Multi-family Waste Characterization Sample Study:

# City of Sausalito, CA

Spring 2017

Prepared by:

EXECUTIVE SUMMARY

Envirolutions Consulting conducted a waste characterization of municipal solid waste (MSW) from multi-family dwellings (MFDs) for the City of Sausalito (City) in the spring of 2017. The purpose of this waste characterization was to measure the amount of recoverable material being disposed by MFD residents, measure participation levels in green waste and recycling programs among residents living in MFDs, and compare these results to findings from the waste characterization performed by SCS Engineers in 2013. Based on these findings, Envirolutions has made recommendations on where to focus efforts to assist the Sausalito Sustainability Commission, the City and the waste hauler Bay Cities Refuse Service (BCRS) in achieving the Marin County Hazardous and Solid Waste Management Joint Powers Authority's (JPA) zero waste goal by 2025.

In conducting the waste characterization, Envirolutions worked closely with BCRS to secure MSW discards from the multi-family sector only. Selected loads were directly dumped on the transfer station tipping floor to be sorted by Envirolutions staff. Sorting staff sorted 13 samples of approximately 250 pounds each (3,273.8 lbs total) into 9 categories and placed the material into barrels to be weighed. The 9 categories included: recyclable paper, recyclable plastics, compostable organics, non-compostable organics, electronics, recyclable metal, recyclable glass, household hazardous waste, and other waste (or mixed residue). The material categories are defined in more detail under the Waste Sampling section of this report but were largely based on corresponding Waste Category Types from the 2013 waste characterization. The resulting data was analyzed to calculate the mean, range, and standard deviation of the samples and compared to the results of the 2013 waste characterization.

ES Chart 1:
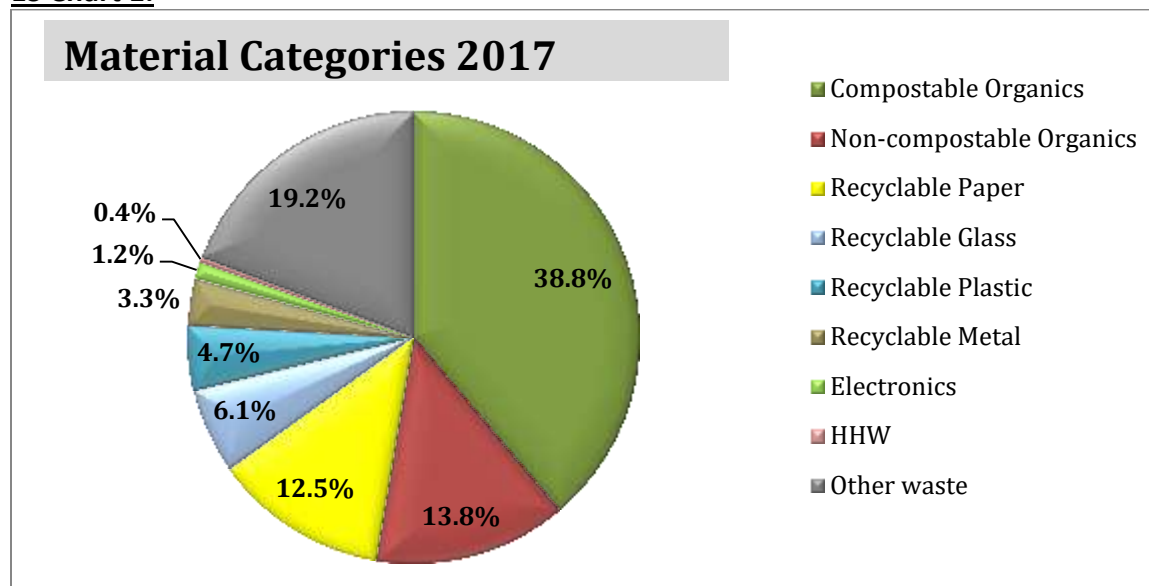
Our findings showed that the non-recoverable amount (or non-compostable organics plus residue or "other waste") = 33% of all discards. Which means around nearly two-thirds of the material found in the MSW stream is divertible. Based on the findings, Envirolutions recommends a continued focus on education and outreach on green waste diversion, getting more recyclable paper and compostable organics out of the wastestream, and expanding the type of materials collected to include more difficult-to-recycle items such as plastic bags, film, textiles, and carpet.

