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Memorandum

MONTEREY REGIONAL WASTE MANAGEMENT DISTRICT

Reviewed by: [Signature] Date: 10/18/2021
General Manager

DATE: October 15, 2021
TO: General Manager
FROM: Senior Engineer and Director of Engineering & Compliance
SUBJECT: 2021 Single Stream Recycling Characterization Study by SCS Engineers

RECOMMENDATION: That the Board receive the 2021 Single Stream Recycling Characterization Study Report prepared by SCS Engineers.

BACKGROUND

At their May 21, 2021 regular meeting, the Board authorized staff to engage SCS Engineers to conduct the fourth annual Characterization Study of the Single Stream Recyclables (SSR) materials delivered to MRWMD's Material Recovery Facility (MRF). This study was successfully conducted during the months of July and August and yielded a weighted average contamination rate of 28% for all SSR being delivered to MRWMD.

DISCUSSION

The 2021 Single Stream Recycling Characterization Study was successfully conducted during the months of July and August and yielded a weighted average contamination rate of 28% for all SSR being delivered to MRWMD.

District staff worked with SCS to determine the statistically significant sample ratio separately for each jurisdiction delivering SSR to MRWMD. The District also worked with the collection companies (aka "haulers") to determine the pick-up schedule and routes for each jurisdiction.

On each day of the study, scale staff directed the selected number of trucks to the sort area as defined by the sampling requirements for each jurisdiction. SCS Engineers then pulled randomly selected samples from the chosen load and prepared them for processing.

The manual recycling characterization procedure used was based on ASTM procedure D 5231-92 which is consistent with the California statutory requirements in Public Resources Code 41030, et. Seq. and regulatory requirements of CalRecycle for performing recycling characterization studies. The 150-pound sample was placed on a sorting table and separated by hand into pre-determined material types (See "Category Table" on page 2). Each material type was weighed, and the composition of the sample was documented.

Residue material, which is material that does not fit into the pre-determined categories listed below, was characterized visually.

RESULTS

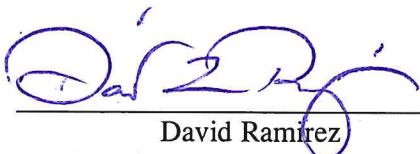
Results for the 2021 SSR composition study are included in the report. On average, the results show that 72% of the SSR being delivered to MRWMD is recyclable and 28% is not recyclable and deemed as “contamination”.

Category Table

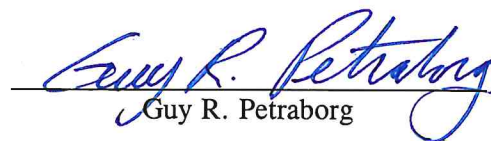
Recyclables	Waste Component Categories
	Uncoated Corrugated Cardboard
	Mixed Paper
	White Office Paper
	Paper Board
	ONP
	PET
	PET Thermoform
	Natural HDPE
	Pigment HDPE
	Polypropylene #5
	Rigid Plastic
	Mixed Plastic #3, 4, 6, 7
	Film Plastic
	Mixed Glass
	Bi Metal
Aluminum	
Aluminum Other	
Organics	Organic
Contamination	HHW
	Batteries
	Medical Waste
	Manufactured Products
	Polystyrene
	Aseptic lined containers
	Refuse

CONCLUSION

The results of the study to characterize the materials in the recycling stream received at the District’s MRF have multiple benefits of informing the MRF operations, informing improvements in the public outreach of recycling programs, reducing contamination in the recycling stream, and improving the quality of the bales of recyclable materials. Staff designs outreach and operational adjustments to take advantage of the information collected. Therefore, it is recommended that the Board receive the 2021 Single Stream Recycling Characterization Study Report prepared by SCS Engineers.



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2021 Recycling Characterization Study

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1.0 INTRODUCTION

The Monterey Regional Waste Management District (MRWMD or District) retained SCS Engineers (SCS) to conduct physical characterizations of the commercial and residential single-stream recycling (SSR) materials hauled to the District’s Materials Recycling Facility (MRF) by GreenWaste Recovery, Monterey Disposal, Waste Management, Republic Services, City of Watsonville Public Works, and Recology. The project’s goals are to understand the types of recyclable materials present, their relative presence, and the level of non-recyclable materials (referred to herein as “contamination” or “residual materials”) delivered to the MRF by each of the franchised haulers for each of the municipalities they service. This characterization provides data to inform stakeholders of the composition and contamination rates of the SSR. It will also inform outreach staff regarding the contaminants to be targeted for behavior change and outreach efforts.

Exhibit 1. Haulers and the Municipalities they Serve

Hauler	Municipality Served
Greenwaste Recovery	Marina
	Sand City
	Del Rey Oaks
	Seaside
	Carmel by the Sea
	Pebble Beach
	Pacific Grove
Monterey City Disposal	City of Monterey
Waste Management	Unincorporated Monterey County
	King City
Republic Services	Salinas
City of Watsonville Public Works Department	Watsonville
Recology	San Benito County

2.0 METHODS

This section summarizes methods used to characterize the recycling stream generated from the cities of Marina, Sand City, Del Rey Oaks, Seaside, Carmel by the Sea, Pebble Beach, Pacific Grove, Monterey, King City, Salinas, and Watsonville; and portions of both San Benito County and Unincorporated Monterey County. Sampling and sorting activities for the study took place during the months of July and August 2021. Characterization activities involved manually sorting single stream recycling samples into 25 pre-determined material categories over two two-week periods (four weeks total). Data were recorded on the Manual Data Sorting Form for each sample, presented in **Exhibit 2**. Examples for each of the material types are included on the Sorting Form.

2.1 SELECTING THE SAMPLES TO BE SORTED

Efforts were made to minimize sampling bias or other impacts consistent with good practice in such sampling programs. To this end, field sampling was coordinated to avoid holidays and other out of the ordinary events. SCS reviewed average monthly quantities of recyclables delivered to MRWMD by hauler and by municipality to estimate the number of samples required. Using data from the recycling composition studies completed in 2018, 2019, and 2020, SCS estimated the number of

samples needed from each municipality in order to obtain an estimate of the composition of materials delivered with statistically representative accuracy and precision.

The SCS Sampling and Sorting Supervisor communicated with the scale house to direct the targeted load to the sorting location. Once the targeted recyclables collection vehicle was deemed suitable for sampling and sorting, the SCS field staff professional directed the driver to a pre-arranged area at the MRF for load discharge. The pile was divided into an imaginary eight-section grid and a sample of materials weighing approximately 150 pounds was extracted from a randomly selected section of the discharged load. This sample was then transported to the sorting area.

2.2 CHARACTERIZATION PROCEDURES

2.2.1 Manual Characterization Procedures

SCS provided two Sampling and Sorting Supervisors and five contracted sorters to manually sort each of the samples. The manual recycling characterization procedure is based on American Society for Testing and Materials (ASTM) procedure D 5231-92 and consistent with California statutory requirements contained in Public Resources Code 41030, et. seq. and regulatory requirements of CalRecycle for performing recycling characterization studies. The sample was placed on a sorting table and separated by hand into the pre-determined material types as listed in **Exhibit 2**.

Separated materials were placed in containers and weighed and recorded. Members of the sorting crew were assigned material categories on which to focus. The recycling samples were sorted until no more than a small amount of homogeneous fine material (“Refuse”) remained, which was determined by the SCS Sampling and Sorting Field Supervisor. The overall goal was to sort each sample directly into the material categories in order to reduce the amount of indistinguishable fines or miscellaneous categories.

For each sample, the SCS Sampling and Sorting Field Supervisor reviewed the sorted material for homogeneity before the containers were weighed using a pre-calibrated scale and recorded the weights for each sorted material category on the sampling form.

When household hazardous materials were discovered during the sorting process, they were weighed and then set aside for proper handling.

