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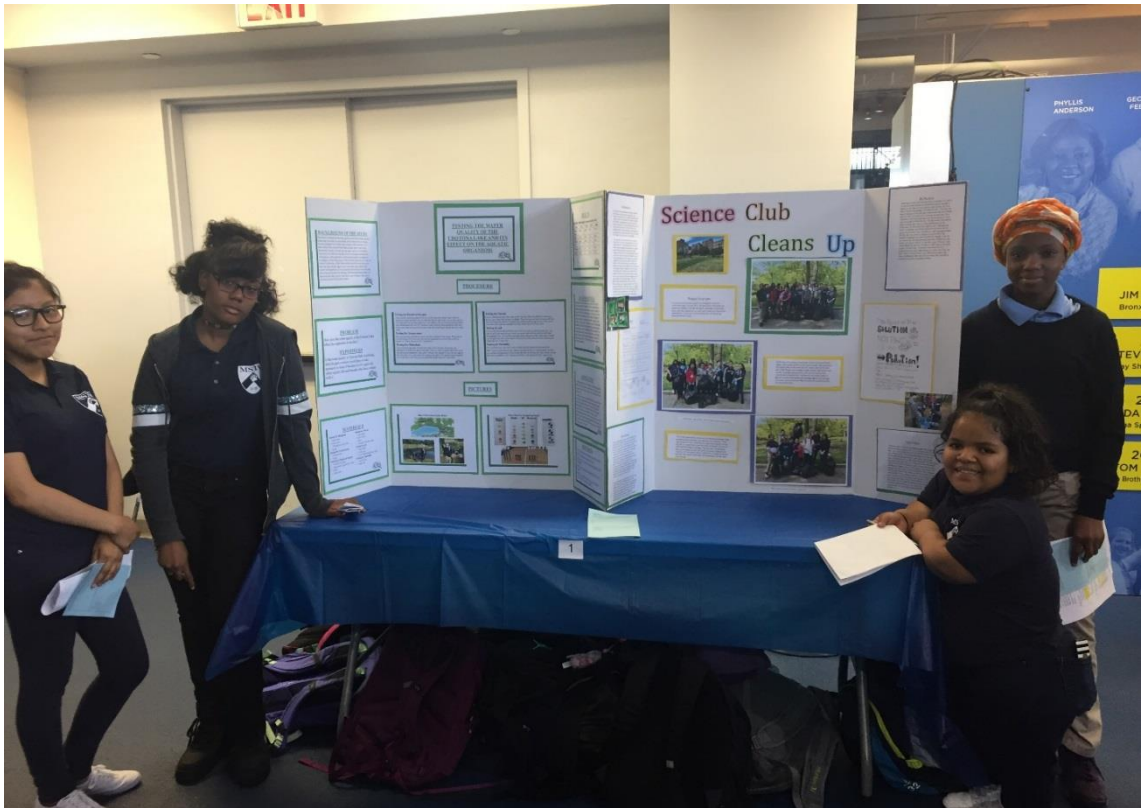
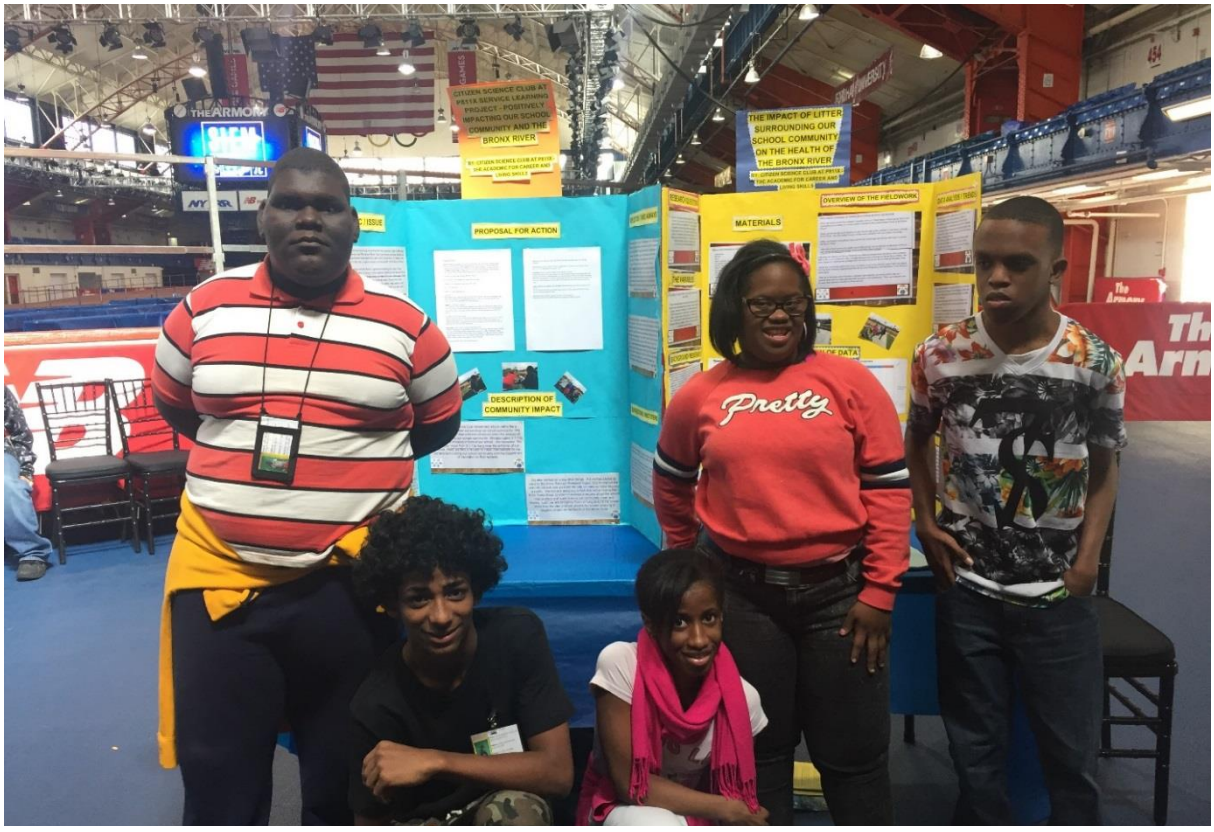
8.3 Appendix C – Photos from Project WASTE events

