Quality Assurance Project Plan
Title and Approval Page

Stopping Trash Where it Starts
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Plan prepared by the Hudson River Foundation/NY-NJ Harbor & Estuary Program (HEP)

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In addition, any agencies, organizations, and individuals not listed here may obtain a copy of this Quality Assurance Project Plan upon request.

Project/Task Organization

Name	Title	Organizational Affiliation	Responsibilities (specific to this project)
Ariane Giudicelli	Project Manager	NY-NJ HEP	Coordinate with contractors and partners; prepare QAPP; provide grant oversight; assist with data collection method development and implementation; hire community groups and conduct outreach; direct community group field work at 10 sites; present results to groups and engage Trash-Free Waters Partnership
Meiyin Wu	Project Manager	PRI/Montclair University	Review and assist with QAPP; direct development of data collection methodologies and field work; oversee Ph.D. candidate and Montclair students/staff; direct data analysis and reporting
Alessandra Rossi	Ph.D. Candidate/Montclair project supervisor	Montclair University	Develop/refine data collection protocol and training materials; identify sites for data collection; implement protocol at 25 sites; supervise Montclair data collection; conduct data analysis and reporting
Tsung-Ta Hsu	Project QA Manager	Montclair University	Review QAPP; review data for completeness and accuracy; address data deficiency issues with HEP and PRI project managers
Drew Youngs	NEIWPCC Project Manager	NEIWPCC	Review QAPP; review and oversee technical work progress and deliverables
Michael Jennings	NEIWPCC Quality Assurance Officer	NEIWPCC	Review QAPP
Kathryn Drisco	EPA Quality Assurance Officer	EPA	Review QAPP
Josh Kogan	EPA Project Officer	EPA	Review QAPP
Jonathan Grupper	Community Project Supervisor	Friends of Bonsal Preserve	Supervise community data collection; submit data to Montclair; oversee outreach in local community

Debbie Mans	Community Project Supervisor	NY-NJ Baykeeper	Supervise community data collection; submit data to Montclair; oversee outreach in local community

Background, Problem Definition and Project Objectives

Background and Problem Definition

The lower Passaic River (NJ) is a 17-mile tidal stretch flowing through the most urbanized and industrialized areas of the state, and is one of the most polluted in the nation (Wikipedia, 2017a). Because of the extension of its basin this stretch includes communities with deep differences in their ethnical, educational, and economic compositions.

A litter survey conducted in 2004 in the whole State of NJ (GBB, 2005) estimated that trash rates for NJ will definitely pass the national average, if correction actions will not be taken. The Status of the Estuary 2012 (NY-NJ HEP, 2012) denounces the much higher costs of restoring/maintaining ecosystems degraded ecological communities compared to preservation of ecosystems which are self-sustaining.

Among the programs addressing the reduction of the accumulation of trash, some examples are the Sanctuary Act (a.k.a. Ocean Dumping Act), the Marine Plastic Pollution Research and Control Act. Moreover, there have been substantial improvements in the NY-NJ Harbor Estuary in terms of floatable debris, largely thanks to the implementation of the Floatables Action Plan (FAP). This Plan was put in place in 1989 due to the efforts of the interagency Harbor Estuary Program Floatables Work Group and has resulted in significant reduction in beach closures.

The New York City Department of Environmental Protection (NYC DEP) has a well-established program to capture and remove marine debris through floating barriers, skimmer vessels, underflow baffles and screens, as well as source control programs such as street sweeping, clean streets-clean beaches, adopt-a-basket, water-on-the-go, adopt-a-catch-basin and a B.Y.O campaign. NYC DEP also initiated an interim media campaign in 2016 for reducing street litter at the source and to amplify the existing relevant programs.

New Jersey also has a number of programs in place to capture and remove debris from the waterways. Netting or screening facilities exist at NJ Combined Sewer Overflow (CSO) outfalls, the New Jersey Department of Environmental Protection's Municipal Separate Storm Sewer System (MS4) and CSO permits require street sweeping programs, and the Passaic Valley Sewerage Commission (PVSC) operates skimmer vessels to remove floatable debris from the Passaic River.

In spite of the progress achieved, floatable debris continues to negatively impact our region, and current efforts mostly deal with debris after the fact (aerial surveillance to spot slicks, skimmer vessels to collect the debris, shoreline cleanup programs, and booms and nets to contain debris from outfalls) rather than attacking the root of the problem. In 2014, an estimated total of $59M was spent on marine debris waste

management activities in the Hudson-Raritan Estuary[1]. While efforts to clean up floatable debris will continue to be necessary for the foreseeable future, there is a growing interest among a wide range of stakeholders in exploring pollution prevention options as a more sustainable and rational manner of tackling the issue. In particular, it is important not to neglect that approximately 80% of the marine litter around the world has originated on land (GESAMP, 1991). At the same time, there is growing concern globally about the ultimate fate of marine debris (in particular plastics) and its many potential effects throughout the food web (including humans).

The Lower Passaic watershed was selected because it is a tributary to the Hudson River Harbor Estuary and Montclair State University is located in the watershed. Focusing on this watershed will allow HEP to fill data and information gaps on prominent sources and types of litter in the greater Harbor Estuary.

Project Objectives

This project aims to:

1) Characterize and identify sources of trash focusing on floatables entering local waterways and local conditions contributing to trash dispersal in order to target specific actions for reducing trash at the source.
2) Build on Columbia University's 2016 data collection efforts in NYC (funded by NYC DEP). Implementing the protocol in additional areas in NJ will fill data and information gaps to better characterize local sources and types of floatable debris to the greater NY-NJ Harbor Estuary.
3) Utilize the data collected at each location to help identify the most effective source reduction actions, including voluntary source control, preventative and reactive policy options, and targeted public awareness and education campaigns.
4) Create and evaluate a model for engaging citizens and stewardship organizations in identifying sources of litter.
5) Showcase this project to educate local businesses and residents about trash impacts and solutions to encourage responsible vendor and consumer behavior and stewardship.

[1] Columbia Marine Debris Research Team (2015) Quantifying the Financial Costs to Communities of Managing Trash in the Hudson-Raritan Estuary. Columbia University.

Project Location

The project will be conducted at publicly accessible locations of the Lower Passaic Watershed in New Jersey, within the area highlighted in Figure 1. Acceptable survey locations are likely to be sites within areas that are highly impacted by trash, close to public shorelines and other environmentally sensitive areas, as well as other areas with special considerations, including identification of low-income communities. Although, sites were selected along the Passaic, Second and Third Rivers using GIS and this selection was random. This means that the final list of sites will include a representatively vary list of sites which will be helpful later in terms of data analysis and understanding of the local reality at this selected watershed. The final list of sites will include a total of 35 locations along the Lower Passaic River and its tributaries. Each site will be visited at least twice during the data collection phase.