2.2.2 Visual Characterization Procedure

Once the entire sample was sorted into the defined material categories, the residual of the sorted stream was emptied onto the sorting table and separated for viewing. SCS performed a visual characterization by splitting the refuse into sections then estimated the percentage of notable materials by volume percentage and recorded the data on the data form. For example, if after reviewing the entire sample there appeared to be a significant number of textiles or multi-layered products, those percentages were noted. The objective was to identify large amounts of contaminants (e.g., the predominance of contaminant type(s)) that will help inform the MRWMD and the franchise collection companies (aka “haulers”) on appropriate outreach efforts and changes to the recycling program.

Exhibit 2. Manual Sorting Data Form

MRWMD Recycling Characterization Study					
Date:		M T W TH F		Time:	
Sample #:		Route:		Source:	
Major Waste Fractions	Waste Component Categories	Examples	WEIGHT (In Pounds)		
			Gross Wt.	Tare	Net Wt.
Recyclables	Uncoated Corrugated Cardboard	Non-waxed shipping/moving boxes, 3-layers, no food residue			
	White Office Paper	White paper			
	Mixed Paper	office paper, computer paper, paper bags, phone books, magazines and catalogs, food/detergent boxes, office mix, junk mail			
	Paper Board	Thick paper-based material, cereal box, supply box			
	ONP	Old newspaper			
	PET	CRV containers, soda and water bottles			
	PET Thermoform	Clamshells, cups, tubs, lids, boxes, trays, egg cartons and similar rigid, non-bottle packaging made of PET (#1) plastic resin			
	Natural HDPE	Milk jugs, small juice bottles			
	Pigment HDPE	Detergent bottles, some hair-care bottles, some margarine and yogurt tubs, clamshell packaging, empty motor oil, empty antifreeze, and other empty vehicle and equipment fluid containers			
	Polypropylene #5	Food containers (ketchup, yogurt, cottage cheese, margarine, syrup, take-out), medicine containers, straws, bottle caps, Britta filters, Rubbermaid and other opaque plastic containers, including baby bottles			
	Rigid Plastic	Tubs, buckets, toys			
	Mixed Plastic #3, 4, 6, 7	Detergent/cleaning product bottles, personal care bottles, food containers, yogurt cups, syrup bottles, microwave trays, clamshell-shaped fast food containers, vitamin bottles			
	Film Plastic	Shrink-wrap, mattress bags, furniture wrap, and film bubble wrap, plastic shopping bags, dry cleaning bags, agricultural film			
	Mixed Glass	All glass bottles and jars (mayonnaise, apple juice bottles, wine bottles, etc.), CA redemption bottles (beer, juice, wine coolers, etc.)			
	Bi Metal	Steel/tin food and beverage cans, and foil food trays			
Aluminum	Aluminum beverage cans				
Aluminum other	Aluminum food cans (e.g., cat food cans), foil				
Organics	Organic	Food Waste, food soiled paper, green waste, landscaping			
Other	HHW	Paint, vehicle and equipment fluid, used oil, batteries, mercury containing items, fluorescent lights			
	Batteries	Household battereries, watch battereis.			
	Medical Waste	Sharps, bandages, items containing bodily fluids			
	Manufactured Products	Electronic waste, items with cord, brown goods, white goods			
	Polystyrene	Styrofoam clam shells, Styrofoam packaging			
	Aseptic lined containers	Soup containers, soy containers			
	Refuse	Anything else that does not fit in the above category			
Comments:					

This procedure involved four steps:

1. Estimating the volume of refuse;
2. Recording the estimated percentage of the residuals corresponding to each material class, and then record the estimated percentage for specific material types within the material classes;
3. Reconciling the percentages to be 100; and
4. Recording the weight of the entire load.

Data gathered from fieldwork were summarized to develop the composition of collected recyclables from each geographic area and each franchised hauler. The composition of materials delivered to the MRWMD MRF from each municipality is discussed in subsections below.

Contamination of source-separated recyclables that are delivered to the MRWMD MRF includes materials that typically do not have a market for recycling and which must be disposed in a landfill. Contaminants were initially classified into the following types of materials:

- Film Plastic
- Organics
- HHW
- Batteries
- Medical Waste
- Manufactured Products
- Polystyrene
- Aseptic Lined Containers
- Refuse

At the end of sorting each sample, the field crew emptied materials in the Refuse category onto the sorting table and visually characterized the items into the subcategories defined in **Exhibit 3**.

The true proportion of contamination is estimated by the average of the individual samples. The 90% confidence interval contains the true proportion of contamination with 90% probability. The length of the confidence interval is based on sample-to-sample variability and the number of samples. For example, if the average sampled contamination is 20 percent and the associated 90% confidence interval is calculated to be plus/minus five percent, there is a 90% probability that the true proportion of contamination is between 15 and 25 percent of material delivered (20 percent +/- five percent). If the sampled municipality delivers 100 tons of source separated recyclables each month, the quantity of contamination is estimated to be 20 tons (20 percent of 100 tons per month) with a 90% probability of being between 15 and 25 tons per month.

The goal of the project was to minimize the length of the 90% confidence interval. Since the individual municipalities delivered between 10 and 1,600 tons of source-separated recyclables each month, the number of samples was proportional to the monthly tonnage delivered by each municipality and varied between five and 50 samples.

Exhibit 3. Visual Characterization of Refuse

Potentially Recyclable	Contaminated Recyclable	Recyclable paper, plastic, or metal that is contaminated with food or other debris
	Glass	Glass bottles and jars that are contaminated with food or other materials.
Organics	Green waste	Leaves, grass, plants, pruning, trimmings, branches, stumps
	Food waste	Food, meat, fruit, egg shells, etc. Containerized liquids.
	Compostable paper	Paper contaminated with food / wax / moisture, waxed OCC, napkins, paper towels, paper plates, tissues
	Organic debris (less than 3")	Mix of green waste, food, and or compostable paper with dimensions less than 3 inches
	Clean wood	Clean and untreated wood and dimensional lumber including plywood and shingles. NO paint or preservative treatment
	Pallets	Untreated and treated wood pallets
Inerts	Crushable Inerts	Includes rock, brick, Portland-cement concrete, asphaltic-cement concrete, tile, and ceramics
	Gypsum Boards	Gypsum-based wallboard including board for use in the drywall or plaster trades.
	Treated Wood Waste	Any wood with paint or preservative treatment including particleboard
Elec-tronics	Brown Goods / White Goods	White Goods - Discarded, enamel-coated major appliances, such as washing machines and refrigerator. Brown Goods - Electronically powered household products fabricated from metals and plastics, includes hair dryers, toasters, and other common house electronics.
	Computer-Related Electronics	Processors, keyboards, printers, fax machines, mice, disk drives, and modems
	Other Small Consumer	Cell phones, phone systems, phone answering machines, computer games and other electronic toys, portable CD players, camcorders, digital cameras
HHW	Paints/Adhesives & Vehicle Fluids	Containers with a measurable amount of liquid, including used oil filters. NO dried paint, NO empty paint/aerosol containers.
	Universal Hazardous Waste	Common hazardous waste materials including, fluorescent light bulbs, mercury containing devices, and non-empty aerosol cans that contain hazardous materials.
	Medical Waste	Treated medical waste that has been sanitized prior to disposal or untreated medical waste such as sharps, surgical instruments, and bloody bandages. Includes Medicine in either pill or liquid form.
	Other Hazardous Waste	Hazardous waste not described above including household cleaners and chemicals, detergents, fire extinguishers, pesticides, and herbicides.
Other	Textiles / Leather	Fabric materials from natural and man-made fibers including clothing, rugs, curtains, leather such as belts and wallets, and shoes.
	Carpet	Carpets made from natural and man-made materials. Includes carpet padding.
	Poly-coated paper	Paper or paperboard with a plastic layer or treatment on the surface often used in food and drink packaging
	Polystyrene	Platic often used for are: disposable cutlery, plastic models, CD's & DVD cases, and smoke detector housings. Styrofoam.
	Tires	Tires from trucks, automobiles, motorcycles, heavy equipment, lawn mowers, and bicycles
	Other	Material not identified above.