INTRODUCTION
Envirolutions partnered with the City of Sausalito to perform a waste characterization of a sample subset of MSW discards from MFDs to measure the amount of recoverable material not diverted through existing and available recycling and green waste collection programs. All of the MFD sites included in the study have access to both recycling and green waste collection programs and have had access to the programs for multiple years. The results were compared as best as possible to the 2013 waste characterization performed by SCS Engineers. Their categorization included 62 categories, which were collapsed into 9 categories in order to accommodate the limited budget and in order to perform more samples to increase confidence in our findings.

Envirolutions would like to thank Greg Christie with Bay Cities Refuse Service for his assistance in identifying MFD sites to be included in the study, coordinating the delivery of the waste materials to the West County Recycling Center and coordinating with the facility staff. Envirolutions would also like to thank the Republic Services for their coordination and making space available for our activities during the 2-week period. Lastly we would like to thank the City of Sausalito Sustainability Commission for their assistance in the development of the project and the waste sampling plan, and the Marin County Hazardous and Solid Waste Management Joint Powers Authority for funding of the project.

WASTE SAMPLING

The waste characterization spanned 3 collection days: Friday March 24, Tuesday April 4, and Friday April 7, 2017. For the Friday sorting days, MFD sites that typically had collection on Thursday and Friday were combined and included in the sample and for the Tuesday sort day, MFD sites with Monday and Tuesday collection were combined as part of the sample. Over the course of the 3 days, 40 of Sausalito's 52 eligible MFDs sites were sampled (4 sites were not included in the collection because of lack of access to recycling and green waste carts).

Members of the sorting staff were equipped with high visibility vests, gloves, and safety glasses. Safety was prioritized in accordance with standards and procedures in place for the BCRS facility.

After the BCRS truck collected the materials from the MFDs, the truck backed up to a bay on the side of the tipping floor which had been cleared for the Envirolutions sorting staff within the West County Recycling Center. The sorting staff weighed out samples of approximately 250 pounds of materials randomly selected from different sections throughout the dumped load, under the supervision of the Crew Supervisor and the Project Lead. The materials were then sorted into barrels for each of the agreed upon material categories and weighed to the nearest tenth of a pound as was done in 2013. This process was repeated during each of the 13 samples taken, for a total of 3,272.8 lbs total. The 9 categories included: recyclable paper, recyclable plastics, compostable organics, non-compostable organics, electronics, recyclable metal, recyclable glass, household hazardous waste, and other waste (or mixed residue).

Category Number	Major Waste Types	Waste Component Categories	Examples
1	**Recyclable Paper**	Uncoated Corrugated Cardboard	Packing/shipping boxes
		Paper Bags	Shopping bags, department store bags
		Newspaper	Daily, weekly newspapers, including inserts
		White Ledger Paper	High grade white copy paper or letterhead
		Other Office Paper	Junk mail, notebook paper, envelops/folders
		Magazines and catalogs	Shiny/glossy magazines, catalogs, brochures
		Phone Books and Directories	Phone books, real-estate listings
		Other Recyclable Paper	Milk cartons, non-corrugated boxes/boxboard
2	**Recyclable Plastic**	PETE #1 Containers	Soda, water bottles, food containers
		HDPE #2 Containers	Milk jugs, detergent bottles, motor oil bottles
		Miscellaneous Plastic Containers	Containers with #3-7, usually for food products
3	**Compostable Organics**	Food Waste	Meat scraps, fruit/vegetable peels
		Leaves and Grass	Leaves, grass clippings, plants, seaweed
		Prunings and Trimmings	Woody plant material < 4 inches in diameter
		Branches and Stumps	Woody plant material > 4 inches in diameter
		Other Miscellaneous paper	Tissues, paper towels, paperboard, cups/plates
4	**Non Compostable Organics** ***(Not recoverable)**	Manures	Farming/animal wastes and bedding
		Textiles	Fabric trimmings, draperies, clothes
		Carpet	Natural/synthetic fibers with backing material
		Remainder/Composite Organic	Leather, hair, cigarettes butts, diapers, cat litter
5	**Electronics**	Brown Goods	Microwaves, stereos, VCRs, DVD players
		Computer-Related Electronics	Laptops, keyboards, printers, modems
		Other Small Consumer Electronics	Cell phones, cameras, computer games, PDAs
		Video Display Devices	Computer monitors
6	**Recyclable Metal**	Tin/steel Cans	Food/beverage containers, paint cans
		Major Appliances	Washing machines, stoves, refrigerators
		Used Oil Filters	Metal oil filters for vehicles and other engines
		Other Ferrous	Iron, steel, stainless steel items
		Aluminum Cans	Aluminum food and beverage cans
		Other Non-Ferrous	Copper, brass, bronze, lead, or zinc items
		Remainder/Composite Metal	
7	**Recyclable Glass**	Clear Bottles/Containers	Food containers, beverage bottles
		Brown Bottles/Containers	Soda, beer and wine bottles whole or broken
		Green Bottles/Containers	Beverage bottles

