Follow-Up Assessment of Litter Loading in Urban Streams

Wilmington, North Carolina

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Introduction

Man-made debris has become an increasingly serious waste management and environmental issue in urban areas of the United States and around the world. The vast majority of trash generated in the US is collected through municipal waste systems and some recycling streams. However, a portion of the trash generated is never disposed of properly and eventually ends up in the urban landscape, making its way into local creeks, rivers, bays and estuaries, ultimately being transported to the Ocean. Despite being produced by land-based sources, plastics are continually finding their way into the Oceans, so much, that current estimates suggest 80% of debris found in the ocean (marine debris) is plastic and comes from land-based sources(2).

Throughout its "lifetime" trash can adversely affect humans, fish and wildlife. The presence of litter in the environment can disrupt a variety of habitats and even impede natural processes such as the flow of rivers. The effects of this pollution in non-human organisms are undeniable, as lethal consequences often result from entanglement, ingestion or otherwise (5). This debris can also affect humans and the economic stability of coastal communities by diminishing aesthetic qualities and thusly property values – especially in communities that depend on tourism for income. There are also issues that arise in water quality such as the infiltration of drinking water supplies by microplastics, and the subsequent introduction of bacteria and other toxins that have been absorbed by the plastic particles.

Man-made debris is not currently recognized by the EPA as an official water pollutant under the Clean Water Act (CWA)(3), so the goal of this survey is to establish a connection between storm water runoff and litter levels in local waterways, while also gathering quantitative data on the purveyors of this debris. This helps establish a baseline to understand the type, amount, and location of litter in urban waterways in order to influence the development practical policy changes which address local litter pollution in the city of Wilmington and beyond.

SITE SELECTION

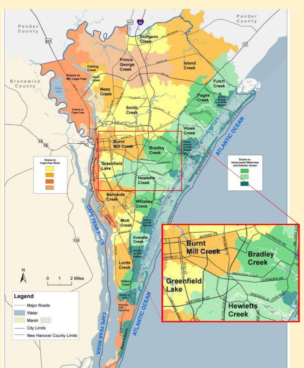


Figure 1. Wilmington and New Hanover County watersheds 2014 - map by Wilmington Storm water Services(4).

The designated survey sites – Burnt Mill Creek, Bradley Creek, Greenfield Lake and Hewletts Creek – are the four major watersheds of Wilmington and drain either into the Intracoastal Waterway or directly into the Ocean. Furthermore, each body of water is in close proximity to various urban development often resulting in the accumulation of man-made debris that is eventually transported into the Ocean(4).

Bradley Creek: Drains a watershed of 4,583 acres, including much of the UNCW campus, into the Atlantic Intracoastal Waterway (AICW). The watershed contains about 27.8% impervious surface area with a population of about 16,470(4).

Greenfield Lake: – This lake drains a watershed of 2,465 acres, covered by about 37% impervious surface area with a population of about 10,630(4).

Burnt Mill Creek: drains a 4,207 acre watershed with a population of about 23,700. Its watershed is extensively urbanized (39.8% impervious surface coverage) and drains into Smith Creek(4).

Hewletts Creek: drains a large (7,478 acre) watershed into the Atlantic Intracoastal Waterway. This watershed has about 25.1% impervious surface coverage with a population of about 20,210(4).

Photos

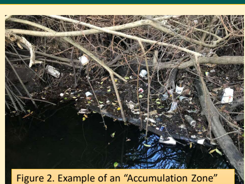


Figure 2. Example of an "Accumulation Zone" located in Bradley Creek Site- Transect #2

Photos by: Rachel Jacobs

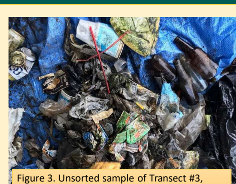
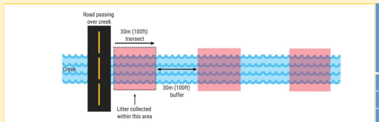


Figure 3. Unsorted sample of Transect #3, Bradley Creek (follow up)

Methods

- Travel to selected sample site
- Fill out the site information form (date, time, site coordinates, researchers/participants present)
- Begin at the pre-measured transect furthest downstream to minimize turbidity from disturbances caused by walking through the stream.
- Collect all litter within each 30m transect of the stream and 1m up the banks on either side of the transect, excluding any debris located more than 1m up the banks or in a Buffer Zone (See Fig. 4).
- Consolidate recovered debris in a trash bag and continue until area is cleared.
- Repeat for the remaining transects at the site until every transect is accounted for.
- Lay out collected debris on a large tarp organized by transect (one transect at a time).
- Sort debris into piles by litter category: Plastic Film, Hard Plastic, Styrofoam and Other Foam, Metal, Glass, Other and Sports Equipment.
- Sorter(s) quantify the total number of debris in each category for that transect and express their findings to the notetaker.
- If logos or brands are legible on the debris, sorter(s) document the brands present in sample and quantify the total number of items produced by that particular company or manufacturer.