2.2.3 Changes to Procedures of Prior Studies

Field procedures for the most part were identical for each of the studies conducted in 2018, 2019, 2020, and 2021. Procedures that changed in 2020 and 2021 include:

- **Waxed Cartons Classified with Aseptic Lined Containers:** Waxed cartons were sorted and classified as recyclable in 2018 and 2019; however, waxed cartons were included with Aseptic Lined Containers in the 2020 and 2021 studies.
- **Batteries Separated:** Batteries were included with non-recyclable HHW in 2018 and 2019; however, batteries were separated for the 2020 and 2021 studies.
- **Increased Communication with Haulers:** Sampling targets were established before initiating fieldwork and were based on the desired statistical precision and quantity of material delivered by hauler and city. In 2018, vehicles were selected for sampling upon arrival to the MRWMD MRF and after the driver was interviewed to confirm the origin of materials in the load. In 2019, we used both driver interviews and discussions with haulers to select appropriate loads for sampling. In 2020, due to safety concerns for the coronavirus, drivers were not interviewed and trucks were targeted based on coordination with hauler representatives. Communication for the 2021 study was similar to that in 2019.
- **Additional Visual Characterization Categories:** An expanded list of materials was used to visually characterize the materials in SSR that were classified as refuse. Material types included in the 2020 and 2021 studies that were not used for visually characterizing refuse in 2019 include:
 - **Organics:** Green Waste, Food Waste, Compostable Paper, Organic Debris less than three inches, Clean Wood, Treated Wood, and Pallets.
 - **Inerts:** Crushable Inerts and Gypsum Boards
 - **Electronics:** Brown/White Goods, Computer-Related Electronics, and Other Small Consumer Electronics
 - **HHW:** Paints/Adhesives/Vehicle Fluids, Universal Hazardous Waste, Medical Waste, and Other Hazardous Waste
 - **Other:** Carpet, Polystyrene, Tires

3.0 RESULTS

3.1 STUDYWIDE

Overall, the MRWMD MRF receives about 4,700 tons of source-separated recyclables each month from six haulers delivering material from 13 municipalities. On average, 27.8 percent (1,311 tons) of this material is contamination. The City of Salinas delivers the most material to the MRWMD MRF and also has the highest proportion of contamination (33.2 percent of material delivered) which equates to about 531 tons per month. There is a 90% probability that the true quantity of contamination delivered from Salinas is between 481 and 581 tons each month. In contrast, about 15.4 percent of the recyclables delivered from City of Monterey are contamination; however, since Monterey Disposal delivers only one-ninth of their monthly quantity of recyclables to the MRWMD MRF, their 27 tons of contamination has a lesser impact.

Exhibit 4 presents the results of a four-week field effort that collected and manually characterized 200 samples of source-separated recyclables from residential and commercial sources delivered to the MRWMD MRF.

Exhibit 4. Summary of Contamination Delivered to MRWMD Per Month

Hauler (City)	Tons/ Month	No of Samples	Contamination			
			Proportion		Monthly Tons	
			Average	90% Confidence	Average	90% Confidence
Greenwaste Recovery	905	60	27.8%	+/- 1.5%	252	+/- 13
Marina	170	10	30.0%	+/- 6.3%	51	+/- 11
Sand City	10	5	28.4%	+/- 4.5%	3	+/- 0.5
Del Rey Oaks	25	5	17.1%	+/- 7.9%	4	+/- 2
Seaside	265	10	32.2%	+/- 4.4%	85	+/- 12
Carmel by the Sea	150	10	22.9%	+/- 6.5%	34	+/- 10
Pebble Beach	110	10	25.3%	+/- 5.9%	28	+/- 6
Pacific Grove	175	10	20.7%	+/- 6.3%	36	+/- 11
Monterey Disposal	175	10	15.4%	+/- 3.6%	27	+/- 6
City of Monterey	175	10	15.4%	+/- 3.6%	27	+/- 6
Waste Management	1,500	50	27.7%	+/- 2.9%	416	+/- 44
Unincorporated Monterey County	1,350	40	29.8%	+/- 3.0%	402	+/- 41
King City	150	10	19.5%	+/- 7.2%	29	+/- 11
Republic Services	1,600	50	33.2%	+/- 3.2%	531	+/- 50
Salinas	1,600	50	33.2%	+/- 3.2%	531	+/- 50
City of Watsonville (Public Works Dept.)	120	10	27.4%	+/- 7.6%	33	+/- 9
City of Watsonville	120	10	27.4%	+/- 7.6%	33	+/- 9
Recology	416	20	27.5%	+/- 4.1%	114	+/- 17
San Benito County	416	20	27.5%	+/- 4.1%	114	+/- 17
IN DISTRICT	2,430	110	26.2%	+/- 1.9%	637	+/- 45
OUT OF DISTRICT	2,286	90	29.8%	+/- 2.4%	680	+/- 54
Total	4,716	200	27.8%	+/- 1.5%	1,311	+/- 70

Note: Monterey Disposal does not usually deliver SSR to the MRWMD MRF. While it is estimated that material delivered by Monterey Disposal contributes 34 tons per month of contamination, only about one-ninth of that quantity is delivered to the MRWMD MRF.

3.1.1 Comparison to Previous Years' Results by Hauler

Exhibit 5 presents the average and associated confidence intervals for the proportion of contamination delivered by each hauler. The bold yellow horizontal line identifies the maximum desired level of contamination for a municipal recycling program of 10 percent. With the exception of Monterey (served by Monterey City Disposal), the SSR materials for every other municipality (served by other haulers) exceeds 20 percent contamination in 2021 with statistical confidence.

Exhibit 5. Average Proportion of Contamination and Associated 90% Confidence Intervals by Hauler: 2018 - 2021