Figure 1 Survey locations will be selected within the yellow shaded area along the main stem of the lower the Passaic River and its two tributaries (Second and Third rivers).

Project Description

The Hudson River Foundation/NY-NJ Harbor & Estuary Program (HEP) and Montclair State University's Passaic River Institute (PRI) developed a survey protocol comparable to the litter survey protocol developed and used by Columbia University (see https://sipa.columbia.edu/academics/capstone-workshops/stopping-trash-where-it-starts-data-collection-and-analysis-project for more information) students in NYC during the summer of 2016. The protocol will be implemented by conducting street litter surveys to track trash to specific points of sale, to identify brand items and to record visual observations of conditions that could influence transport of trash to storm drains. PRI will implement the protocol at 25 sites while HEP will engage two community groups to conduct surveys at 10 additional sites. All data from both PRI and the community group surveys will be collated and analyzed. The field data analysis and results will be described in a final report. The final report will include recommendations for how to best eliminate or reduce local and/or regional sources of floatable debris. A trash reduction toolkit for the community will include lessons learned, how to replicate the litter surveys and recommended courses of action for local source reduction depending on results.

Project Schedule

Activities	Organization/Group responsible for activity completion	Timeframe work will be done
QAPP preparation and approval	NEIWPCC and EPA Quality Assurance Officers	April-August 2017
Base map development	Montclair	May-August 2017
Develop/refine data collection protocols & site selection	Montclair/HEP	May-August 2017
Community engagement for surveys	HEP	July 2017
Site groundtruthing & protocol testing	Montclair/Community groups	June-August 2017

Municipal office visits	Montclair	September 2017
Litter surveys	Montclair/Community groups	September-November2017
Data analysis & reporting	Montclair	November–December 2017
Community presentations, outreach & trash reduction toolkit	HEP	November– December 2017
Submission of final report	HEP	January 2018

Existing Data

Existing Data	Data Source	How Data Will Be Used	Acceptance Criteria
Trash pick-up and street sweeping schedules	Municipal offices	To help schedule site visits	N/A
US Census Data	https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml	To conduct statistical analysis to explaining variables	N/A

Quality Objectives

Litter amount, type and site conditions will be recorded using the datasheets found in Appendices 1 and 2 and submitted electronically using fillable PDF forms. Teams will also have paper versions of the datasheets in case they are unable to submit the forms electronically. Sites have been selected following the criteria in Appendix 3. Each litter survey team must be composed of at least 2 individuals (preferably 3) for safety reasons and to ensure an additional level of data verification (to remove any uncertainty in the identification of litter material, type or brand for example).

Precision

The GPS unit (Garmin *e*trex 10) that will be used in this project has a precision of less than 4m.

Bias

The geographic area where the surveys will take place in this project is influenced by a number of factors, including distance to the waterway, pedestrian traffic, litter quantity, among other factors. Sites with known litter issues are being targeted in order to collect sufficient data to determine pollution prevention measures and there is inherent bias in this approach.

It is possible that there is a seasonal influence on types and sources of litter that would not be captured during this project as all field work will be conducted from September-November.

During the 10-minute counting timeframes to obtain estimates of passing pedestrians and vehicles, double counting is a possibility if the same person walks back in the other direction or if a car that had previously passed comes back the other way.

Representativeness

These surveys will be conducted in the Lower Passaic River Watershed in urbanized areas (see Appendix 3 for all site selection criteria). The results of the surveys may be broadly applicable to other urbanized areas with similar site characteristics (for example proportions of plastic bottles or Styrofoam coffee cups relative to other types of litter), but many factors can influence this including local/regional/state legislation (plastic bag bans, bottle deposit fees), demographics, infrastructure and personal behaviors.

In order to ensure that an accurate representation of the litter at the site is being recorded, street sweeping and trash pickup schedules will be obtained for each municipality. Surveys will occur before sweeping and trash pickups.

Comparability

All surveys will be conducted using the same methodology and will record data using the same datasheets, ensuring a high degree of comparability between sites. However, one of the goals of this project is to

determine which factors may influence litter accumulation and distribution, and this may vary from site to site. Meticulous data records, including final site selection criteria used for each site and site photographs, will be kept by the project managers.

It is hoped that the data collected through this effort can be compared to the data collected in NYC during 2016 in order to have a better picture of the prominent sources and types of litter for the greater Harbor Estuary region.

Completeness

This project aims to conduct a total of 70 litter surveys during the survey period (35 sites surveyed twice each). The goal is to conduct 100% of these surveys in order to have a robust dataset that will enable conclusions to be drawn on the most appropriate source reductions methods for the local area. However, it is anticipated that weather and other issues may affect data collection. Conclusions will still be able to be drawn with a smaller dataset as the data will still be representative for that particular location. For the purposes of this project, conducting 50% of the surveys (either at a reduced number of sites or only once at certain sites), would still be acceptable, although not ideal.

Sensitivity

Sensitivity for the GPS units (Garmin *e*trex® 10) is less than 4 meters in radius.

Data Collection Methods

Project Design

Survey Schedule

Surveys will occur from September through November 2017. Two surveys will be conducted at each site. There is no particular day of the week on which the surveys will be conducted. This will depend on availability of community and Montclair project participants as well as weather conditions, trash pickup and street sweeping schedules for each municipality. Surveys will not be conducted immediately following heavy rainfall, as this could wash litter into the storm drains. Surveys will also be conducted prior to trash pickup and street sweeping.

Survey Locations

A total of 35 survey locations will be selected within the Lower Passaic Watershed using the criteria in Appendix 3. Community input will also be solicited by speaking with the two community groups that will be collecting data to capitalize on local knowledge of known areas impacted by trash. The HEP project manager and Montclair project supervisor will speak with the groups. Sites will be visited in person prior to the surveys by the Montclair project supervisor to ensure accessibility and suitability of the location. If a survey location becomes inaccessible, there will be two options depending on the circumstances: select another location or accept the missed data collection event. The community project supervisor will consult with the HEP project manager and Montclair project supervisor to make this determination. If the site is

not accessible, this will be noted on the site list kept by Montclair. If the decision is made to select another site, the site will be entered into the datasheet. If the data collection event does not happen, this will be noted in the quarterly progress report. The preferred option will depend on how much data has been collected thus far, how far along the project is and whether the site is temporarily inaccessible (short-term construction such as road repair) or inaccessible for a longer duration (bridge replacement for example).

