

6.0 Permit Requirements

D. Management Programs

4. Trash and Litter

Baltimore County drains to at least two major water bodies (the Middle Branch and Northwest Branch of the Patapsco River) determined to be impaired by trash. The trash and litter section of this permit is to assist in efforts to address water quality improvements. Increases in trash discharges to receiving water have become a growing concern both nationally and within Maryland. This section requires Baltimore County to evaluate current trash and litter control efforts; develop strategies to reduce trash, floatables, and debris within those areas draining to the Middle Branch and Northwest Branch of the Patapsco River; and bolster public education.

- a. Within one year of permit issuance, the County shall inventory and evaluate all current trash and recycling pick-up operations, litter control programs, and public outreach efforts. The analysis shall identify opportunities for improving overall efficiency, especially in the Middle Branch and Northwest Branch of the Patapsco River.
- b. Within one year of permit issuance, develop and implement a public education and outreach strategy with specific performance goals, and corresponding deadlines to initiate or increase residential and commercial recycling rates, improve trash management, and reduce littering. The strategy shall include:
 - i. Educating the public on the importance of reducing, reusing, and recycling;
 - ii. Disseminating information by using signs, articles, and other media outlets;
 - iii. Promoting educational programs in schools, businesses, community associations, etc.; and
 - iv. Providing the strategy to interested parties upon request.
- c. Evaluating annually the effectiveness of the education program.
- d. Within one year of the Environmental Protection Agency's (EPA) approval of a trash total maximum daily load (TMDL) for the Middle Branch and Northwest Branch of the Patapsco River, implement those program improvements identified in Part III.D.4.a above and any additional programs needed to address the TMDL.
- e. Submit an annual report that details progress toward implementing the trash reduction strategies. The report shall describe the status of trash elimination

efforts including resources (e.g., personnel and financial) expended and the effectiveness of all program components.

6.1 Introduction

The 2008 Integrated Report indicated that the mesohaline portion of the Patapsco River basin was listed for impairment of aquatic life by debris/floatables/trash. This listing only applies to the Middle Branch from the mouth (Ferry Bar Park to Harbor Hospital Center) extending westward and the Northwest Branch from the Hull Street Pier to Canton Waterfront Park, which includes the Inner Harbor at the base of Gwynns Falls and Jones Falls. In October 2010 Baltimore County initiated a monitoring program to collect data for development of a trash TMDL, which was completed in November 2011. Following this yearlong study, a long-term trend monitoring program was initiated in March 2012 with a fixed and random site study design. The draft TMDL report was made public on September 11, 2012. The public comment period ended on October 29, 2012. An informational briefing was held prior to the closing on September 21, 2012. Comments were addressed and the trash TMDL was submitted to EPA in August of 2014 for approval. In January 2015, the EPA approved the trash TMDL for the Harbor.

Baltimore County is developing a Trash TMDL Implementation Plan to outline how the County plans to meet the Trash TMDL requirements in the impaired waterbody. The TMDL Implementation Plan is on track to be completed by January 2016. To target areas of high trash accumulation, an upland trash assessment monitoring plan was developed in 2015 to determine the sources of trash within the Gwynns Falls and Jones Falls.

A county-wide Trash and Litter Reduction Strategy has also been developed to address the trash issue throughout the county in response to a requirement in the county's 2013 MS4 permit. The Trash and Litter Reduction Strategy was submitted to MDE in 2014. This section will describe the progress of the Trash and Litter Reduction Strategy and include any monitoring data collected as part of strategy implementation and tracking. In future NPDES Annual Reports, this section will also include progress and monitoring relating to the Trash TMDL Implementation Plan.

6.2 TMDL Compliance

This section describes the key assessment, outreach and progress tracking components of the Trash TMDL Implementation Plan and the Trash Reduction Strategy. The Trash and Litter Reduction Strategy outlines a County wide program to reduce litter pollution and addresses a requirement in part IV.D.4 of the current MS4 permit. The Trash TMDL Implementation Plan addresses the requirement to develop a plan to meet TMDL reductions in Baltimore County within one year of approval of the TMDL.

6.2.1 *Trash TMDL Implementation Plan*

A Trash TMDL Implementation Plan is being developed to outline the County's strategy for compliance with the Trash and Debris TMDL reduction requirements by 2036. This implementation plan will be submitted to MDE by January 5th of 2016.

The implementation plan is a two phase plan. Much like the Trash and Litter Reduction Strategy, The first phase of the plan is to focus on education and outreach, incentives and enforcement actions to meet the reduction requirements. These are the actions that will stop the trash pollution

at its source. Baltimore County will first try to reach the requirements set forth by MDE using these source reduction actions alone. An evaluation of phase I success will be performed after 10 years. At this time, the County will determine if the contingent phase II is necessary or if the reductions can be reached with phase I actions.

Phase II is the implementation of trash trapping devices. These devices trap trash after it has already been littered in the environment. This phase will be more costly than phase I of the plan. It is contingent only on a determination that the TMDL requirements cannot be met with phase I alone.

There is limited available data on the pathways of trash pollution to fresh water bodies and on the efficiency of best management practices to reduce trash pollution. For this reason, this TMDL Implementation Plan emphasizes an adaptive management strategy with emphasis on gathering data to improve our understanding of these uncertainties throughout the implementation process.

6.2.2 *Trash and Litter Reduction Strategy*

Baltimore County EPS has created a Trash and Litter Reduction Strategy. This plan introduces actions to reduce trash, enhance public education, and ensure that Baltimore County meets the compliance requirements of the TMDL.