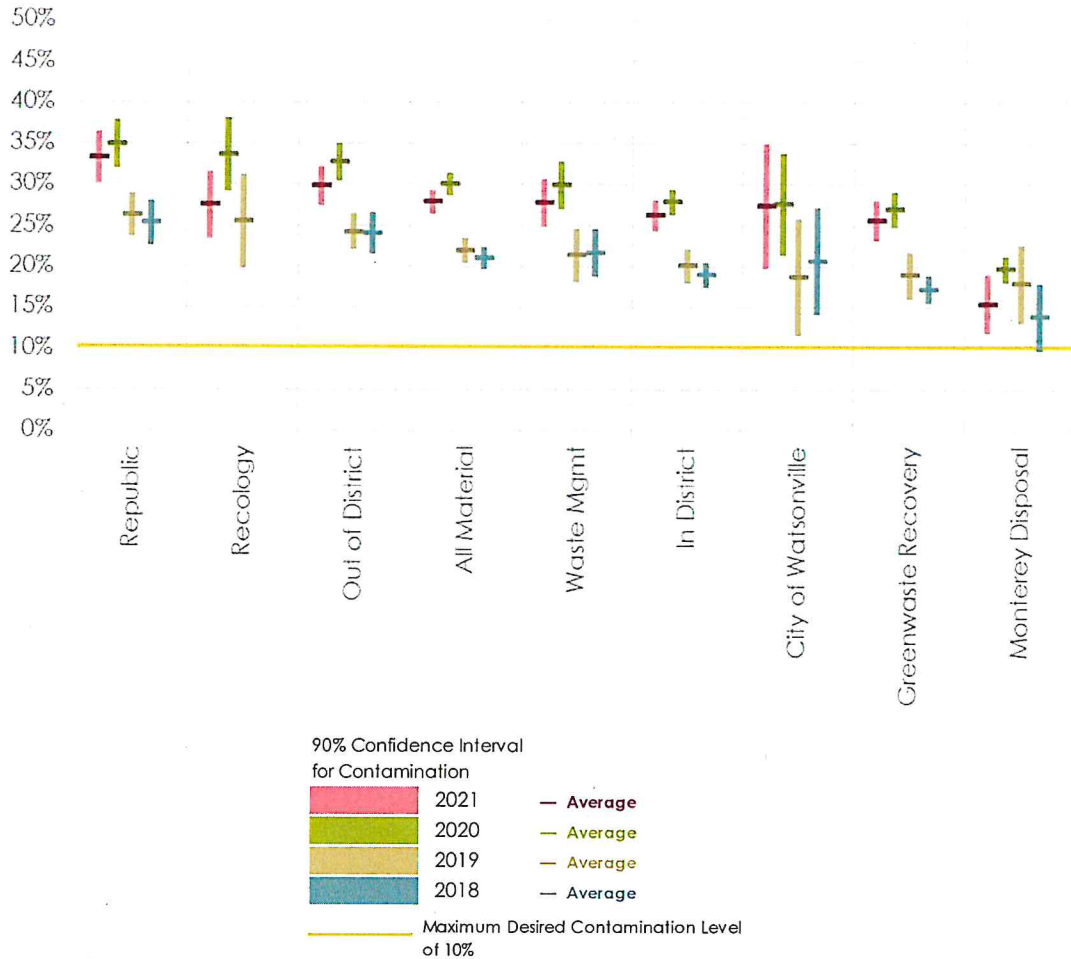
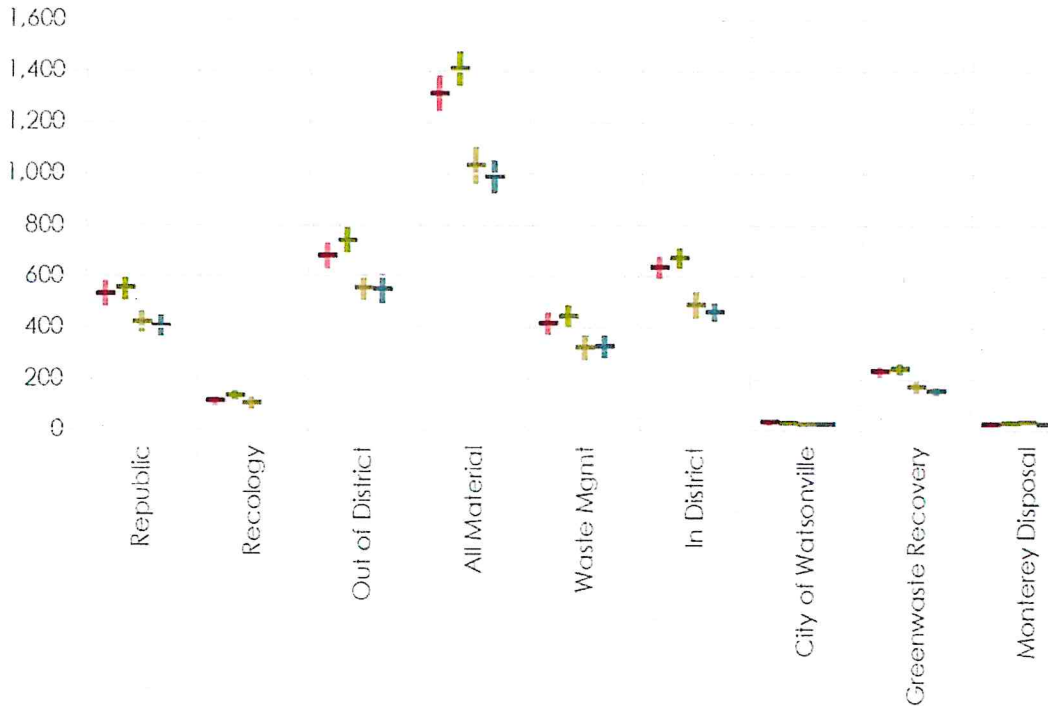
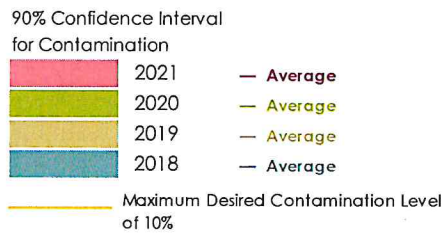


Exhibit 6 presents the average monthly tons and associated 90% confidence intervals for each hauler. Since the municipalities served by Republic and Waste Management bring in substantially more SSR materials each month, the effect of high contamination has a greater impact on the MRF processing activities than small tonnage sources.

Exhibit 6. Average Monthly Tons of Contamination and Associated 90% Confidence Intervals by Hauler: 2018 - 2021



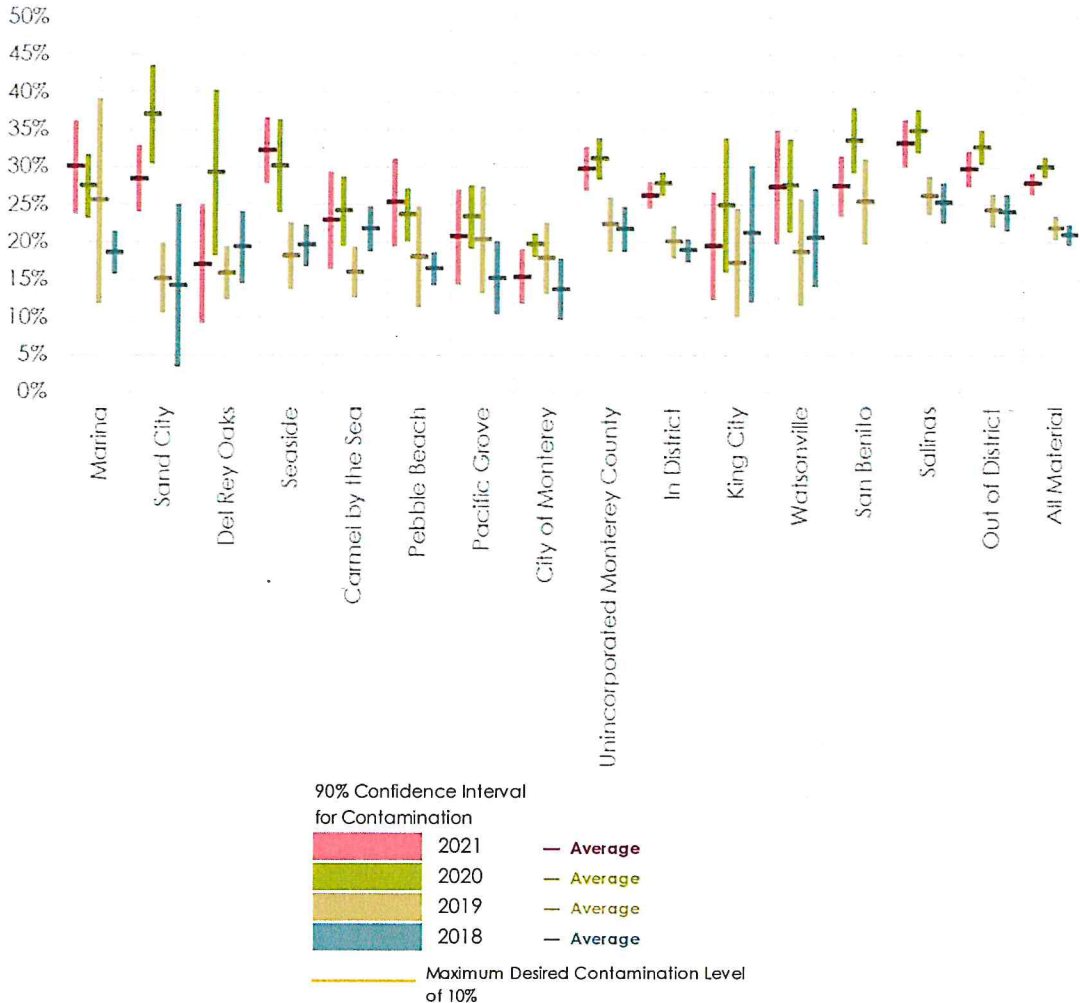
Note: Monterey Disposal does not usually deliver SSR to the MRWMD MRF. While it is estimated that material delivered by Monterey Disposal contributes 34 tons per month of contamination, only about one-ninth of that quantity is delivered to the MRWMD MRF.



3.1.2 Comparison to Previous Years' Results by Municipality

As presented in **Exhibit 7**, every municipality, with the exception of the City of Monterey, likely have contamination that exceeds 20 percent of the total materials delivered to the MRWMD MRF. All locations have significantly more than the 10 percent maximum level of contamination desired in a municipal recycling program.