All survey locations will consist of a 400 m stretch of road and only on one side of the street. The starting point for the survey will be a particular cross-street identified on Google Maps and provided to the two community groups, along with coordinates. The ending point will be identified through an address/landmark and coordinates. The two community groups will also be provided with site maps and parking instructions. Maps/images will display the starting and ending points of each site to be surveyed. Coordinates will be taken with the Garmin GPS and reported in decimal degrees with at least 5 decimal places.

Survey Methodology

The datasheet and tally matrix forms found in Appendices 1 and 2 have been adapted from the forms used by Columbia University for the surveys conducted in NYC during the summer of 2016. The original forms were created with input from NYCDEP and HEP, and took into consideration methodologies used in a number of litter surveys across the country. Additional surveys that were reviewed are included in the literature section on page 18. Survey protocol instructions will also be distributed to the two community groups (see Appendix 4). This will include definitions for all criteria and a photo guide for certain parameters that may be more subjective than others.

Field collection handling and custody procedures

The field teams (two community groups and the Montclair group) will walk their 400 m survey site (on one sides of the street) and one foot into the street, and collect the trash encountered along the way. Which side of the street will be chosen by the survey coordinator and marked on the map of each site.

The SURVEY FORM needs to be filled up with the information which describes the site in general. Numbered points from 1 through 25 can be filled in by an individual person. On the other side, the chart in the first page needs to be completed by two of the field surveyors, being it relative to more subjective information. Each of the two surveyors will have to assign an evaluation number to each of the four assessment parameters (“Trash level fist glance”, “Access to the waterbody from the site”, “Floatability of litter found”, and Large items).

Trash will be collected by two of the surveyors on site but only one person will be in charge of tallying the collected items.

The volume and weight of the collected trash will be recorded (in the TALLY FORM – page 3). The volume can be easily calculated multiplying the three dimensions (*height*, *length* and *width* using metric system units) of the bin used. In cases in which the bin is not filled up to the brim, the height reached by the trash inside the same bin will be recorded and used to determine the volume of that amount of trash. Each item collected (equally or bigger than a cigarette butt) has to be qualified and tallied and right after disposed into a proper trash (every not-recyclable item) or recycle (e.g.: plastic items, aluminum cans, glass bottles) bags. In the interest of time will not attempt to tally small fragments below one inch in size (approximately the

size of a cigarette butt). The trash collected at each site has to be weighted in the field using a digital scale and the weight has to be recorded in the TALLY FORM (page 3). Instructions for both weight and volume measurement procedures are explained in the same TALLY FORM.

Community group survey teams will be responsible of disposing the bags with the garbage content, depending on the logistic challenges that they may encounter in their particular township/survey area and trash pick-up locations and schedules. If any large items are recorded on the datasheet that cannot feasibly be carried the township will be contacted to collect such items. No need to put labels on the above mentioned garbage to be disposed. No preservation instructions needed, being the collected items trash. No

The third surveyor will keep walking along the sidewalk (approximately in a central portion of it) counting all vehicles and people passing in the area designated for the survey. If necessary, binoculars can be used for traffic at a certain distance The tallies/counters used are similar to the ones used in microbiology laboratories for counting bacteria. We will provide each team two tally units, one for foot traffic counts and one for vehicles traffic counts. At the end of each 10 minutes time slot, the totals displayed by the two tallies will be recorded in the proper blanks of the SURVEY FORM.

Photos of the site and site conditions will be taken at the start of each survey at each site and submitted along with the PDF survey forms. The data collection sheets will be field tested by the Montclair project supervisor prior to beginning official data collection activities and adjusted as necessary.

It is the community group's responsibility to determine what safety measures and PPE are adequate overall and for each survey location, as established in the community group's safety plan. The community groups will have their safety plans on file and available upon request or if audited.

Equipment List

Field Supplies/Equipment List

Clipboards
White board
Pens
Erasable marker
Work gloves/Latex gloves
Safety vests
Trash pickers
Trash & recycling bags
Phone/iPad capable of taking photos or digital camera
Tally counters (one for foot traffic & one for vehicle traffic)
GPS Garmin etrex 10
Survey forms and instructions

The following supplies will be loaned from Montclair to the community groups: iPads, GPS, safety vests and counters. The remaining supplies will be purchased by the community project supervisors and distributed to

the other community participants.

Instrument Calibration and Maintenance

Instrument/Equipment	Calibration Frequency	Maintenance Requirements
Handheld GPS Units	N/A	As per manufacturer's instructions

Field Data Sheets

The following data sheets to be utilized for this project are provided in the Appendices as listed below:
Site Description Datasheet – Appendix 1
Tally Matrix Datasheet – Appendix 2

Training and Specialized Experience

Training

Personnel/Group to be Trained	Description of Training	Frequency of Training
Community project supervisors and Montclair assistants	Field data collection protocols and properly filling out datasheets	Once prior to data collection season
Community project assistants	Field data collection protocols and properly filling out datasheets	Prior to data collection event and as needed for new community project assistants

PRI and HEP will host a joint training event at a site prior to the start of data collection. Participants will sign in on an attendance sheet and this sheet will be kept by HRF with contract documents. This training event will be required for all participants of the survey. The community project supervisors will then be responsible for ensuring that the community project assistants follow protocols the day of the data collection event. Community project assistants may rotate for data collection events at assigned locations while community project supervisors must attend all events to ensure protocols are being followed.

Specialized Experience

Training will be provided by the PRI/Montclair project manager and supervisor as well as the HEP project manager.

Ariane Giudicelli is the water quality program manager at HEP. Previously she worked for the NJDEP and has over 10 years' experience in the water quality field. For this project she is overseeing the QAPP development, community group data collection and outreach efforts. Ariane has several years' experience training individuals in macroinvertebrate identification and habitat assessments as well as data management training for EPA's STORET system.

Montclair State University's Passaic River Institute (PRI) actively engages in environmental research and education with a focus on prioritizing area environmental needs and identifying sustainable solutions. PRI has been especially active in providing environmental training and education programs, and promoting public awareness in environmental management and sustainability. Meiyin Wu is the Director of PRI and Professor of Biology at Montclair State University, an environmental scientist with specialization in water quality and aquatic ecology. For this project, Wu is sharing the responsibilities in QAPP development, designing and implementing litter survey, performing data sharing and outreach activities, and report preparation.