Table 1: City of Sausalito
Waste Categories for Manual Sorting

Category Number	Major Waste Types	Waste Component Categories	Examples
		Other Colored Bottles/Containers	Bottles/containers that are not clear/green/brown
8	**Household Hazardous Waste**	Paint	Latex and oil-based paint, fine art paint
		Vehicle and Equipment Fluids	Antifreeze, brake fluid
		Used Oil	Hydraulic oil, gear oil, transmission oil
		Batteries	Car, flashlight, small appliance, watch batteries
		Remainder/Composite HHW	Pesticides, caustic cleaners, fluorescent bulbs
9	**Other Waste *(Not recoverable)**	Remainder/Composite Paper	Waxed cardboard, aseptic containers
		Film Plastic – Grocery and Other Merchandise Bags	Plastic one time use shopping bags
		Film Plastic – Trash Bags	Plastic garbage bags used to contain trash
		Film Plastic – Non-Bag Commercial and Industrial Packaging Film	Bubble wrap, shrink wrap, mattress bags
		Film Products	Agricultural films, drop cloths,
		Other Film	Chip bags, packaging materials
		Durable Plastic Items	Plastic toys, sporting goods, patio furniture
		Remainder/Composite Plastic	Straws, packing peanuts, foam plates/cups
		Flat Glass	Window panes, flat automotive glass
		Remainder/Composite Glass	Pyrex, mirrors, light bulbs, tableware
		Concrete	Building foundations, concrete paving/blocks
		Asphalt Paving	Black/brown tar-like material used for paving
		Asphalt Roofing	Asphalt shingles, roofing tar, tar paper
		Lumber	Lumber, plywood, particle board, pallets
		Gypsum Board	Gypsum sandwiched between paper layers
		Rock/Soil/Fines	Rocks, soil, sand, stones
		Remainder/Composite Inerts & Others	Bricks, tiles, toilets, sinks
		Ash	Ash from fireplaces and barbeques
		Treated Medical Wastes	Medical wastes, syringes, blood contaminated
		Bulky Items	Furniture, mattresses, box springs
		Tires	Automobile, bike and equipment tires
		Remainder/Composite Special Waste	Auto fluff, pipe insulation
		Mixed Residue	Miscellaneous materials that don't fit any designated categories

The most significant difference between our material categories and the major waste types identified in Exhibit 3 of the SCS final report is that the categories for recyclable materials in our study included only the plastics, paper, metal, and glass that are currently included in the City's

recycling programs. The SCS study included all plastics, paper, metal, and glass that were accepted as recyclable as well as other materials that were not recyclable but could conceivably be if technologies & processing were changed. These included plastic materials such as film plastics, plastic bags, and bubble wrap, and glass such as plate glass and Pyrex®. Our reason for not including non-recyclable plastics, paper, metal, and glass in this study was because the purpose of the study was to determine how well MFD properties were doing at following the programs outlined in informational materials made available to them so we did not want to include materials that are not currently divertible. For this reason, the "Other Waste" category is higher in our study than it was in the SCS study. For ease of comparison, Table 2 below shows the Waste Categories utilized in this study and how they correspond to the Major Waste Types in the SCS study:

Table 2: Comparison of Waste Categories 2017/2013

Envirolutions Waste Category (2017)	SCS Major Waste Types (2013)
Recyclable Paper	Paper
Recyclable Plastic (excluded soft film plastics, bags, etc.)	Plastic
Compostable Organics	Compostable Organics
Non Compostable Organics	Non Compostable Organics
Electronics	Electronics
Recyclable Metal (excluded corded appliance made of metal)	Metal
Recyclable Glass (excluded flat glass, plate glass, Pyrex®, etc.)	Glass
Household Hazardous Waste	Household Hazardous Waste
Other Waste	Inerts & Other, Special Waste, & Mixed Residue combined

DATA ANALYSIS

Data collected during the sorting days was entered into a statistical model that transformed it into a normal distribution for comparative purposes and analysis. The results were calculated to analyze the mean percentages by weight, the standard deviations, as well as the 95% upper and lower confidence intervals for each material category.

The mean represents the mathematical average or average percent of material composing the waste stream by weight. The confidence interval is an expression of accuracy. It provides the upper and lower limits of the "actual" mean for the sampled materials. For example, the 95 percent confidence interval indicates that there is a 95 percent level of confidence that the true mean falls within the upper and lower bounds of the confidence interval. In general, the more samples that are sorted, the narrower the confidence interval becomes for a given reported value. The narrower the intervals, the less variability in the data.

The results are presented below in both tables and charts for ease of comparison to 2013 SCS study.

SUMMARY OF RESULTS
Table 3:

Sample	Paper	Plastics	Comp Org	Ncomp Org	Elec	Metal	Glass	HHW	Other	TOTAL
1	28.85	12.50	122.61	12.85	6.75	2.55	11.5	0.1	60.9	258.61
2	19.00	7.95	104.45	48.4	0.4	4	12.55	2	39.1	237.85
3	30.95	7.85	91.50	22.4	5.6	1.6	11.2	3.5	61.05	235.65
4	28.65	17.95	86.45	31.85	15.25	6.95	22.70	0.15	51.25	261.20
5	19.85	5.25	73.85	25.25	0.00	39.00	10.80	0.00	90.80	264.80
6	55.65	12.95	79.90	27.6	2.8	9.5	20.25	0.25	48.55	257.45
7	40.55	12.00	77.85	37.85	0	6.3	25	0.15	50.55	250.25
8	37.95	15.45	94.40	23.30	4.75	4.90	13.95	1.90	49.35	245.95
9	19.25	10.60	136.60	45.3	1.15	4.35	13.7	0	26.25	257.20
10	24.95	10.50	118.35	46.05	0	2.95	19.1	0	22.05	243.95
11	38.60	14.90	115.05	30.7	2.75	13.6	15.6	0.35	26.2	257.75
12	34.95	10.15	80.10	62.85	0	6.6	12.8	1.15	43.25	251.85
13	28.80	14.60	87.65	37.05	0.25	7.55	10.85	3.3	61.25	251.30
Total	408.00	152.65	1,268.76	451.45	39.70	109.85	200.00	12.85	630.55	3,273.81
%	12.5%	4.7%	38.8%	13.8%	1.2%	3.4%	6.1%	0.4%	19.3%	100.0%