Exhibit 7. Average Proportion of Contamination and Associated 90% Confidence Intervals by Municipality: 2018 - 2021



3.1.3 Comparison to Previous Years' Results by Composition of Materials

Exhibit 8 presents the composition of incoming SSR (overall including all cities and haulers) for the past four yearly studies. In general, most materials have similar proportions from year to year with the exception of Uncoated Corrugated Cardboard, Mixed Glass and Refuse. Uncoated Corrugated Cardboard increased to 32 percent of incoming SSR in 2021; previous years have averaged between 25.4 and 28.1 percent. Mixed Glass has declined to 9.6 of incoming SSR in 2021; previous years have averaged between 11.0 and 20.3 percent. Refuse in 2021 was 17.1 percent of SSR which is a decrease from 2020 where it was 20.8 percent of SSR; in 2018 and 2019 refuse was 10.6 and 14.2 percent respectively.

Exhibit 8. Detailed Recycling Composition by Year

ALL MATERIAL BY YEAR					
Category	Material Type	Composition			
		2021	2020	2019	2018
Paper	Uncoated Corrugated Cardboard	32.8%	25.4%	27.4%	28.1%
	White Office Paper	1.8%	2.8%	0.8%	3.9%
	Mixed Paper	9.5%	10.2%	10.8%	8.2%
	Paper Board	4.5%	4.9%	3.2%	5.5%
	Old Newspaper	2.2%	2.4%	1.9%	3.8%
	Waxed Cartons	*	*	0.1%	0.3%
Plastic	PET	1.7%	2.1%	1.8%	2.0%
	PET Thermoform	1.1%	1.2%	1.0%	1.8%
	Natural HDPE	0.9%	1.1%	0.9%	1.2%
	Pigment HDPE	1.2%	1.7%	1.1%	1.4%
	Polypropylene #5	0.6%	0.9%	0.6%	0.9%
	Mixed Plastic #3, 4, 6, 7	0.5%	0.4%	0.3%	0.7%
	Rigid Plastic	1.9%	1.5%	3.4%	1.7%
	Film Plastic	2.3%	2.6%	1.6%	2.9%
Glass	Mixed Glass	9.6%	11.0%	20.3%	15.8%
Metal	Bi Metal	3.4%	3.3%	3.7%	3.4%
	Aluminum	0.5%	0.7%	0.4%	0.4%
	Aluminum - Other	0.2%	0.4%	0.3%	0.3%
Organics	Organics	4.9%	3.1%	3.2%	4.8%
Other	HHW	0.3%	0.5%	0.2%	0.3%
	Batteries	0.0%	0.0%	*	*
	Medical Waste	0.9%	0.4%	0.1%	0.0%
	Manufactured Products	1.9%	2.0%	2.2%	1.3%
	Polystyrene	0.1%	0.2%	0.1%	0.3%
	Aseptic Lined Containers	0.4%	0.5%	0.2%	0.2%
	Refuse	17.1%	20.8%	14.2%	10.6%
Total		100.0%	100.0%	100.0%	100.0%
Contamination (noted in grey shading above)		27.8%	30.0%	21.9%	21.0%

* Waxed cartons are included with Refuse in 2020 & 2021.

* Batteries are included with Refuse in 2019 and 2018.

Exhibits 9 and 10 present the proportion of recyclable materials and contaminants, respectively.

Exhibit 9. Average Proportion of Recyclable Materials in SSR and Associated 90% Confidence Intervals: 2018 - 2021

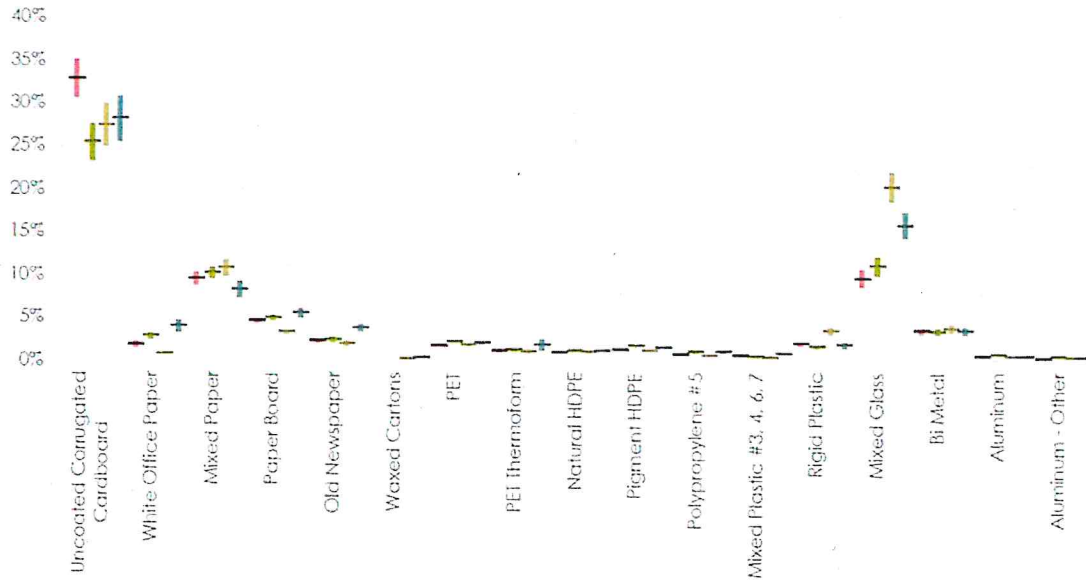
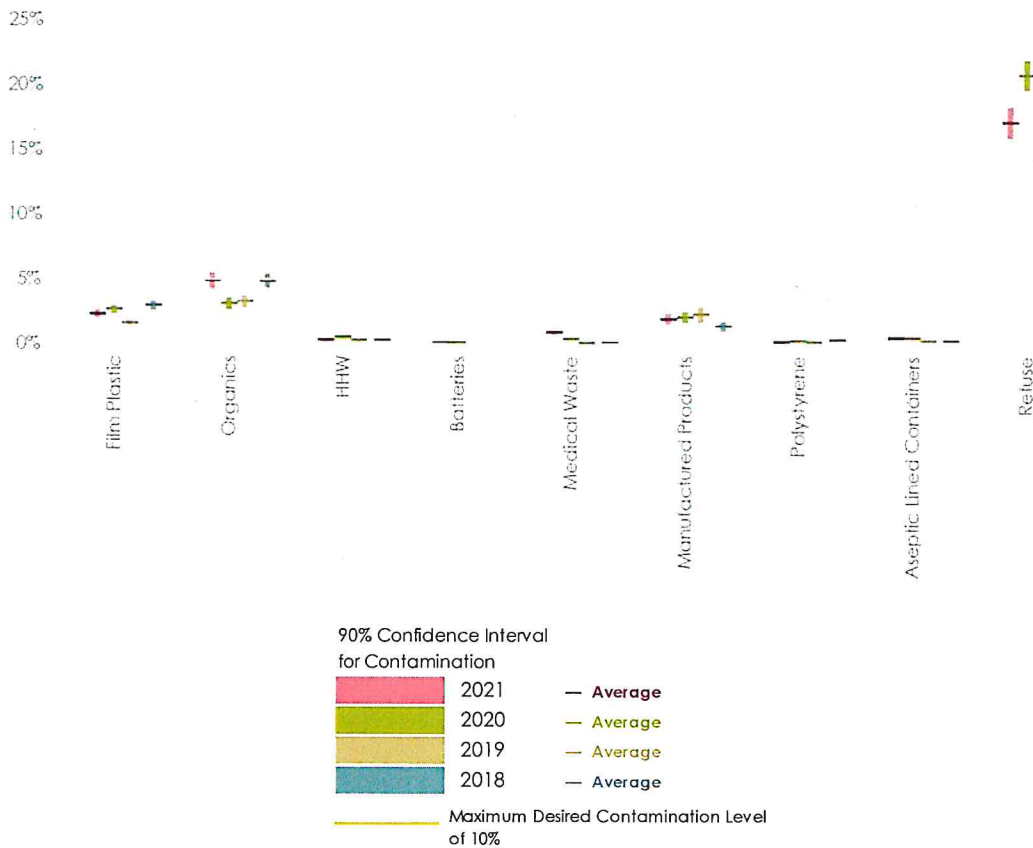