Alessandra Rossi is a Ph.D. candidate in the Environmental Management program at Montclair State University. Alessandra has several years of experience in training students both in field and laboratory duties. This experience has been acquired during her Master Degrees (Biology and Ecology), her years of work in the environment, and during her current Ph.D. program. Also, she has been a Teaching Assistant for almost 7 years educating and training students both in laboratory sections, field experiences and lectures. Alessandra is designing and implementing the litter survey, conducting the groundtruthing for site selection, helping in editing the QAPP, and training personnel for the actual site survey. She will also personally supervise and conduct the sites survey for the locations not assigned to the Community groups and will perform data analysis after collection will be complete.

Assessments and Oversight

Assessment Type	Frequency of Assessment	What is Being Assessed	Who will Conduct the Assessment	How Issues or Deviations will be Addressed
Data Checks and Assessments	After each survey event	Completeness of datasheets (electronic and/or paper versions)	Community project supervisors	Verify with field survey team
On-Site Field Inspection	During each survey with a new team	Field sampling teams following protocols	Community project supervisors	Discuss any issues with HEP/PRI project managers

Any issue and challenge encountered during the survey will be reported to HEP Project Manager, MSU Project Manager, and MSU QA Officer within 24 hours. Project managers and QA officer will evaluate the scenario and provide instructions for corrective action if needed.

All collected data will be deposited to MSU. MSU will tabulate and analyze the data. The final results will be reported to NEIWPCC by HEP.

NEIWPCC may implement, at its discretion, various audits or reviews of this project to assess conformance and compliance to the quality assurance project plan in accordance with the NEIWPCC Quality Management Plan.

Data Management, Review and Usability

Data Management

All data will be entered electronically in the field into the datasheets using fillable PDF forms and will include photos taken at the sites. If an issue arises (dead battery, survey team forgot the iPad, etc.), paper sheets will be used and data will be entered into a computer or the iPad by the community project supervisor after the survey is completed. After each survey event, the data will be checked for completeness, missing information or questionable data. The community project supervisors will contact the community project assistants if any data is missing and have the team clarify any discrepancies with the data. The project supervisor is required to be present at all surveys. Two community survey teams comprised of one project supervisor each and at least two project assistants each will conduct the community surveys while the Montclair project supervisor and at least two assistants will conduct all Montclair surveys.

The PRI and HEP Project Managers will review 10% of the data to verify completeness and reasonableness of the data entered into the datasheets. The completed and quality-assured datasheets will be shared with Drew Youngs at NEIWPCC (either via email or Dropbox) at the conclusion of the data collection period. He will inform the HEP Project Manager of any outstanding data issues.

Data Checks

Field	Data Management
Surveys performed per QAPP/Protocols	Data entry and transcription errors
Evaluate any deviations from QAPP or Protocols to determine the impact to the data and project objectives	Proper data and document storage
	Missing and uncertain data documented

Any data issues identified by the community project supervisors, including but not limited to the items stated in the Data Checks table above, will be discussed with the project managers and Montclair project QA manager to determine data usability on a case by case basis. All decisions to allow data that did not fully comply with QAPP requirements will be explained in the quarterly reports, and any resultant limitations on data use fully discussed in the final project report.

Post Collection Data Handling Information

Data collected on site through fillable pdf files will be saved on the iPad devices, together with any pictures that were taken. This information will be collected off-line and it will be delivered by the field teams, once an internet connection is available, to the Passaic River Institute using an email address created ad hoc. The files will be saved in the PRI computer at Montclair State University, in which a

password secures the content. All information collected on site will be received by the same person in charge for coordinating the sites collections (Ph.D. candidate at MSU). This person will manually transfer the information in two separate excel documents, one for the site survey and the other for the tally matrix. In this way data can be rearranged and or merged into one document for the statistical analysis and other elaborations. The above mentioned Ph.D. candidate, will also properly save the above mentioned files. In the event that there is an issue with the iPad (such as low battery), paper datasheets will be used. The community project supervisor will be responsible for ensuring that the paper datasheets have been properly completed and will enter the data into the iPad as soon as possible after the data collection event.

Statistical Analysis

We will use, among other methods, multiple regression models to evaluate the relationship between the possible outcomes (e.g.: weight, volume, and trash counts) and the several variables potentially explaining them. We will use stepwise regression approach to select the most significant predictors at the 95% level, but also the 99% level will be evaluated.
Examples of variables we will regress against the outcomes are socio-economic categories (U.S. Census Bureau - https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml):

- Residential/ business/mixed
- Racial/ethnicity
- Population age and sex
- Household income
- Education
- Population size
- Household and families

We will particularly focus on counts of plastic litter.
Analysis of variance (ANOVA) also will be evaluated as a possible model to explain significant variance in the dependent variables (outcomes).

Reconciliation with User Requirements

The quality and reliability of data collected during the surveys will be assured through several methods.
First of all, the days of survey have avoided rigorously within two days (48 hours) after street sweeping and/or after a rain event. Conducting the survey, for instance, the day after street sweeping would represent a bias because it would underrepresent the quantity of trash which usually accumulates on the site. Same issue we would have if surveying right after a major rain event which, with the help of surface water runoff, would wash away the litter present in that specific area.
A second way of conducting a quality check on the collected results is to instruct the surveyors to report any abnormality or accident happening in the segment area during or witnessed immediately before starting the survey. There is a dedicated section on page 3 of the SURVEY FORM which can be used to write notes in regard. An example is if one of the surveyors seeing a dweller or a business owner, sweeping or picking up the

trash in front of their door or property. In this case, the surveyor has to estimate an approximate count of items removed and, if possible, their category/subcategory/material. Again, an estimation in this case is sufficient but it has to be specified as a note separate from the official TALLY FORM.
The above mentioned statistics will also represent a way to evaluate the goodness and the quality of data collected. The results of significant variables explaining the trash distribution along the sites and the quality of this trash will add value to the verification of quality of the site collections.

Reporting

Reports

PRI will collate and analyze all field data collected by Montclair and community groups. The field data analysis and results will be described in a final report. Analysis will include most frequently littered items, litter ranking by type/product and if possible by point of sale and brand. Further analysis will look into site conditions and additional variables.

The HEP Project Manager will submit quarterly reports to the NEIWPCC Project Manager which will include status information for individual tasks, including completed project activities and any outstanding issues that require resolution.

The above project-related materials will be kept by HEP/HRF for as long as possible and for a minimum of three years from the date of submission of the final expenditure report, as stipulated by HRF's Document Retention and Destruction Policy.

Literature cited

Alice Ferguson Foundation (AFF) (2008) *Volunteer Monitors Visual Trash Survey Handbook.* Alice Ferguson Foundation Trash Free Potomac Watershed Initiative.

EOA (2013) *Visual On-Land Trash Assessment Protocol for Stormwater.* Version 1 (Draft).