The strategy addresses MS4 permit requirements as stated in Part IV.D.4 of the current permit. This strategy was developed by Baltimore County's Department of Environmental Protection & Sustainability (EPS) in close partnership with various county agencies, public stake holders, local watershed associations, and with input from Trash Free Maryland. Suggestions from the public, via community input events held throughout the county, are the main driver of the actions within this plan. Suggestions for litter reduction actions, made by individual citizens, were compiled into a report in the initial phase of strategy development. Those suggestions were then evaluated for their feasibility and potential effectiveness. This plan is the result of that evaluation.

6.2.2.3 *Inventory and Evaluation of Operations and Outreach*

Baltimore County EPS worked closely with Baltimore County Department of Public Works' (DPW) Bureau of Solid Waste Management, Baltimore County Department of Permits, Approvals, and Inspections (PAI), Baltimore County Police Department and the Department of Health in an effort to identify opportunities for improving efficiency within programs pertaining to trash and recycling pickup, litter control, and public outreach.

In 2009, MDE approved a Ten Year Solid Waste Management Plan covering the years 2009-2018. The goals of this plan are to promote waste prevention, increase recycling, increase resource recovery, and decrease the quantity of solid waste requiring use of the landfills. The use of this plan will allow for identifying effective ways to improve waste management efforts.

Enforcement of trash regulations is conducted by PAI and by the Baltimore County Police Department. The Baltimore County Bureau of Solid Waste Management has a comprehensive education and outreach program to improve county recycling rates and reduce the amount of trash generated. The Bureau of Solid Waste also has a Community Clean Up Program and Recycle Bin Loan Program. The Baltimore County Bureau of Highways runs several litter reduction programs including county street sweeping, Adopt-A-Road, Inmate Litter Crew Highway Cleanup, District Litter Removal, and Neighborhood Dumpster Clean-Ups.

Collaboration with these departments will ensure effective litter control and trash reduction programs.

Existing programmatic and municipal trash reduction actions that have associated measurable load reductions have been inventoried in Section 9 of the Trash TMDL Implementation Plan. Those actions with calculable load reductions are street sweeping, storm drain cleaning, SWM facilities, Clean Green 15, Community Clean Ups, Project Clean Stream, and Enforcement programs. Calculated reductions are based on the best available data. This section will serve as the means for reporting any reduction calculation changes based on future data.

A gap analysis is also available in Section 9 of the Trash TMDL Implementation Plan, which shows the remaining reductions needed to meet the TMDL requirements for trash and the process of analysis used to select opportunities for program enhancements. The program enhancements are projected to achieve the remaining reductions. This section will also serve to report progress of program enhancements and the status of Phase I and II of the Trash TMDL Implementation Plan.

6.2.2.4 Public Education and Outreach

To provide outreach to schools, businesses, community associations, etc., collaboration will be required with the Baltimore County School System, as well as community and watershed groups. Trash activities with high citizen involvement and publicity, such as Project Clean Stream, and watershed group clean-ups, will be beneficial in reaching the targeted audiences.

A county wide litter reduction media campaign is being developed as part of the Trash and Litter Reduction strategy and Trash TMDL Implementation Plan. The media campaign is intended to reach as many Baltimore County Citizens as possible with the message to stop littering in Baltimore County. A request for proposal has been issued to retain the services a consultant(s) to develop this campaign and to develop a methodology for tracking the effectiveness and related trash reduction efficiencies of the campaign. This is one of several education and outreach actions described in the Trash and Litter Reduction Strategy. Other potential actions outlined in the Trash and Litter Reduction Strategy include: development of a county based trash treaty, promoting service learning opportunities, school litter awareness programs, anti-littering signage, and continued support of cleanups by watershed groups and faith based institutions.

Baltimore County EPS has developed an educational door-hanger that can be used as an alternative to a citation, as a means to educate communities with high trash accumulation. The use of websites, e-newsletters, local newspaper, etc. will also provide a valuable tool in promoting information. Many departments within Baltimore County have media programs already established that can be built upon to cater to specific trash and recycling information needs.

6.2.2.5 Program Effectiveness

The effectiveness of the education and outreach programs can be evaluated annually through the NPDES report. Information will be compiled from all responsible agencies with education materials. DPW Bureau of Solid Waste Management analyzes the annual recycling rate throughout communities in Baltimore County on its website <http://www.bcrecycles.com>. This is an example of how EPS can deliver information to the public while promoting trash and recycling activities.

Baltimore County EPS will also track the effectiveness of its Trash and Litter Reduction Strategy and Trash TMDL Implementation Plan as part of the initial phase of implementation. The Trash TMDL Implementation Plan requires that the need for the contingent structural phase be evaluated after 10 years. The Trash and Litter Reduction Strategy has a similar contingent structural phase, but at a County wide level. This too will be addressed in this section of future NPDES reports. The data collected from the initial phase can also be used to better target actions to areas where they will be most beneficial.

6.3 Monitoring

Following the TMDL development study, the trash monitoring program has developed into a long-term trend monitoring program for stream sites only. Trash from both fixed and random sampling sites will be collected on an annual basis to document trends and identify problem areas. Results of this program will help to target improvement efforts.