Exhibit 10. Average Proportion of Contaminants in SSR and Associated 90% Confidence Intervals: 2018 - 2021



90% Confidence Interval for Contamination

	2021	— Average
	2020	— Average
	2019	— Average
	2018	— Average

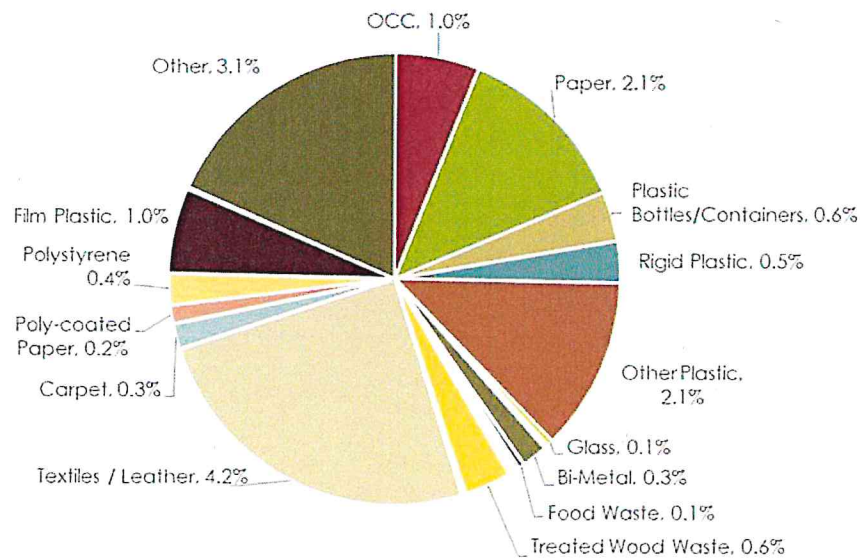
— Maximum Desired Contamination Level of 10%

3.1.4 Visual Characterization of Refuse in SSR

After sorting each sample into the material categories identified in **Exhibit 2**, materials in the Refuse category were spread on a tarp and visually characterized by volume into the material types identified in **Exhibit 3**. While this method does not provide statistically reliable results, it does provide information on the types of refuse materials that are in the SSR delivered to the MRWMD MRF. Recyclable materials that are classified as Refuse are dirty, soiled, wet, or contain food and or liquids.

Exhibit 11 presents the average volume of Refuse materials in the 200 SSR samples. Refuse materials comprise 17.1 percent of SSR in 2021. The largest component of Refuse materials are Textiles/Leather at 4.2 percent followed by Other materials (unclassified) at 3.1, Paper and Other Plastic, each representing 2.1 percent of SSR.

Exhibit 11. Average Composition of Refuse Materials in SSR



3.2 HAULER: GREENWASTE

Greenwaste Recovery is the franchise hauler for Carmel by the Sea, Del Rey Oaks, Pacific Grove, Pebble Beach, Sand City and Seaside. In total, SCS completed 60 recycling stream samples from the cities that Greenwaste Recovery services. Of the material sampled, 73 percent is Recyclable and 27 percent is Contamination as shown in Exhibit 12.

Exhibit 12. Detailed Recycling Composition of Loads Hauled by Greenwaste

Greenwaste					
Category	Material Type	Average Composition	Monthly Tons (90% Confidence)		
			Low	Average	High
Paper	Uncoated Corrugated Cardboard	25.9%	203	234	266
	White Office Paper	2.2%	12	20	28
	Mixed Paper	12.5%	99	113	127
	Paper Board	4.8%	39	43	47
	Old Newspaper	3.7%	27	33	39
Plastic	PET	2.1%	18	19	21
	PET Thermoform	0.9%	7	8	9
	Natural HDPE	0.5%	4	5	5
	Pigment HDPE	0.9%	7	8	9
	Polypropylene #5	0.7%	5	6	7
	Mixed Plastic #3, 4, 6, 7	0.4%	3	4	4
	Rigid Plastic	1.1%	7	10	12
	Film Plastic	1.8%	14	16	18
Glass	Mixed Glass	14.8%	112	134	156
Metal	Bi Metal	3.0%	22	27	32
	Aluminum	0.7%	6	7	7
	Aluminum - Other	0.2%	1	2	3
Organics	Organics	4.3%	29	39	48
Other	HHW	0.4%	<0.5	4	7
	Batteries	0.0%	<0.5	0	0
	Medical Waste	0.6%	4	6	7
	Manufactured Products	1.6%	7	15	22
	Polystyrene	0.1%	1	1	1
	Aseptic Lined Containers	0.5%	4	4	5
	Refuse	16.4%	129	148	167
Total		100.0%		905	
Contamination (noted in grey shading above)		25.6%	210	232	254

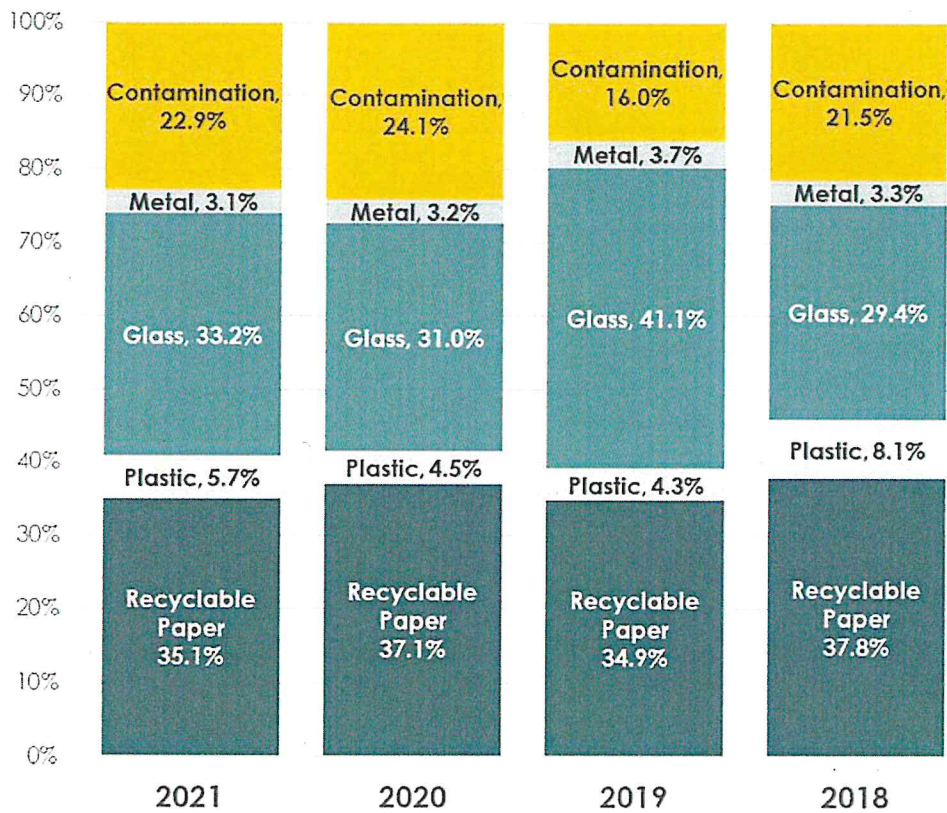
The following section examines the recycling composition per municipality that Greenwaste Recovery services. Results are compared to similar studies performed in the summers of 2018, 2019, and 2020.

3.2.1 Carmel By the Sea (Carmel)

Recycling Composition

The composition of Carmel’s recycling stream by category is presented in **Exhibit 13**. Based on the samples collected, the most prevalent material category by percentage is Recyclable Paper, representing 35.1 percent of the overall recycling stream. Recyclable Glass represents 33.2 percent of the overall recycling stream, and Contamination represents 22.9 percent, which is a slight decrease from the 2020 study.

Exhibit 13. Composition of Recyclable Loads from Carmel, 2018 to 2021



A detailed breakdown of Carmel By The Sea’s recycling stream by material type and associated monthly tonnage is presented in **Exhibit 14**.