Environmental Resources Planning, LLC (2013). *Final Report: 2013 Texas Litter Survey. A Survey of Litter at 253 Sites throughout the State of Texas*.

Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) (1991) *The State of the Marine Environment.* Blackwell Scientific Publications, London, 146 pp.

Surface Water Ambient Monitoring Program (SWAMP) (2007). Final Technical Report: *A Rapid Trash Assessment Method Applied to Waters of the San Francisco Bay Region: Trash Measurement in Streams.* http://www.swrcb.ca.gov/rwqcb2/docs/swampthrashreport.pdf

APPENDIX 1

STOPPING TRASH WHERE IT STARTS - SITE DESCRIPTION

1. Date _____Site ID_____ Name(s) of Surveyor(s) _____
2. Starts at: Lat_____Long_____ Ends at: Lat_____Long_____
3. Today: Temperature (°C/°F) _____ Rain (mm/inch) _____
4. Past 24 h: Avg Temp (°C/°F) _____ Rain (mm/inch) _____
5. Past 48 h: Avg Temp (°C/°F) _____ Rain (mm/inch) _____
6. Wind speed today (miles/h or km/h) _____
7. Survey start time _____ Survey end time_____

Assessment parameter	Least disturbed	Sub optimal urban	Marginal urban	Most disturbed	Average
Trash level first glance	Little or no trash detected (small pieces) which could be easily cleaned up in a short timeframe by one person.	Low levels of trash (few pieces) that could be easily cleaned up by two people in a relatively short time.	Medium quantity of trash evenly distributed or small piles of trash are visible. Site clearly shows MODERATE usage by people (e.g. cigarette butts, food and beverage containers, clothing)	Substantial quantity of trash throughout with large piles of trash . Site clearly shows HEAVY usage by people (e.g. cigarette butts, food and beverage containers, clothing)	
Surveyor 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
Surveyor 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
Access to the waterbody from the site	No access or difficult access due to any sort of barrier (vegetation or gate). Not used by people. Private or restricted area.	Limited access and no evidence of usage by people.	Public access is fair to good but no evidence of frequent use by people.	Optimal access (even dedicated trails) to the waterbody. Evident usage by people (e.g. food and/or drink items, cigarette butts).	
Surveyor 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
Surveyor 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
Floatability of litter found	Little (<25 items) or no floatable litter (transportable) litter (e.g. plastics, Styrofoam, cigarette butts)	Low to moderate (26-75 items) presence of buoyant (transportable) litter (e.g. plastics, Styrofoam, cigarette butts)	Moderate (76-200 items) presence of buoyant (transportable) litter (e.g. plastics, Styrofoam, cigarette butts)	Consistent (>200 items) presence of buoyant (transportable) litter (e.g. plastics, Styrofoam, cigarette butts)	
Surveyor 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
Surveyor 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
Large & or household items	No sign of illegal trash disposal. Trash is accidental or carried by surface runoff.	Some evidence of illegal dumping coupled with limited access.	One to two items (e.g. furniture, shopping carts, green waste) illegally dumped coupled with an almost facilitated vehicular access.	More than two items (e.g. furniture, shopping carts, green waste) illegally dumped coupled with an easy vehicular access.	
Surveyor 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
Surveyor 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
FINAL SCORE OUT OF A TOTAL OF 80 POSSIBLE POINTS					

8. Ground cover (%): Paved____ Grass_____ Shrubs/Bushes ____ Wooded _____Sand/Soil _____
9. Number of landscaped areas (e.g. flowers, mowed areas) _____ Specify _____
10. Number of people that walk by you:
    1st 10-min period _____2nd 10-min period _____3rd 10-min period _____
11. Number of vehicles that pass by you:
    1st 10-min period _____2nd 10-min period _____3rd 10-min period _____
12. Number of food-related business activities within the block (If 0 skip to question 15):
    a) Number of Grocery stores (e.g. Shop Rite, Walmart, Trader Joe's) _____
    b) Number of Convenience stores (e.g. 7-eleven, Dollar Tree)_____
    c) Number of Restaurants/Diners (e.g. Olive Garden, IHOP) _____
    d) Number of Coffee shops (e.g. Starbucks, Dunkin Donut) _____
    e) Number of Fast-foods (e.g. Mc Donald's, Burger King) _____
    f) Number of Food carts (e.g. hot dog, halal, bagels) _____
    g) Number of Food trucks (e.g. Ice cream truck) _____
    h) Number of Other _____Describe_____
13. Number of open bed vehicles (e.g. construction trucks, road maintenance) _____
14. Number of Public areas within the block_____ near-by_____ Distance _____
15. Number of Construction sites within the block_____ near-by _____Distance _____
16. Number of Loading docks within the block _____ near-by _____Distance _____
17. Number of Public buildings within the block _____near-by _____Distance _____
18. Number of trash cans on the block _____ (If 0 skip to question 21)
    a) Number of Trashcan with plastic bag liner _____ Without _____
    b) 100% full_____ 75% full_____ 50% full_____ 25% full_____ 0% full_____
    c) Number of trashcan with trash on the ground around the trashcan _____
    d) Among the trashcans with trash on the ground next to them, how many are:
       100% full_____ 75% full_____ 50% full_____ 25% full_____ 0% full_____
19. Number of recycling bins on the block _____ (If 0 skip to question 22)
    a) 100% full_____ 75% full_____ 50% full_____ 25% full_____ 0% full_____
    b) Number of recycling bins with litter on the ground around the bin _____
    c) Among the recycling bins with litter on the ground next to them, how many are:
       100% full_____ 75% full_____ 50% full_____ 25% full_____ 0% full_____
20. Number of manhole covers _____
21. Have you seen anyone collecting plastic bottles/cans? Yes _____ No _____
22. Number of storm drains _____
23. Number of storm drains clogged with litter or debris:
    100% clogged__ 75% clogged__ 50% clogged__ 25% clogged__ 0% clogged__?
24. Is there a particular spot in which you see the most litter (next to trash bins, on storm drains, on sidewalk, on the road, in tree pits, etc.)_____
25. Pictures taken (Y/N) _____

Notable/Unusual weather conditions (or NOTES in general)

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Measurements of the collected trash:

- **Volume determination of the bin:**

a) Bin sides (cm): *height*_____ (cm) *width*_____ (cm) *length*_____ (cm)

b) Volume of the bin: *height* x *width* x *length* = _____ (cm^3)