6.3.1 Fixed and Random Study

The twenty stream sites from the previous trash survey were defined as fixed sites, and were randomly selected to be alternately sampled in groups of ten during odd and even years. Each year, twenty additional randomly selected sites (ten in Gwynns Falls, ten in Jones Falls) are added to the survey along with the ten fixed sites. The random sites will not be repeated in the survey during the following years. Figure 6-1 below shows the locations of the fixed and random sites for 2014 throughout the Gwynns Falls and Jones Falls.

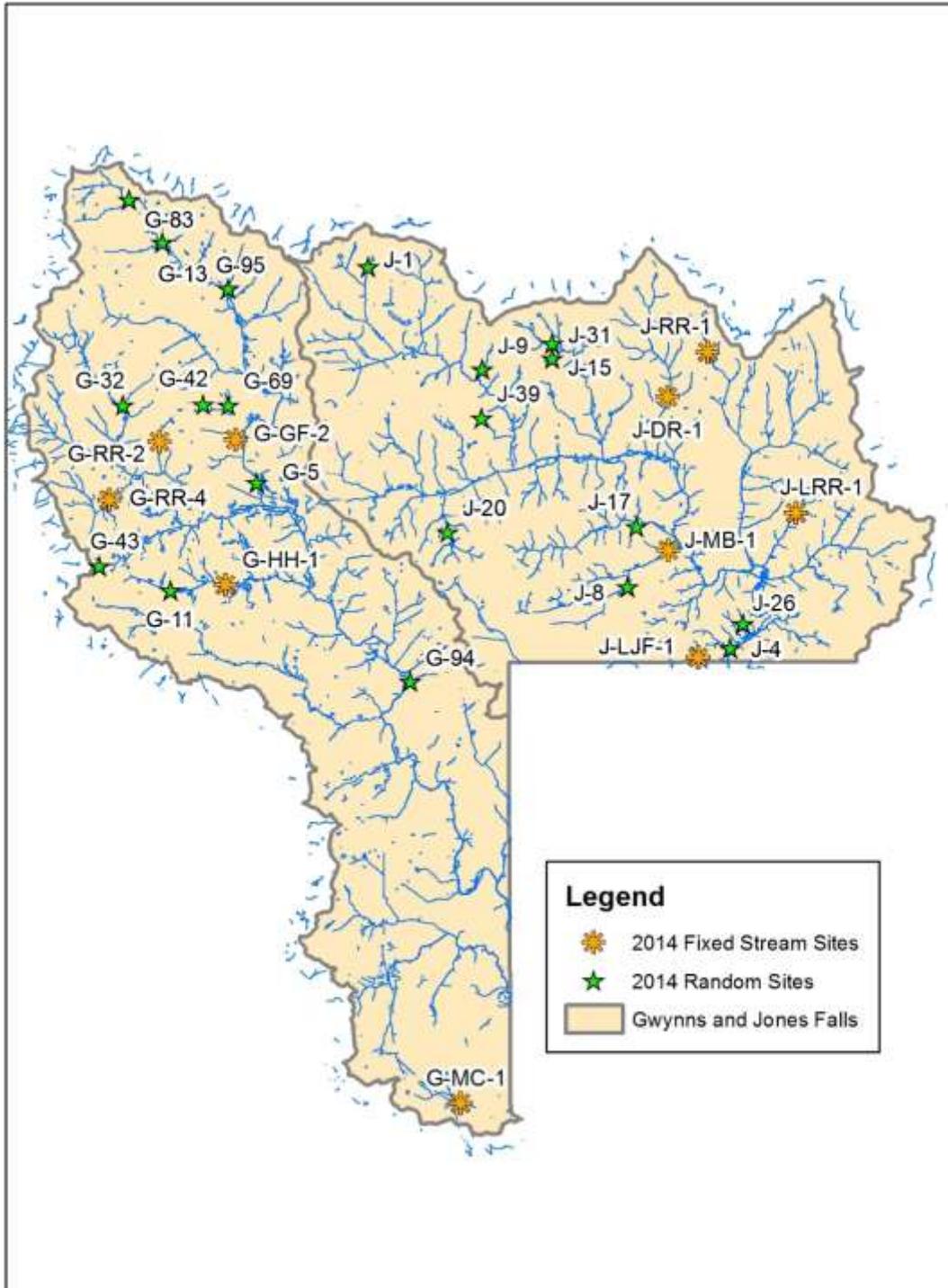


Figure 6-1: Map of 2014 Fixed and Random Monitoring Locations

6.3.1.1 Results

The results from the 2014 fixed/random survey are presented below. The data is broken into total pounds of trash collected per site, count of bottles/cans per site, and the loading rates with and without dumping (lbs/acre) per site. As opposed to the survey of random sites in 2012, there was not a significant amount of dumping in 2014. Table 6-1 displays the site-specific information, grouped by watershed.