As was found in the waste characterization in 2013, compostable organics still continue to be the most prevalent material in the discard stream at nearly 39% of the waste stream. Though this category was not divvied up more fully, photo analysis shows large amounts of food-soiled and compostable paper, with yard waste being less prevalent. We would anticipate this is because landscaping services working at Sausalito MFD properties are expected to haul out their yard waste. The second most prevalent discard stream was "other waste" at just over 19%. This category includes all the materials that are not easily recoverable and/or are not currently included in the City's residential recycling program. The non-compostable organic category comprised nearly 14% of discards. This is comparable with the results from 2013 when

it was also 14% of the multi-family waste stream. Anecdotally we attribute a large percentage of this to the high incidence of diapers (both baby, adult and pet pads) found in the waste stream, as they were very common and weigh a lot. All of the readily recyclable materials for the recycling bin follow after this, with recyclable paper being by far the most prevalent at over 12%, then glass at 6%, plastic at nearly 5%, and metal at 3%. There was very little incident of either electronic waste or HHW in the trash.
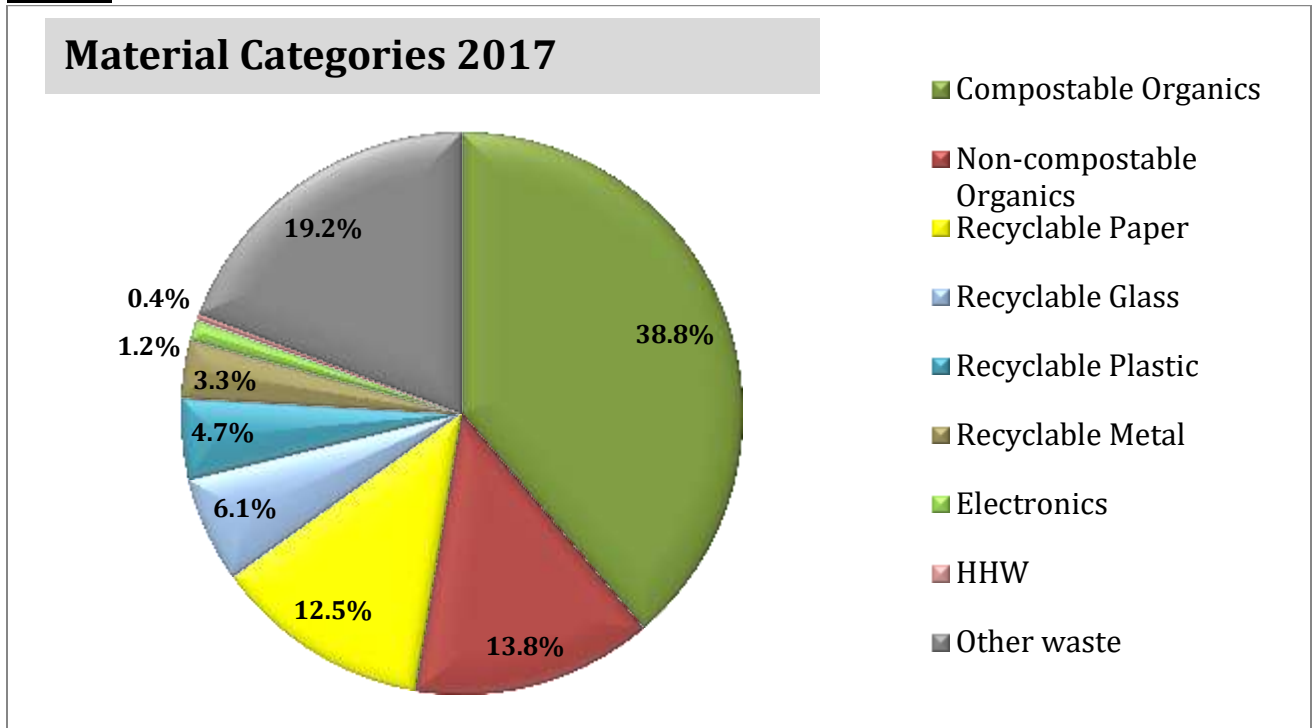
Chart 1:

Table 4:

		95% Confidence Interval		
Material	**Mean (%)**	**Standard Deviation**	**Lower Bound**	**Upper Bound**
Compostable Organics	38.8%	8.0%	34.0%	43.7%
Non-compostable Organics	13.8%	5.5%	10.5%	17.2%
Recyclable Paper	12.5%	4.0%	10.0%	14.9%
Recyclable Glass	6.1%	1.9%	5.0%	7.2%
Recyclable Plastic	4.7%	1.3%	3.8%	5.5%
Recyclable Metal	3.3%	3.6%	1.1%	5.5%
Electronics	1.2%	1.7%	0.2%	2.2%
HHW	0.4%	0.5%	0.1%	0.7%
Other waste	19.2%	7.1%	15.0%	23.5%
TOTAL	100.0%			