- **Volume determination of the trash collected:**

Trash volume (full bin): Same volume of the bin at b): _____ cm^3

Trash volume (not-full bin): _____ cm^3

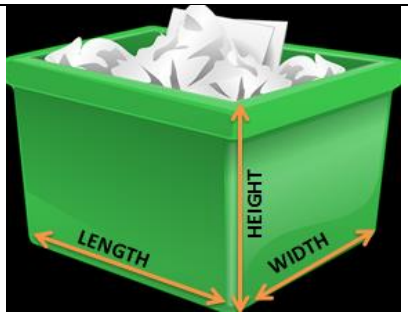
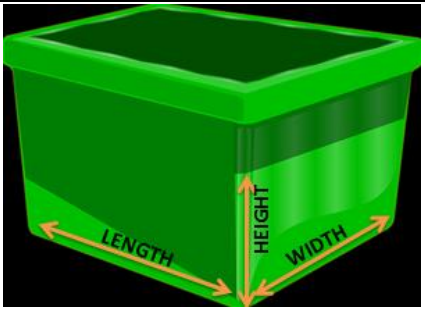
- Measure the *new height* of the trash inside the bin
- As for the *length* and *width* use the bin's measures from a).
- Compute the volume applying the multiplication at b).

- **Weight determination of the trash:**

  Put either the trash bag(s) or the bin with the garbage content on a digital scale.
  If using the bin, weight the bin first or put the bin on the scale first and reset the scale to 0.
  Then weight the content, either loose or inside a trash bag.

Trash weight: _____ kg (one decimal point is fine).

NOTE: If measures are taken in pounds or inches or feet, this MUST be specified.

Bin with trash – example of **FULL** bin	Bin with trash – example of a **NOT-FULL** bin
	

APPENDIX 2

STOPPING TRASH WHERE IT STARTS - TALLY FORM

Category	Subcategory	Material	Tally	Brand/Notes
DRINKS CONTAINERS AND PARTS	Liquor Bottles	Glass		
	Non-Liquor Bottles	Plastic		
		Glass		
		Metal		
	Juice boxes	Composite		
	Cups	Styrofoam		
		Plastic		
		Paper		
		Glass/Ceramics		
	Caps	Plastic		
		Metal		
	Lid	Plastic		
		Metal		
	Straw	Plastic		
	Coffee stirrer	Plastic		
	Cup sleeves	paper		
	Four or Six pack rings for cans	Plastic		
	Bottle neck ring	Plastic		
	Liquor Cans	Metal		
	Non-Liq. Cans	Metal		
	Drink carrier/tray	Paper		
	Pull tabs	Metal		
FOOD WRAPPING & PACKAGING	Gum/Snacks/ candies Wrappers	Plastic		
		Aluminum		
		Paper		
	Utensils	Plastic		
	Ziplock bag	Plastic		
	Lollipop stick	Paper		
		Plastic		
	Popsicle stick	Plastic		
		Wood		
	Food Wrappers/Packaging	Plastic		
		Styrofoam		
		Metal		
		Paper		

		Composite		
	Food Containers	Plastic		
		Styrofoam		
		Metal		
		Paper		
		Composite		
	Subcategory	**Material**	**Tally**	**Brand/Notes**
	Plates	Styrofoam		
		Paper		
		Glass/Ceramics		
		Metal		
		Plastic		
MEDICAL RELATED	Drug vials	Plastic		
	Drug vials with content	Composite		
	Condoms	Plastic		
	Bandages	Plastic		
	Wound wrapping	Textile		
	Syringe	Composite		
	Pipette tips	Plastic		
ORGANIC WASTE	Human waste	Organic		
	Loose Pet waste	Organic		
	Wrapped Pet waste	Composite		
	Food waste	Organic		
	Yard waste	Organic		
	Leaves	Organic		
LARGER AND OR HOUSEHOLD ITEMS	Furniture	Composite		
	Mattresses	Composite		
	Bags with trash	Composite		
	Tires	Plastic		
	Appliances	Metal		
	Shopping carts	Metal		
	Vehicle batteries	Composite		
	Bike	Composite		
	Bike wheel	Composite		
	Vehicle wheel	Composite		
	Vehicle (specify)	Composite		
	Vehicle parts	Plastic		
		Metal		

TOBACCO PRODUCTS	Lighters	Composite		
	Cigarette/cigars butts	Composite		
	Tobacco wrap (cellophane)	Plastic		
		Cellophane/Foil		
	Tobacco box	Paper		
	Cigarette holder	Plastic		
	Matches	Composite		
Category	**Subcategory**	**Material**	**Tally**	**Brand/Notes**
CONSTRUCTION MATERIALS/TOOLS	Concrete waste	Rock		
	Bricks	Rock		
	Wood boards	Organic		
	Wood chips	Organic		
	Rebar	Metal		
	Tiles	Rock		
	Tarp	Plastic		
	Tools	Composite		
	Gloves	Textile		
MISCELLANEOUS	Balls (type)	Plastic		
	Toys	Plastic		
	Toys	Textile		
	Non-vehicle batteries	Composite		
	Pen/pencil	Plastic		
		Metal		
		Wood		
	Chemical containers	Composite		
	Personal care bottle	Plastic		
	Home care bottle	Plastic		
	Make up item	Plastic		
		Composite		
	Greasy layer on water (either oil or surfactant)	Composite		
	Spray paint cans (or bottles)	Composite		
	Hose/Pipe parts	Plastic		
		Metal		
	Wire/cable/rope	Plastic/Synthetic		
		Metal		

		Electric		
		Composite		
	Tarp	Plastic		
	Foam materials	Styrofoam		
	Dryer sheets	Textile		
	Non-food Wrappers/Packaging	Plastic		
		Metal		
		Styrofoam		
	Human diapers/pads	Composite		
	Wipes	Textile		
	Tampon applicators	Plastic		
	Grocery/Shopping bags	Plastic		
		Textile		
		Paper		
	Non-food containers	Plastic		
		Metal		
		Styrofoam		
MISCELLANEOUS	Product tag/label	Paper		
		Plastic		
		Textile		
		Metal		
	Newspaper	Paper		
	Magazine	Paper		
	Office paper	Paper		
	Cardboard	Paper		
	Tissue/Napkin	Paper		
	Flyer	Paper		
	Shoe/Boot	Composite		
	Clothes	Fabric		
	Bedding	Fabric		
	Cleaning bottles/spray	Plastic		
		Metal		
	Dead animals	Organic		
FRAGMENTS	Fragments/ Pieces	Glass		
		Plastic		
		Textile		
		Paper		
		Metal		
		Styrofoam		

		Composite		
		Other		
OTHERS (SPECIFY)				

APPENDIX 3

Criteria for selection of sites to be surveyed:

The first constrain that we are applying to the selection of the good candidate sites is a buffer distance of 300 m from both the center of the main stream (Passaic River) and from the center of the two tributaries (Second and Third rivers). This will ensure a geographic consistency of the selected sites to be investigated. We believe that at this distance, trash will more likely end up into the river without incurring into much obstruction. A total of 140 sites will be randomly selected along the Passaic River and the two tributaries. In detail, 100 sites will be selected along the Passaic River and 20 sites will be randomly selected along each tributary. All sites will be constrained inside the 300m buffered area.