Table 6-1: 2014 Fixed and Random Site Information

Stream Site	Fixed/Random	Stream Name	Watershed	Major Designation Land Use*	Drainage Area (acres)	Trash Total (lbs)	Trash (lbs/acre)	Trash w/o dumping (lbs/acre)
G-GF-2	Fixed	Trib to Gwynns Falls	Gwynns Falls	MDR	150.26	120.82	0.8040	0.5112
G-HH-1	Fixed	Horsehead Branch	Gwynns Falls	MDR	508.47	0.88	0.0017	0.0017
G-MC-1	Fixed	Trib to Maiden's Choice Run	Gwynns Falls	MDR	414.40	60.79	0.1467	0.0984
G-RR-2	Fixed	Trib to Red Run	Gwynns Falls	Forest	112.82	0.58	0.0051	0.0051
G-RR-4	Fixed	Trib to Red Run	Gwynns Falls	Forest	522.83	10.06	0.0192	0.0192
J-DR-1	Fixed	Mainstem Deep Run	Jones Falls	LDR	1,149.03	22.15	0.0193	0.0158
J-LJF-1	Fixed	Lower Jones Falls	Jones Falls	HDR	48.77	29.99	0.6149	0.6149
J-LRR-1	Fixed	Trib to Roland Run	Jones Falls	Institutional	180.29	14.50	0.0804	0.0804
J-MB-1	Fixed	Moores Branch	Jones Falls	LDR	1,315.70	4.08	0.0031	0.0031
J-RR-1	Fixed	Roland Run	Jones Falls	OU	221.48	2.00	0.0090	0.0090
G-13	Random	Trib to Gwynns Falls	Gwynns Falls	MDR	1,254.64	172.63	0.1376	0.0404
G-32	Random	Trib to Red Run	Gwynns Falls	MDR	143.50	6.207	0.0433	0.0433
G-83	Random	Gwynns Falls	Gwynns Falls	MDR	506.46	31.28	0.0618	0.0618
G-5	Random	Gwynns Falls Mainstem	Gwynns Falls	MDR	6,328.11	158.07	0.0250	0.0115
G-69	Random	Trib to Gwynns Falls	Gwynns Falls	HDR	27.96	11.78	0.4212	0.0635
G-94	Random	Trib to Gwynns Falls	Gwynns Falls	MDR	164.10	6.53	0.0398	0.0398
G-11	Random	Horsehead Branch	Gwynns Falls	MDR	201.64	20.93	0.1038	0.1038
G-42	Random	Trib to Gwynns Falls	Gwynns Falls	MDR	52.20	53.60	1.0268	0.4521
G-43	Random	Red Run	Gwynns Falls	MDR	16.82	30.58	1.8174	1.8174

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Stream Site	Fixed/ Random	Stream Name	Watershed	Major Designation Land Use*	Drainage Area (acres)	Trash Total (lbs)	Trash (lbs/acre)	Trash w/o dumping (lbs/acre)
G-95	Random	Trib to Gwynns Falls	Gwynns Falls	MDR	244.69	26.21	0.1071	0.1071
J-15	Random	Dipping Pond Run	Jones Falls	Forest	269.93	0.50	0.0019	0.0019
J-17	Random	Slaughterhouse Branch	Jones Falls	LDR	1,060.17	11.00	0.0104	0.0104
J-8	Random	Moore's Branch	Jones Falls	MDR	915.19	2.58	0.0028	0.0028
J-20	Random	Trib to Jones Falls	Jones Falls	LDR	335.28	52.93	0.1579	0.0535
J-1	Random	Trib to North Branch Jones Falls	Jones Falls	LDR	95.50	7.00	0.0733	0.0366
J-31	Random	Trib to Dipping Pond Run	Jones Falls	LDR	49.48	14.75	0.2981	0.0960
J-9	Random	Trib to North Branch Jones Falls	Jones Falls	LDR	113.81	5.73	0.0503	0.0503
J-26	Random	Trib to Jones Falls	Jones Falls	Forest	36.86	11.12	0.3017	0.0304
J-4	Random	Trib to Jones Falls	Jones Falls	Forest	99.96	21.00	0.2101	0.0100
J-39	Random	Trib to North Branch Jones Falls	Jones Falls	LDR	39.59	0.25	0.0063	0.0063

*-Note: The abbreviations used in the Land Use column are as follows: LDR – Low Density Residential, MDR – Medium Density Residential, HDR – High Density Residential, OU – Open Urban.

In order to analyze the trend of trash loading at random sites between 2012 and 2013, a 1-way analysis of variance was performed between the two datasets. Since there was a substantial amount of dumping at the random sites from 2012, the two years were compared based on the loading rates without dumping. The results in table 6-2 show that there is not a significant difference between the loading rates of the last two years, based on the P-value of 0.6. This indicates that a similar amount of trash can be expected at random locations throughout Baltimore County streams.

Table 6-2: Results of 1-way ANOVA

Year	Average Loading Rate w/o Dumping	P-value
2012	0.19	
2013	0.14	
Between Years		0.6

An additional ANOVA was performed between data from random sites analyzed in 2013 and 2014, to ensure that the assumption that random sites have a similar amount of trash remains valid. The results of this ANOVA are shown in Table 6-3, which shows that, not only does the assumption remain valid, the random sites between 2013 and 2014 are more similar than those between 2013 and 2012.

Table 6-3: Results of 1-way ANOVA

Year	Average Loading Rate w/o Dumping	P-value
2013	0.14	
2014	0.15	
Between Years		0.9

A two-tailed, paired t-test was also performed on data from fixed sites analyzed in 2012 and 2014, to ensure that the trash loading rates remained consistent. The results of this test indicate that, with a p-value of 0.12, loading rates between 2012 and 2014 did not change significantly at the fixed sites.