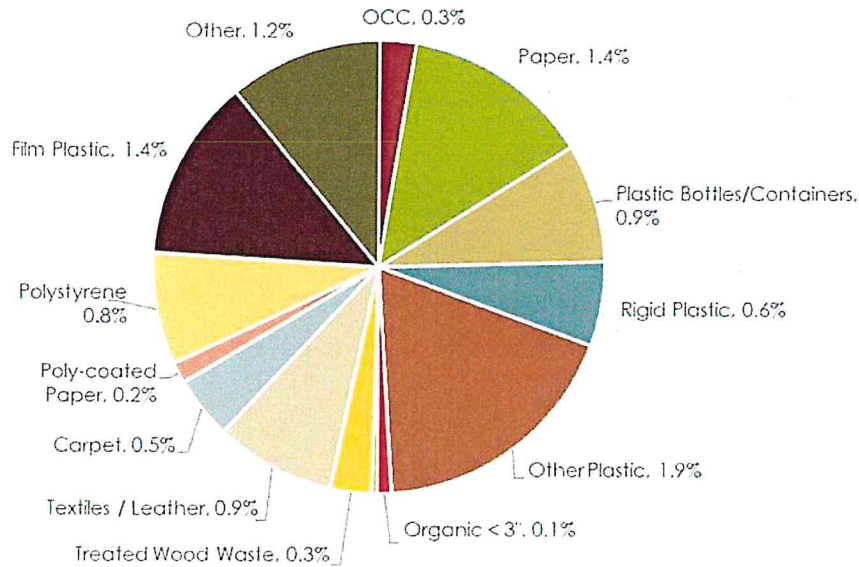
Exhibit 14. Detailed Recycling Composition from Carmel

CARMEL BY THE SEA					
Category	Material Type	Average Composition	Monthly Tons (90% Confidence)		
			Low	Average	High
Paper	Uncoated Corrugated Cardboard	10.8%	14	16	18
	White Office Paper	1.6%	2	2	3
	Mixed Paper	12.6%	17	19	21
	Paper Board	5.6%	8	8	9
	Old Newspaper	4.6%	6	7	8
Plastic	PET	2.5%	3	4	4
	PET Thermoform	0.9%	1	1	1
	Natural HDPE	0.4%	<0.5	1	1
	Pigment HDPE	0.9%	1	1	1
	Polypropylene #5	0.7%	1	1	1
	Mixed Plastic #3, 4, 6, 7	0.4%	<0.5	1	1
	Rigid Plastic	0.1%	<0.5	0	0
	Film Plastic	1.9%	3	3	3
Glass	Mixed Glass	33.2%	47	50	53
Metal	Bi Metal	2.1%	3	3	4
	Aluminum	0.8%	1	1	1
	Aluminum - Other	0.1%	<0.5	0	0
Organics	Organics	8.5%	10	13	16
Other	HHW	0.0%	<0.5	0	0
	Batteries	0.1%	<0.5	0	0
	Medical Waste	0.6%	1	1	1
	Manufactured Products	0.6%	1	1	1
	Polystyrene	0.0%	<0.5	0	0
	Aseptic Lined Containers	0.5%	1	1	1
	Refuse	10.6%	13	16	19
Total		100.0%		150	
Contamination (noted in grey shading above)		22.9% +/- 6.5%	25	34	44

Refuse Characterization

The residual in Carmel's recycling stream are 22.9 percent of incoming recyclables which includes 10.6 percent refuse. **Exhibit 15** presents the visual characterization of refuse materials in SSR. The most prevalent material is Refuse Less than 3-Inches at 5.4 percent. OCC represents 2.5 percent and Textiles/Leather and Compostable Paper each represent 2.5 percent of SSR.

Exhibit 15. Composition of Refuse Materials in SSR from Carmel



As presented in **Exhibit 16**, all samples from Carmel by the Sea in 2020 were from mixed loads (both residential and commercial sources). In 2021, all samples were from residential loads.

Exhibit 16. Proportion of Residuals from Carmel by Sector

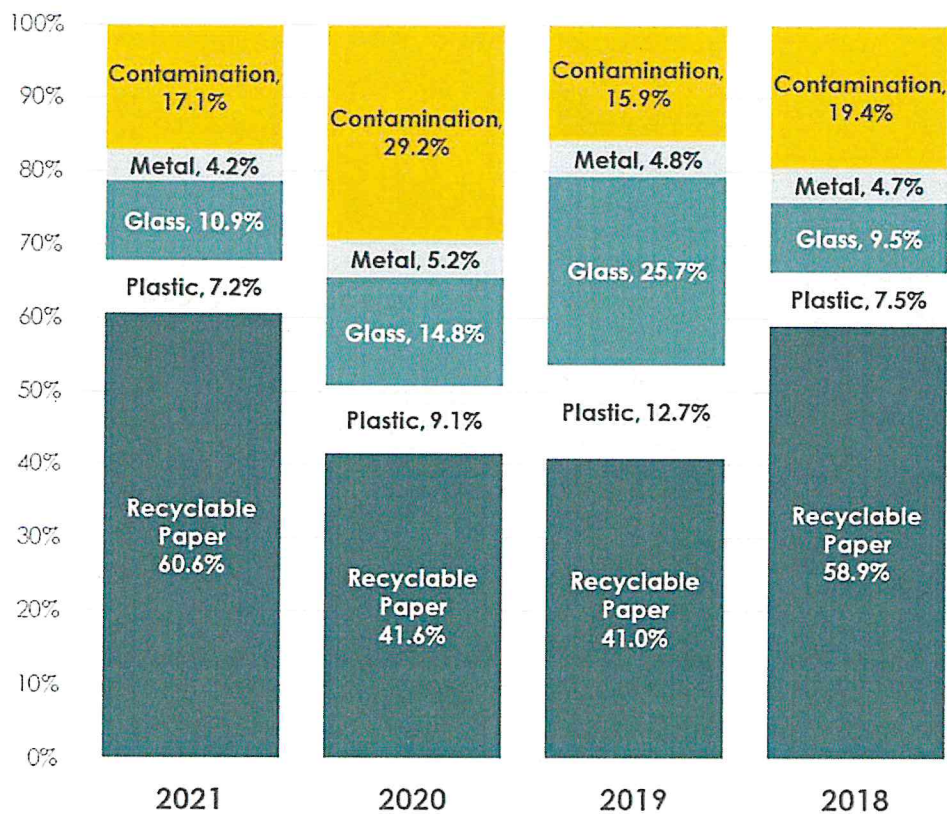
Sector	Number of Samples			Contamination		
	2021	2020	2019	2021	2020	2019
Residential	10	0	4	22.9%	NA	20.5%
Commercial	0	0	1	NA	NA	13.2%
Mixed Loads	0	10	6	NA	24.1%	13.5%
Total	10	10	11	22.9%	24.1%	16.0%

3.2.2 Del Rey Oaks

Recycling Composition

The composition of Del Rey Oak’s recycling stream by category is presented in **Exhibit 17**. Based on the samples collected, the most prevalent material category by percentage is Recyclable Paper, representing 60.6 percent of the overall recycling stream. Contamination represents the second most prevalent material category at 17.1 percent by weight, which is a significant decrease from the 2020 study.

Exhibit 17. Composition of Recyclable Loads from Del Rey Oaks, 2018 to 2021



A detailed breakdown of Del Rey Oak’s recycling stream by material type and associated monthly tonnage is presented in **Exhibit 18**.