The total of 140 pre-selected sites will be reduced eliminating all sites that fall inside the water channels, on highways, and on the East side of the Passaic River. Moreover, an in person-scouting will be conducted to verify that there is access to the site and that the site is good for the purposes of the present project.

Some characteristics or events most likely influence the accumulation of trash in some spots of the sites, and eventually, into nearby waterways. Examples of these influences are: :

- Flood areas
- Slope
- Surface runoff
- Impervious surfaces
- Structures vs. empty spaces (roads, empty lots). This information will be estimated (%) on site during the survey.

Once the sites have been randomly selected using GIS, we plan to visit the Municipality offices and inquire them regarding the following information:

- Township/Municipality each site belongs to.
- Storm water drain/system maintenance
- Frequency of street sweeping. This information (together with the trash pickup schedule) will be crucial for a free-of-bias schedule of the surveys at the sites.
- Trash pickup schedule

This information will help us to schedule the survey dates based on criteria mentioned earlier. We remind here that we want to avoid the trash collection for 48 hours after the streets have been swept and trash has been picked up.

APPENDIX 4

STOPPING TRASH WHERE IT STARTS – SURVEY PROTOCOL

Survey dates:

The survey will take place on pre-scheduled dates which will depend on the absence of major rain events as well as the absence of street sweeping in the previous 48 hours.

Data forms and data insertion:

Both the SURVEY FORM and the TALLY FORM will be converted into a fillable pdf file once the final versions will be official. The fillable pdf files will be uploaded into iPads and surveyors will insert the information collected on site in these fillable forms. The forms will be saved using the following labeling code: DATE_SITEID. (DATE should be in the format *ddmmyy*).

The Site ID of each location will be provided to the surveyors in a list of sites complete of street names delimiting the area to be surveyed and indicative coordinates (longitude and latitude). This list will be completed at the end of the sites selection and scouting evaluation.

The SURVEY FORM is the first one that has to be completed. After completion of this document, the surveyor can move to the TALLY FORM, qualifying and quantifying the trash items found.

Meteorological information:

Air temperature (T) and rain during survey, average diurnal air T and cumulative rain in the previous 24 h, average diurnal air T and cumulative rain in the previous 48 h, and wind speed during the survey, should be noted from reliable sites on the same day, before heading to the site (e.g. NOAA, Newark International Airport).

Survey start time and survey end time:

They should be written in military format (24 hour-method). Example: instead of 2 pm it should be noted as 14:00. In this way, AM and PM specifications are not needed.

Names of the surveyors:

Complete first and last names of the surveyors are needed. Moreover, the initials of each surveyor should be reported in parentheses next to the full name.

Assessment parameter table:

This table is meant to provide an initial general visual assessment of the visited site. Since this information is mostly subjective to the surveyor's opinion, both surveyors at each site should select the value that better describes (from least disturbed to most disturbed) each of the

four parameters provided in the assessment parameter table. Two lines are provided in the table (one per each surveyor). No need to indicate who is surveyor 1 or 2. The values assigned to each parameter under evaluation will be averaged and each averaged value will be summed up to a final score reported out of the total of 80 possible points. This final score will help us to classify each site based upon an initial visual evaluation. For each parameter, four situations are described, and for each situation 5 values are available.

1. Trash level first glance: the surveyors should express in a value from 0 to 20, what is the level of trash presence in a first glance (pictures with examples will be provided).
2. Access to the waterbody from the site: each of the 35 sites was selected at a maximum distance of 300 m from the waterbody (either Passaic River or its tributaries). This means that they are located fairly close to the waterbody. Despite their vicinity, some of them might not have direct access to the waterbody (e.g. there is a private passage and/or a gate is present; it is densely vegetated and no pathways are cutting through the vegetation). On the other hand, direct access could be present that would easily let people do some activities next to the water and leave traces (trash) along the shoreline or on the way to the waterbody.
3. Floatability of litter found: the amount of trash found at the site might be significant but only a part of it is light enough to be easily transported by the wind or surface runoff to the waterbody. Here we want to estimate the approximate quantity of items that potentially could reach the water because of light-weighted items (e.g. plastic, Styrofoam, paper, cardboard).
4. Large or household items: in addition to the light trash that potentially could be transported to the waterbody we will evaluate the eventual presence of large and/or heavy items or any household object dumped on the street illegally that would negatively affect aesthetics.

Ground cover (%):

Here the surveyor is required to estimate the percent coverage at the ground level of the following ground cover categories: 1) Paved 2) Grass 3) Shrubs/Bushes 4) Wooded 5) Sand/Soil. For instance: Paved 80% Grass 0% Shrubs/Bushes 5% Wooded 5% Sand/Soil 10%
Depending on the representativeness of each category here, they could imply a higher or lower possibility of trapping or retaining the trash. Moreover, a lower paved area might represent a lower surface runoff effect.

Landscaped areas:

Usually, signs of beautification like, presence of flowers, mowed areas, trimmed bushes, are a sign of people taking care of the neighborhood and interested in keeping the area clean and in

order. There might be a linkage between the amount of trash found and the frequency of these signs of beautification.

People and vehicles that pass by you:

This information will give us an idea of how busy the site is and the relative frequentation of vehicles versus pedestrians. While two surveyors are collecting and tallying the trash found along the surveyed segment, a third person will be in charge of counting people and vehicles passing by in the street segment designated for the survey. This person will do it for 10 consecutive minutes using tally counters (like the ones used in a laboratory of biology). One tally counter will be used for counting the vehicles and one for counting the persons. Ideally, the 10-minute intervals should be repeated two more times any time during the permanence of the surveyors on the site that date.

This will allow a consistent comparison of foot and wheel traffic between sites. We suggest that the surveyor choose a spot in the block and maintain it, approximately, for the entire duration of the count. Although double counts are expected and will be considered as possible bias in this count, deciding not to change position is intended to minimize count bias.

Food related business activities within the block:

We distinguished the different types of food related businesses with the purpose of later finding the sources of litter, especially when the wraps and containers found are showing a brand. The different types are grocery and convenience stores, restaurants are grouped with diners, coffee shops, fast-foods. These are the stores that are always present, but there also could be food-carrying vehicles like ice cream trucks and carts. Some examples are provided in parentheses for each category. Also, an extra line for any other food business not listed is provided.