Table 6-4: Comparison of Fixed Site Results 2012-2014 (#s/Acre)

Site	Loading Rate 2012	Loading Rate 2014	Difference
G-GF-2	0.1538	0.5112	+0.3574
G-HH-1	0.0001	0.0017	+0.0016
G-MC-1	0.0841	0.0984	+0.0143
G-RR-2	0.0000	0.0051	+0.0051
G-RR-4	0.0138	0.0192	+0.0054
J-DR-1	0.0115	0.0158	+0.0043
J-LJF-1	0.1430	0.6149	+0.4719
J-LRR-1	0.0174	0.0804	+0.0630
J-MB-1	0.0024	0.0031	+0.0007
J-RR-1	0.0009	0.0090	+0.0081
Mean	0.0427	0.1359	+0.0932

As can be seen in tables 6-5 and 6-6 below, the total pounds of trash per sorting category and total count of bottles and cans were moderately higher at the random sites than at the fixed sites. This may be due to the fact that the fixed sites had been previously monitored 5 times during the course of the TMDL development study, which removed a significant amount of trash from prior years. Trash collected from the random monitoring sites could include items that have been there for many years, in addition to any trash dumping that may have occurred. The amount of trash collected during the survey was most likely higher due to the land use, which was predominately medium density residential at both the fixed and random sites.

Table 6-5: Pounds of Trash Collected by Sorting Category

Sorting Category	Fixed (lbs)	Random (lbs)	Project Total (lbs)
Plastic Bottles	6.35	12.67	19.02
Glass Bottles	3.82	6.54	10.36
Aluminum Cans	3.18	2.96	6.14
Other	184.50	297.00	481.50
Dumping	68.00	325.50	393.50
Total	265.84	644.66	910.50

Table 6-6: Count of Bottles and Cans Collected

Bottle Counts	Fixed	Random	Project Total
Plastic Bottles	82.5	164.5	247
Glass Bottles	7	12	19
Aluminum Cans	43.5	40.5	84

The results of the loading rate analysis, displayed in figures 6-2 and 6-4 show that the loading rates for several of the random stream sites are skewed higher due to moderate amounts of trash found at streams with small drainage areas. For example, at random site G-43, had 30 pounds of trash, the average amount of trash for all 2014 random sites, but a drainage area of only 16 acres. This resulted in a loading rate of 1.82 pounds per acre, by far the highest loading rate amongst the random sites. Large item dumping was again a large source of trash for the random sites, with just over half of the trash by weight accounted for by large items.