When comparing these results to those from 2013, as mentioned previously, the most prevalent material in the waste stream is still compostable organic material - 40.2% in 2013 and 38.8% in 2017, so a slight decrease. When comparing the typical post-consumer recyclable materials, it must be noted that the categories are not exactly the same. As mentioned previously, the SCS study included all plastics, paper, metal, and glass while this study only included the recyclable portion of those categories. The percentage of recyclable paper is down considerably from 2013, from 19.9% to 12.5%. This hopefully indicates more paper recycling is occurring, though it is most likely contributable could indicate less paper use overall.

In 2017 the recyclable plastic made up 4.7% of the waste stream. This is compared to 4.2% from 2013. (The overall plastics in the 2013 study equaled 11%, however when the non-recyclable portion was subtracted, the recyclable portion totaled 4.2 %.) This is consistent with what we see in other waste composition studies – the amount of plastic in the waste stream has been increasing with the upsurge in plastic packaging.

The metals in the multi-family waste stream increased slightly since 2013, from 2.5% to 3.3% and the amount of glass increased from 4.1% to 6.1% (when the non-recyclable glass was removed from the last study results). These slight increases are not considered significant enough to be a trend.

The biggest difference from the 2017 waste characterization to the 2013 waste characterization was in the amount of other waste or mixed residue waste there was. This was calculated as 4.9% in 2013 as compared to 19.2% of the sample in 2017. This increase as stated previously can be primarily attributed to the difference in the definitions of the categories used between the two studies. The 4.9% in 2013 is the total of Mixed Residue(3.6%) , Inerts (0.1%), and Special Waste (1.2%). The 19.2% in 2017 includes not only Mixed Residue, Inerts, and Special Waste, but also the remaining categories not covered in the other 8 categories as shown in Table 1.

In 2013, materials such as plastic film, plastic bags, agricultural films, drop cloths, and polystyrene foam were included in the plastic category. Also metal containing small appliances were included in the metal category and Pyrex, plate glass, and mirrors were included in the glass category. We omitted these materials from our recyclable plastics, metal and glass categories because they are not considered recyclable in the City of Sausalito's recycling program. Therefore if we are measuring the effectiveness at efforts to educate the public about how best to recycle and compost, it did not seem appropriate to include materials as residents were not told to put in either the recycling or the green waste bin. To make the comparison more direct, we adjusted the material categories for 2013 to remove the non-recyclable plastic, glass and paper categories. See the chart and table below.
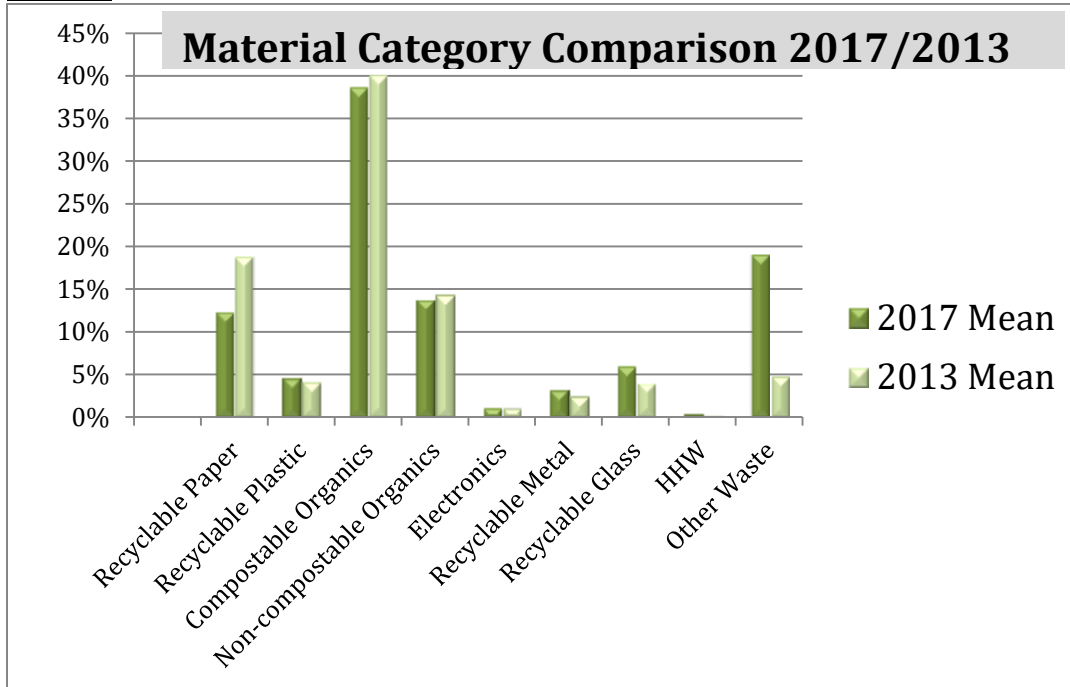
Chart 2:

Material Category Comparison 2017/2013

Table 5:

Material	2017 Mean	2013 Mean	2013 Mean Adjusted*
Compostable Organics	38.8%	40.2%	
Non-compostable Organics	13.8%	14.4%	
Recyclable Paper	12.5%	19.9%	18.9%
Recyclable Plastic	4.7%	11.0%	4.2%
Recyclable Glass	6.1%	5.9%	4.1%
Recyclable Metal	3.3%	2.5%	
Recyclable HHW	0.4%	0.2%	
Electronics	1.2%	1.1%	
Other waste	19.2%	4.9%	
TOTAL	100.0%	100.1%	
*The adjusted means reflect the 2013 recyclable portion of the categories.			

In 2013, the study was able to provide data on the percentage of "potentially recoverable" material that included such materials as plastic film, grocery bags, commercial packaging, textiles, carpet, lumber and tires among others. Because we were not able to divide the waste stream into as many categories with the limited budget, there is limited analysis of "potentially

recoverable" materials such as textiles, ceramics, film, etc. In order to make this comparison, we included the materials described in Exhibit 16 of their final report for non-recoverable materials and potentially recoverable materials to form a category of "Not Currently Divertible" materials. For the 2017 study, we combined the non-compostable organics material with Other waste to form the "Not Currently Divertible" category. For the 2013 study, we added their "potentially recoverable" category to their "non-recoverable" category. The result of this analysis is a slight increase in the amount of non-divertible material in the waste stream, from 29% in 2013 to 33% in 2017.
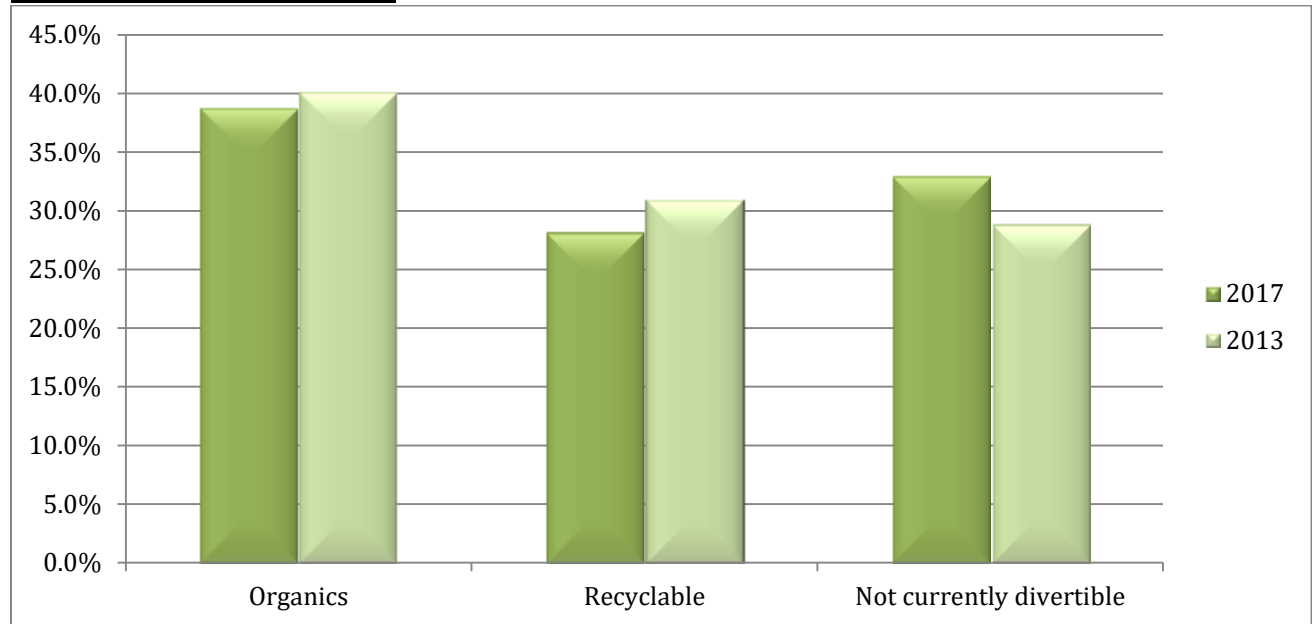
Chart 3: Divertibility Analysis