Open bed vehicles:

Vehicles that do not cover or secure their loads may allow for the release of items into the environment while operating or when parked and this may represent a noticeable contribution of trash to local waterways and also to Municipal Separate Storm Sewer System (MS4s). New Jersey regulates this issue through section 39:4-77 and any violator may be fined. For this reason, surveyors should write notes (e.g. plate number, construction business name) of any open-bed truck vehicle, within the surveyed segment site, which load is not secured. **Public areas, constructions sites, loading docks, public buildings:**

These areas are potential sources or carriers of trash. Public areas include playgrounds and parks and may be a source of food and drink-related containers and packages. Construction sites and loading docks may be sources of big plastic wraps, debris and cardboard. Public

buildings like hospitals, libraries, and post offices might represent highly-frequented meeting areas that may result in litter generation. These trash sources might be within the delineated surveyed area (within the 400m pre-determined segment(s)) and/or near-by. In this last case, the surveyors have to estimate the approximate distance (in m) from the limits of the surveyed block.

Trash cans and recycling bins:

The presence of trash cans and recycling bins is extremely important in the intent to keep the environment in which we live clean. The higher the number of these containers and the better they are maintained (replaced if broken and emptied when almost full) the easier is to keep the street clean. In addition, the presence or absence of plastic bag liners is important especially when liquids are disposed and when trash is in small pieces. The presence of a liner would prevent liquids and small parts to be spread out on the ground and also leach into draining systems when rain dilutes and washes them.

Manhole covers:

A manhole cover is a small opening in the street and covered by a lid, in order to allow staff in charge of maintenance to have access underneath it. This opening usually leads to a sewer. Depending on how the cover is made and what condition it is in, there could be passage of trash eventually present on the street into the opening.

Collectors of recyclables:

Often we can see people (mostly homeless) sorting plastic bottles and aluminum cans from the trash bins and from the street and collecting them in big plastic bags in order to sell them later to recycle points. If we see one of these individuals, it is important to mention it because they might be usually removing these items in that area. In fact, these people usually do not possess any vehicle so they can just cover a small area, the surveyed one included, and there could be bias in the tallying.

Storm drains:

Storm drains in between the curb and the street usually have large opening for allowing a good drainage of the stormwater flowing along the street. Unfortunately, when trash is present on the street, it can be transported along with the same stormwater (through water runoff) and it ends very often in these storm drains. Items smaller than the openings can be drained together with the water but larger items can remain stuck against the storm drain structure. This can prevent the rest of the water from draining properly and increase the amount of water running over the surface and eventually reaching the nearest waterbody together with the light trash that moves with it. In this case, both large and small trash items

represent a big problem. This is why we have to identify any storm drains and their condition (if clogged and at what percentage).

Particular spot with a lot of litter:

Surveyors should write down (and take a picture of it) if they see any particular spot in which the trash or debris seems to accumulate most. The location of accumulated debris could tell us a lot about the movement of material at that site or about particular activities or conditions which should receive the most attention.

Pictures:

We suggest taking pictures of significant areas/points/events/situations. Before doing this, the first picture to take should be of a white board showing site-specific information (date, Site ID, Initials of the surveyors) written with a dry erasable marker. In this way all the following pictures taken at the site will be consecutive to the board displaying the site-specific information. Pictures will be saved in the iPad and in the folder named PICTURES. Pictures and completed and saved forms will be sent through email to a project-specific email address. In this way the information and material collected will be maintained separate from other projects.

Notes in general:

Surveyors can write here anything that they think might need to be mentioned. For example if there is any unusual weather condition or activity.

Measurements of the collected trash:

- Volume determination of the bin (cm^3): the measurements of the bin should be taken and multiplied one another. This will provide the volume of the bin.

- Volume determination of the trash collected (cm^3): this value will be the same of the volume of the bin if the bin is filled with trash. If the bin is not full of trash, only the height of the bin will be different. The surveyor will have to measure the new height and multiply this new measurement by the same width and length. If both a full bin AND a portion of the bin are the case, both values need to be reported in the proper blank spaces.

- Weight determination of the trash (kg): the surveyor should put the trash on a field scale and written in the proper blank spaces (one decimal point). Put either the trash bag(s) or the bin with the garbage content on a digital scale. If using the bin, weight the bin first or put the bin on the scale first and reset the scale to 0. Then weight the content, either loose or inside a trash bag. NOTE: If measures are taken in pounds or inches or feet, this MUST be specified.

TALLY FORM

The first column lists the ten categories we grouped the item into: Drink containers and parts, Food wrapping and packaging, medical related, Organic waste, Larger and/or household items, Tobacco products, Construction material /tools, Miscellaneous, Fragments, Others.

The second column shows a long list of subcategories per each category, describing in details the several items that might be found as trash in an area. The subcategories indicate the individual items that will be tallied.

In the third column are listed all possible materials the individual items can be made of. The different materials listed are: metal, plastic, paper, glass, composite (when more than one material is present in the same item), Styrofoam, textile, fabric, organic (e.g.: food waste, material from pruning), and rock (e.g.: concrete, brick, tile).

The fourth column is for the tally. The person in charge tally lines (|) for each subcategory in the specific material it has been found. Tallies will be added up during the data analysis phase. A trash grabber or metal tongs and or latex/textile gloves should be used for picking up the trash.

The last column is intended for notes of any type. In particular, whenever it is possible and clear, the brand of the tallied item clearly coming from a particular store/discount/retailer should be specified. This will later help to trace back the sources of particular trash items and evaluate what could be done to reduce these sources.

Once trash has been tallied it has to be disposed in trash or recycle bags (except the large and/or heavy items) in plastic bags. These bags can be placed on a field scale in order to determine the weight of the entire collection from each site for each individual survey date. The weight value (in kg) should be reported on page 3 of the SURVEY FORM. Still on page 3 of the SURVEY FORM, the size (volume in cm^3) of the collected trash from the day should also be reported. Detailed instructions regarding how to determine the volume of the trash are provided in the same SURVEY FORM (still page 3). . The purpose of recording both volume and weight of the collected trash at the different locations is to provide results that can be compared with other projects even when the sites are in a totally different area. In some projects information about trash surveys is reported as count of items. In other researches, weight of the trash collected is provided. Finally, trash may be reported as a volume estimation. Having the opportunity to record both counts, weight and volume of the litter that we are going to collect will provided an exhaustive set of information which will allow different projects with different methodologies applied to be compared