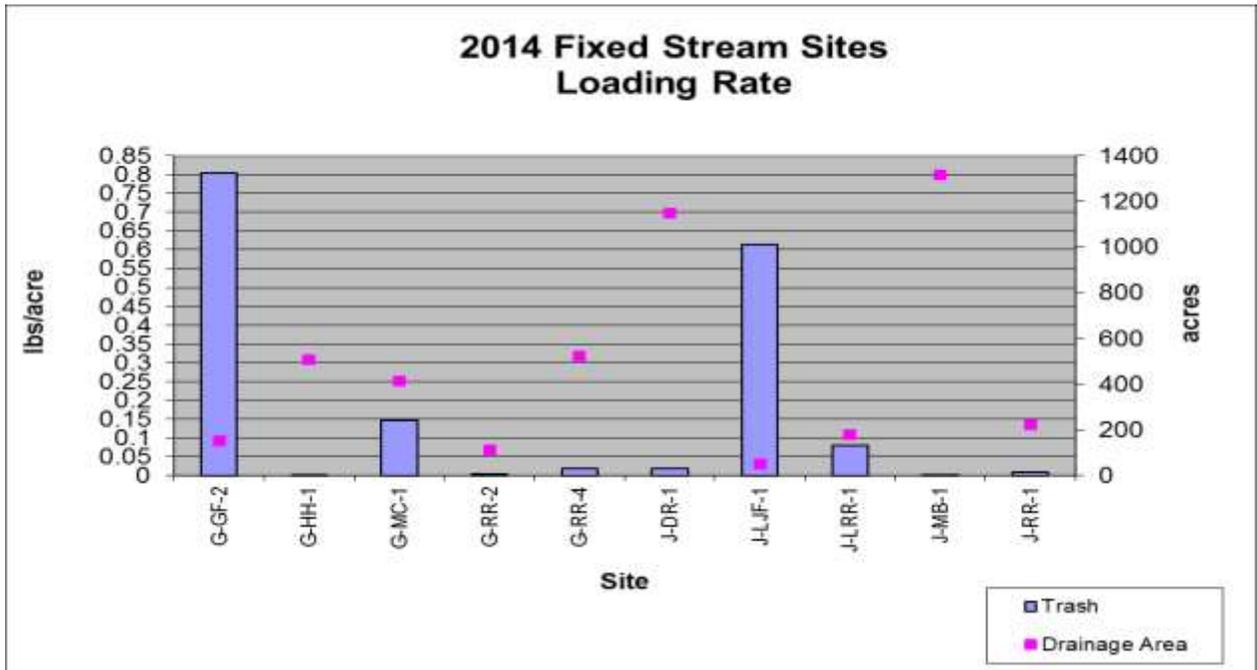


Figure 6-2: Fixed Stream Sites Loading Rates

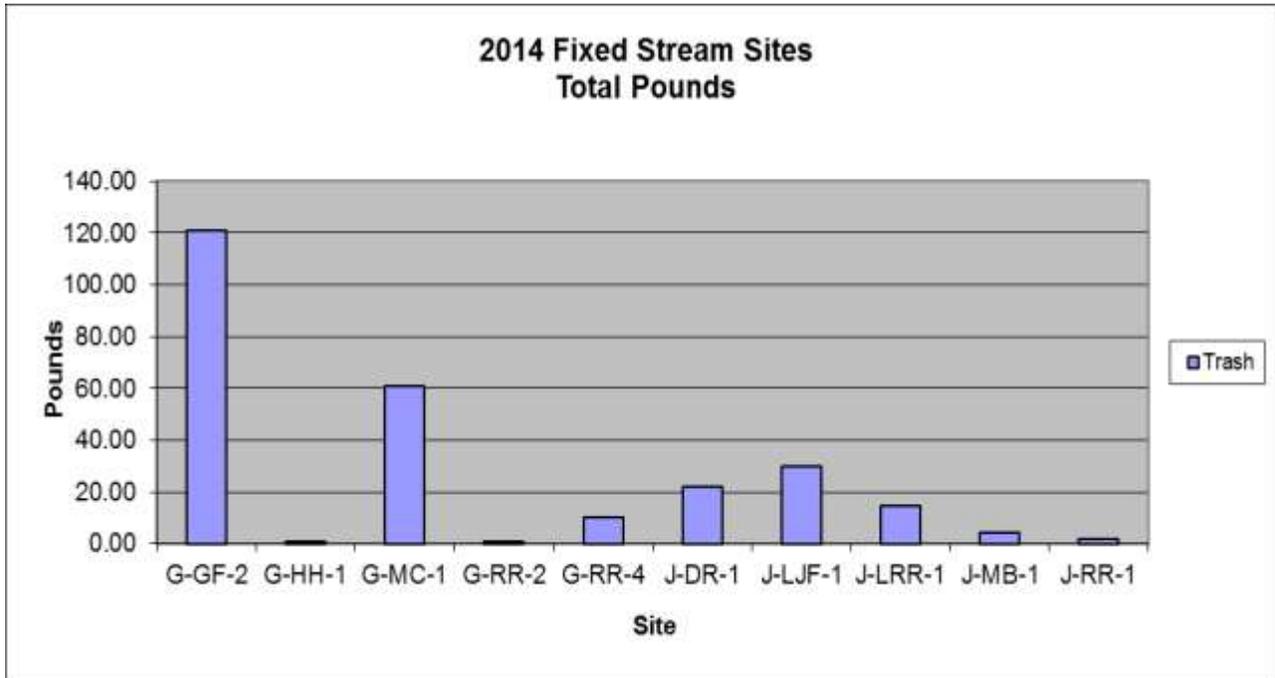


Figure 6-3: Fixed Stream Sites Total Pounds

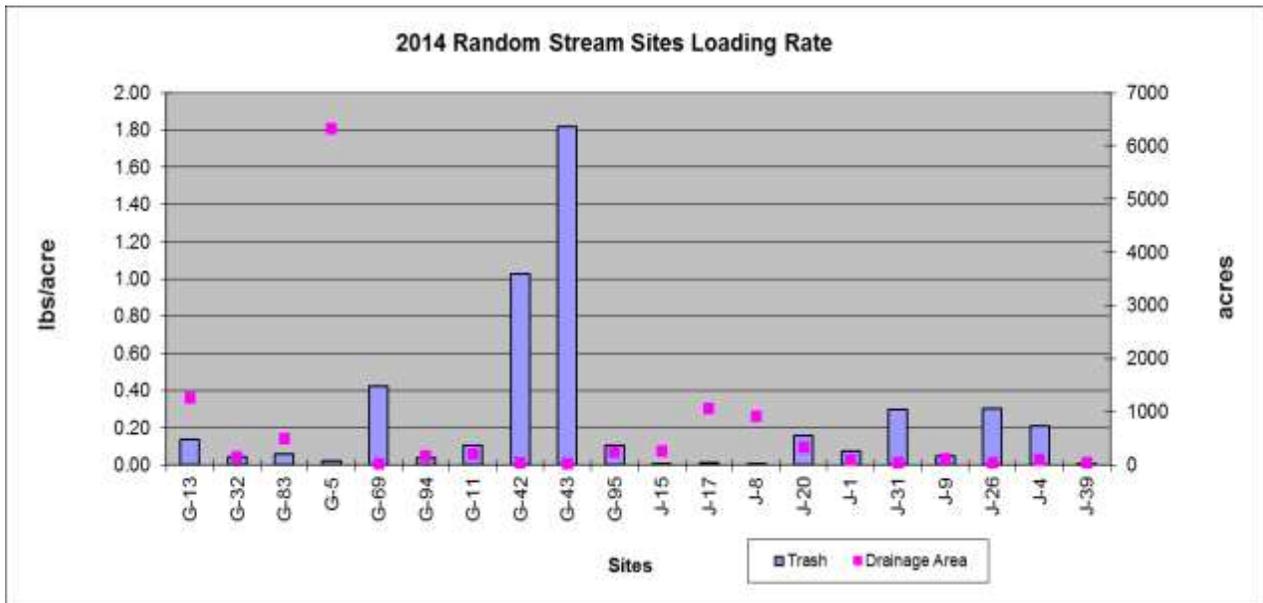


Figure 6-4: Random Stream Sites Loading Rates

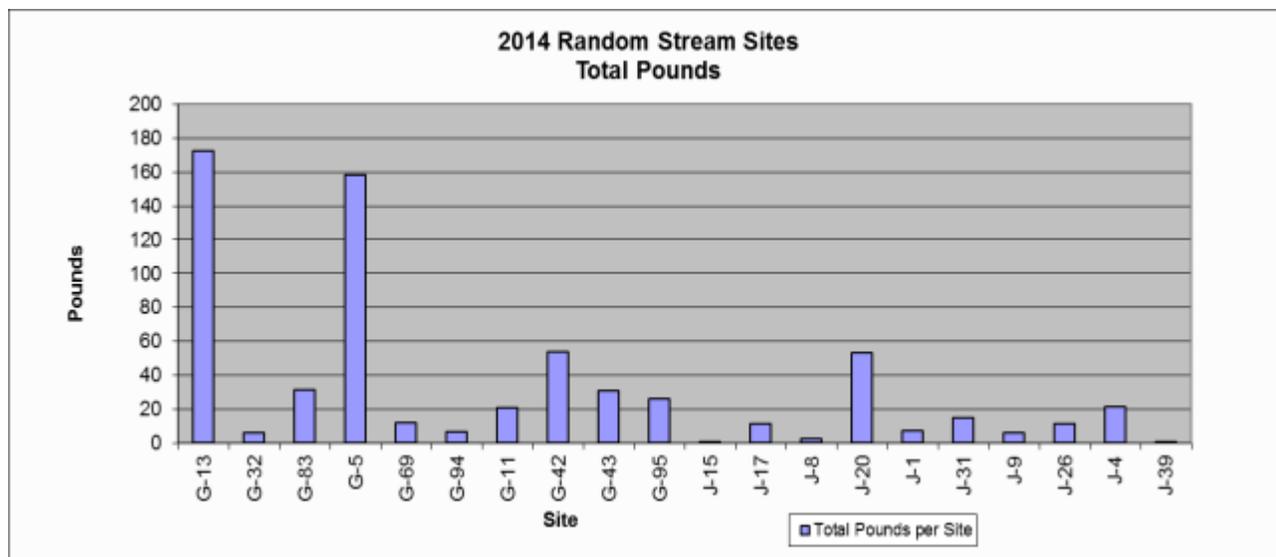


Figure 6-5: Random Stream Sites Total Pounds

6.3.3 Upland Trash Assessment

In order to assess the sources of trash throughout the study area, an upland assessment has been developed. Upland trash monitoring will be used as a tool to track the sources of trash in watersheds. Specifically, this program will be used in the watersheds draining to the Middle Branch and Northwest Branch of the Patapsco River to address the trash TMDL. The results of this assessment may be a valuable resource for targeting trash reduction actions in order to meet the TMDL requirements.

Methodology from Small Watershed Action Plans (SWAPs) will provide a baseline on how to best identify trash hotspots throughout watersheds. SWAPs have been completed for the Lower Jones Falls, the Northeastern Jones Falls and the Upper and Middle Gwynns Falls. The final SWAP for the remaining Baltimore County areas in the Jones Falls watershed is now in progress. Upland assessments for the SWAPs identify areas in need of improved trash management, providing the data needed to target citizen awareness efforts and additional street sweeping. An Upland Trash Assessment Quality Assurance Project Plan has been developed for this program and can be found electronically in the Miscellaneous Documents folder of the accompanying CD.

An initial pilot of this Upland Trash Assessment took place in 2015. The data collected from the initial pilot can be found in figure 6-6 and table 6-6. Baltimore County plans to implement the full version of the program beginning in 2016. As was done in the Anacostia watershed (and presented in the Anacostia Watershed Trash Reduction Plan), “windshield” surveys are used to survey upland trash on the streets that might enter the water bodies. This consists of a survey where a vehicle is driven throughout a segment of streets, and the amount of visible trash that can be seen is assigned a litter index score based on the level of pollution. This type of survey will be useful in targeting areas for education and for trash removal or street sweeping.

This type of assessment will be beneficial in investigating why sites such as G-PM-1 from the trash survey have significantly large amounts of trash.