Number of Litter Items per 100ft/30m Transect (avg)	Impairment Score
0-10	None/Very light
10.1-25	Light
25.1-50	Moderate
>50.1	High

Figure 4. Illustration of site layout, sampling methodology and impairment score chart – provided by Duke Environmental Law & Policy Clinic (2)

RESULTS

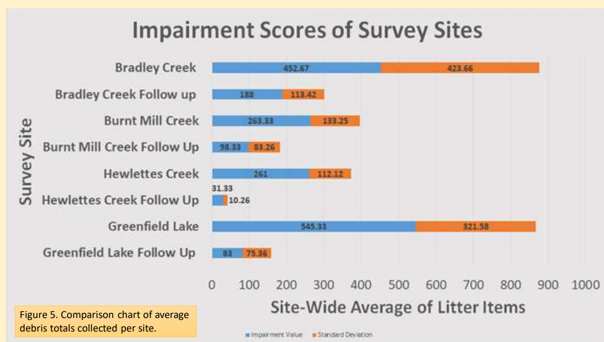


Figure 5. Comparison chart of average debris totals collected per site.

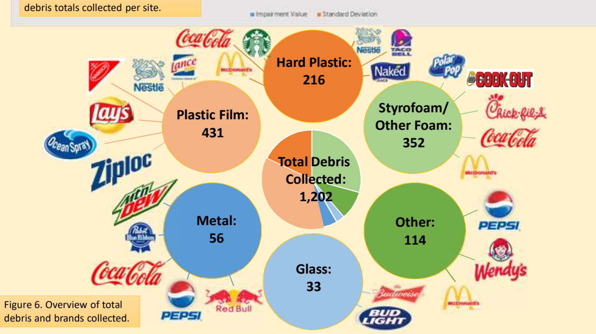


Figure 6. Overview of total debris and brands collected.

Sample Site	Average amount of debris per 30m transect	Impairment Score
Bradley Creek	188 ± 65.48	High
Burnt Mill Creek	98.33 ± 9.25	High
Greenfield Lake	83 ± 43.51	High
Hewletts Creek	31.33 ± 5.93	Moderate

Figure 7. Calculated site Impairment Score with Standard Error

Discussion

Limitations/areas for improvement with this survey protocol:

The majority of the debris in our follow-up surveys appeared to be significantly degraded, suggesting that it had not been recently deposited since the initial survey. This leads us to believe this debris could have been missed by the initial survey group and/or drifted into the transect from a Buffer Zone upstream. In a few instances some debris was too small to completely recover; was physically too large to remove from the area; or was blocked by features such as fallen trees and roots. Certain debris such as Styrofoam items get very brittle over time and would break up into multiple smaller pieces in transit to sorting destination, so this could potentially skew the data to some degree. Human error may have also allowed for minor miscounts or misclassifications of certain items (i.e. large samples of small debris, categorizing hard film-like plastics, etc.). For the sake of producing qualitative and not just quantitative data, collecting data on the weight of debris collected from each transect would have been beneficial. Finally, categories of litter could be more specific to produce stronger evidence of trends.

Conclusions and Implications

Based on the parameters for watershed impairment from debris, as outlined by the Duke Environmental Law & Policy Clinic, three of the four primary watersheds in Wilmington are highly impaired with the fourth being moderately impaired, even after each of the four sites initially received a high impairment score just weeks prior. The data suggests that there is re-accumulation occurring at these sites, however there is not substantiating evidence to support the notion that the accumulating debris is if from new sources. Considering that the purpose of this study is to expand classifications for water pollutants, this preliminary research may be able to support the movement towards categorizing debris as a form of pollution.

Potential strategies in addressing this problem in the future could include **planning controls** (adopting land- use policies which restrict litter-producing activities to areas where it is possible to contain and control debris accumulation), **source controls** (reducing litter loads entering the drainage system by dealing with solid waste at the source and holding the corporations producing this waste accountable for the management of their products) and **structural controls** (removal of urban litter from the drainage systems at specially engineered structures).

References and Acknowledgements

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