Table 6:

Divertibility Analysis	2017	2013
Organics	38.8%	40.2%
Recyclable	28.2%	31.0%
Not currently divertible	33.0%	28.9%*

OVERALL RECOMMENDATIONS

It can be ascertained by the results of this study that the percentage of divertible materials still headed to landfill from MFD sites has not decreased as much as we would like in the City of Sausalito. While there are promising trends in the amount of compostable organics and recyclable materials in the landfill, the decreases are not as significant as we would like to see despite years of access to the recycling and green waste bins. And though the percentage of readily divertible materials found in MSW dropped from 71% to 67%, it is still the case that

nearly two-thirds of the materials found in the MSW stream are readily divertible. We make the following recommendations based on this study's findings:

1) Continued Focus on Green Waste with particular emphasis on food-soiled paper
Food waste and food-soiled paper continued to represent the highest percentage of MSW discard stream. Of this category, food was easily as visually prevalent to food-soiled paper, which can be seen in the pictures below. Many residents are still not putting food-soiled paper, tissue paper, and paper towels in the green waste cart, perhaps because they are not aware they should be doing this. Emphasizing this in future marketing or educational material would be advised to address this issue.

2) **Focus on paper recycling**
Though we saw a decrease in the amount of recyclable paper being disposed of, from 18.9% to 12.5%, paper continues to be the most prevalent readily recyclable material being disposed of in the landfill instead of the recycling bin. Because there is no redemption value associated with paper, residents may not see the value or prioritize recycling it. It is recommended to focus future marketing and education efforts on promoting paper recycling and making the case for why this material is important to recycle in a fresh and innovative way.

3) E-waste and HHW not a significant part of the wastestream
It is worth noting that e-waste and HHW combined made up less than half a percent of the wastestream for the MFD sites sampled in the study. This was also true in 2013. It appears residents understand that these materials should not be discarded in the regular trash and are taking the steps to dispose of these items properly. The education and marketing for e-waste and HHW appears to be working.

4) Adding more materials to the recycling program is the only way to reach zero waste
By conducting the waste characterization to only include plastics, metals, glass and paper that are truly recyclable in those categories, it gave us an accurate depiction of how much waste is divertible with the current recycling and green waste programs. Our finding was that 33% of the materials in the wastestream are not currently divertible in the current program. In order to

reach the zero waste goal set forth for 2025, there need to be programs made available and promoted widely for the convenient recycling of items such as plastic film, plastic bags, textiles, carpets, ceramics, and other divertible materials which together represent a significant portion of the wastestream. Ideally at least some of these materials could be included either in or alongside the blue cart on collection day. Streamlining and simplifying the multi-family sector's experience in discarding these materials will result in higher diversion and is the only conceivable way to reach the JPA's zero waste goal by 2025.