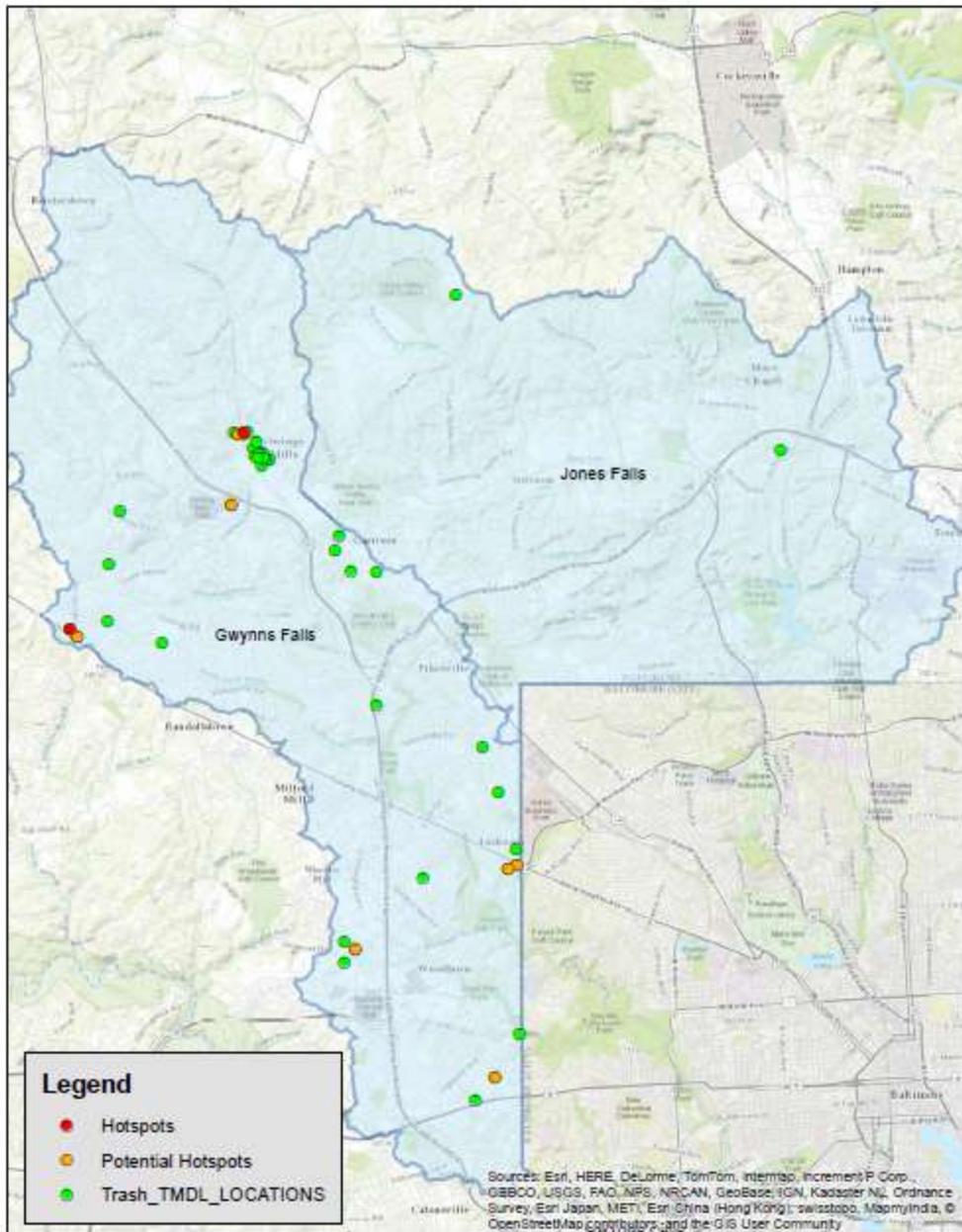


Figure 6-6: Map of 2015 Upland Trash Assessment Pilot Sites

Table 6-7: Trash Assessment Results

Assessment Site	Hotspot Classification	Site Type	Highest Index Score
GF-15-5-8	Potential Hotspot	Business	3
GF-15-5-23	Potential Hotspot	Business	3
GF-15-5-19	Potential Hotspot	Shopping Center	3
GF-15-5-1	Potential Hotspot	Residential	3
GF-15-5-3	Potential Hotspot	Residential	3
GF-15-5-9	Potential Hotspot	Residential	3
GF-15-7-14	Potential Hotspot	Business	3
GF-15-7-16	Potential Hotspot	Business	3
GF-15-5-20	Hotspot	Business	4
GF-15-7-15	Hotspot	Business	4

Of the 42 sites surveyed in the pilot study, 8 of the sites were potential hotspots and 2 of the sites were hotspots. Potential hotspots have at least one index score of 3. Hotspots have at least one index score of 4 or 5. Of all of the sites assessed, no sites were determined to have a score of 5. The majority of sites that were classified as potential hotspots or hotspots were business sites and none of them had stenciled storm drains. Two of the littered sites did have anti-litter signage present.

6.4 Watershed Trash Loading Calculations

While the Trash TMDL developed trash loading rates for the Gwynns Falls and the Jones Falls, there were no calculations for the trash loading rates for the rest of the watersheds in Baltimore County. In order to provide the trash loadings on a county-wide basis, EPS has used the information in the Baltimore Harbor Trash TMDL to develop trash loading rates for all 14 watersheds in Baltimore County. The trash TMDL is based on loading rates attributable to the differing land uses in the county (Table 6-8). These land use loading rates plus a 0.5% margin of safety were used to estimate the trash loads in each of the 14 major watersheds in Baltimore County (Table 6-9). Based on the Baltimore County data, it is estimated that 0.57 pounds of trash per acre are dumped each year, in addition to the land use derived trash load.

Table 6-8: Trash Loading Rates by Land Use

Land Use	Land Use Code	Trash Loading rate Lbs/acre/year
Low Density Residential	11, 191, 192	0.9
Medium Density Residential	12	2.45
High Density Residential	13	4.01
Commercial	14	7.91
Industrial	15	7.91
Extractive	17	7.91
Institutional	16	1.99
Open Urban	18	2.15
Roadways	80	2.06
Agriculture	21,22,23,241,242	2.15
Forest	41,42,43,44	0.02
Construction	73	7.91

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Table 6-9: Baltimore County Watersheds - Annual Trash Loading Rates

Watershed	Acres	Pounds of Trash per Year
Deer Creek	7,152	14,084
Prettyboy Reservoir	25,551	38,761
Loch Raven Reservoir	139,568	266,591
Lower Gunpowder Falls	29,468	62,516
Little Gunpowder Falls	17,276	30,801
Bird River	16,408	50,460
Gunpowder River	5,859	11,669
Middle River	6,466	23,468
Liberty Reservoir	17,597	27,366
Patapsco River	33,579	82,411
Gwynns Falls	28,654	99,563
Jones Falls	25,933	64,051
Back River	23,115	84,816
Baltimore Harbor	11,406	57,236
	388,032	913,793

The trash load calculated for each watershed will be used as the target load for removal each year to reach a goal of zero trash in our waterways.