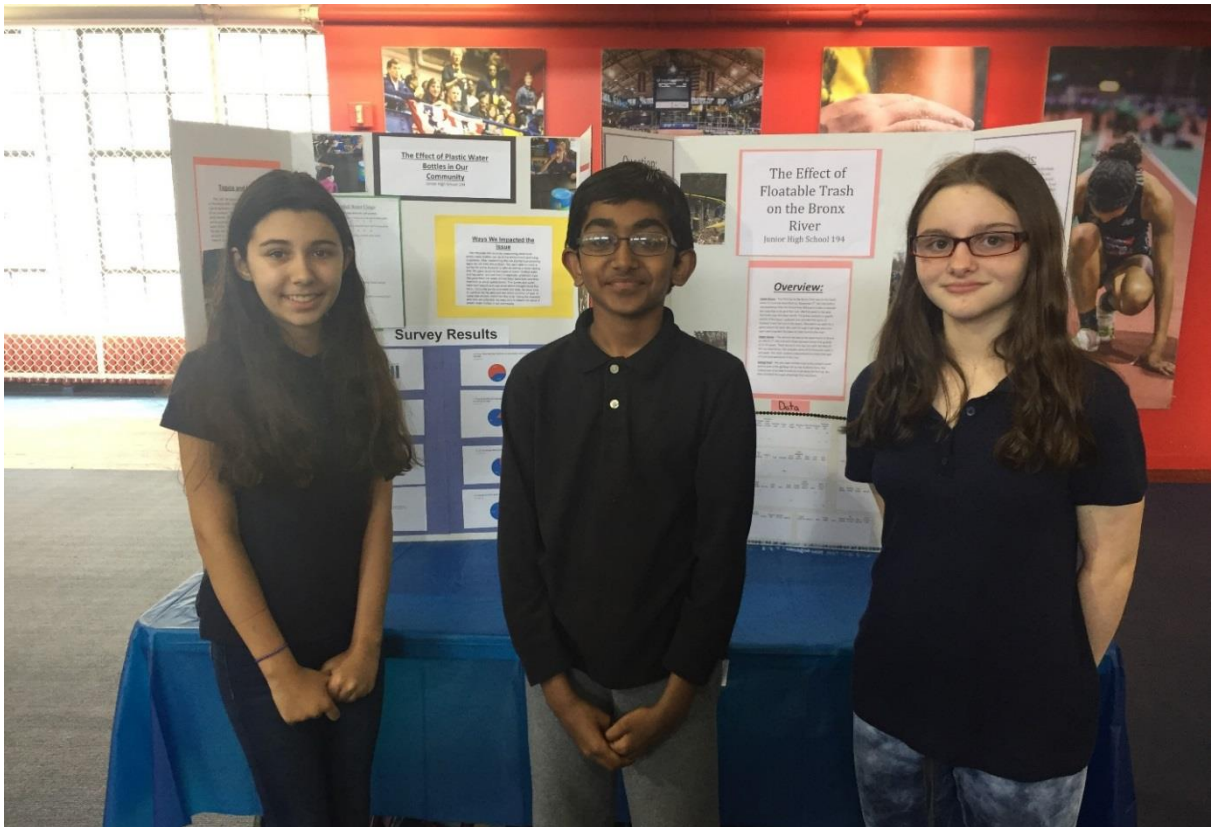
School group doing trash assessment in the Bronx Forest, 5/17/17



Student group reports service learning project at DOE symposium, 6/7/17



Student group reports on its cleanup and outreach project at DOE symposium, 6/7/17



Student group reports on its cleanup and outreach project at DOE symposium, 6/7/17

JHS 194 doing Muskrat Cove Trash Boom assessment, 3/21/17

JHS 194 doing Muskrat Cove Trash Boom assessment, 3/21/17

Harlem Educational Activities Fund group's trash assessment at the boom, 7/19/17

Public volunteer trash assessment event at the boom, 8/5/17

Phipps Houses group trash assessment at the Muskrat Cove boom, 8/25/17

Sustainable South Bronx group doing trash assessment, 9/20/17

8.4 Appendix D – Project WASTE Results spreadsheet (attached)