Exhibit 18. Detailed Recycling Composition from Del Rey Oaks

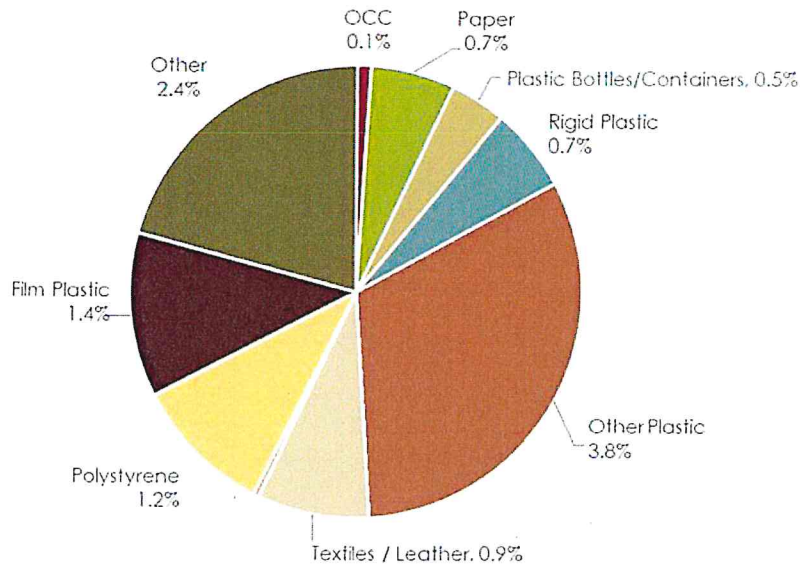
DEL REY OAKS					
Category	Material Type	Average Composition	Monthly Tons (90% Confidence)		
			Low	Average	High
Paper	Uncoated Corrugated Cardboard	39.3%	6	10	13
	White Office Paper	2.1%	<0.5	1	1
	Mixed Paper	11.5%	2	3	4
	Paper Board	5.3%	1	1	2
	Old Newspaper	2.5%	<0.5	1	1
Plastic	PET	1.9%	<0.5	0	1
	PET Thermoform	0.9%	<0.5	0	0
	Natural HDPE	0.3%	<0.5	0	0
	Pigment HDPE	0.8%	<0.5	0	0
	Polypropylene #5	0.6%	<0.5	0	0
	Mixed Plastic #3, 4, 6, 7	0.5%	<0.5	0	0
	Rigid Plastic	2.2%	<0.5	1	1
	Film Plastic	2.0%	<0.5	0	1
Glass	Mixed Glass	10.9%	2	3	3
Metal	Bi Metal	3.3%	<0.5	1	1
	Aluminum	0.9%	<0.5	0	0
	Aluminum - Other	0.1%	<0.5	0	0
Organics	Organics	1.9%	<0.5	0	1
Other	HHW	0.1%	<0.5	0	0
	Batteries	0.0%	NA	0	NA
	Medical Waste	0.1%	<0.5	0	0
	Manufactured Products	1.0%	<0.5	0	0
	Polystyrene	0.1%	<0.5	0	0
	Aseptic Lined Containers	0.2%	<0.5	0	0
	Refuse	11.8%	2	3	4
Total		100.0%		25	
Contamination (noted in grey shading above)		17.1% +/- 7.9%	2	4	6

"NA indicates that we did not find the material during the field effort.

Refuse Characterization

The residual in Del Rey Oak's recycling stream are 17.1 percent of incoming recyclables which includes 11.8 percent refuse. **Exhibit 19** presents the visual characterization of refuse materials in SSR. The most prevalent material is Other Plastic at 3.8 percent. Other materials represents 2.4 percent and Film Plastic represents 1.4 percent of SSR.

Exhibit 19. Composition of Residuals from Del Rey Oaks



The residuals varied significantly by sector as presented in **Exhibit 20**, with commercial loads having 6.9 percent residuals compared to mixed loads which had 23.9 percent residuals in 2021.

Exhibit 20. Proportion of Residuals from Del Rey Oaks by Sector

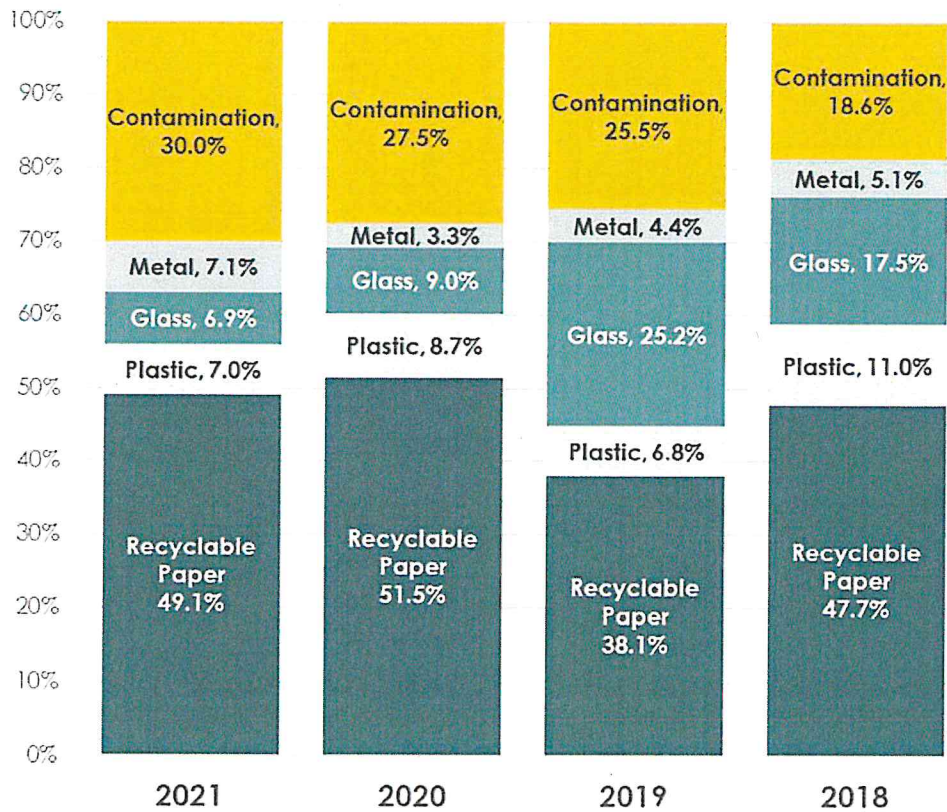
Sector	Number of Samples			Contamination		
	2021	2020	2019	2021	2020	2019
Residential	0	1	2	NA	20.4%	12.5%
Commercial	2	0	0	6.9%	NA	NA
Mixed Loads	3	4	3	23.9%	31.4%	18.1%
Total	5			17.1%	29.2%	15.9%

3.2.3 Marina

Recycling Composition

The composition of Marina’s recycling stream by category is presented in **Exhibit 21**. Based on the samples collected, the most prevalent material category by percentage is Recyclable Paper, representing 49.1 percent of the overall recycling stream. Contamination represents the second most prevalent material category at 30 percent of the overall recycling stream.

Exhibit 21. Composition of Recyclable Loads from Marina, 2018 to 2021



A detailed breakdown of Marina’s recycling stream by material type and associated monthly tonnage is presented in **Exhibit 22**.

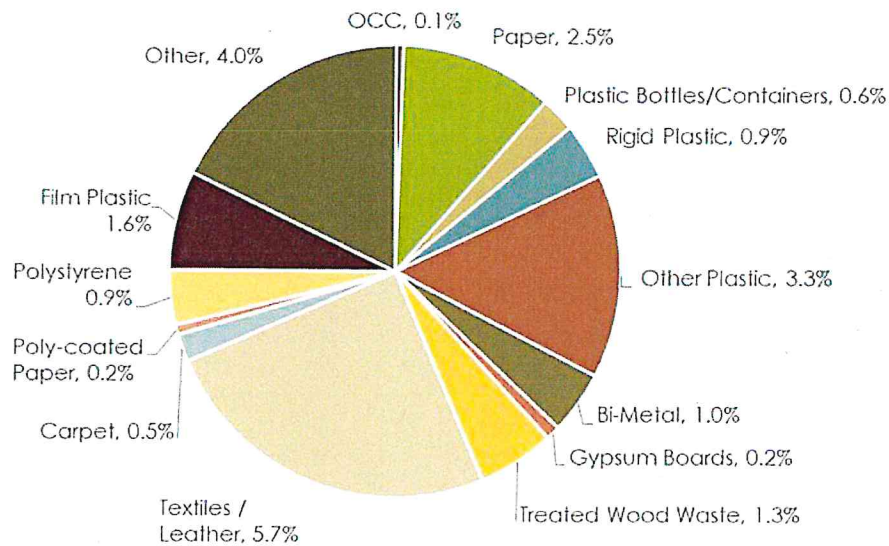
Exhibit 22. Detailed Recycling Composition from Marina

MARINA					
Category	Material Type	Average Composition	Monthly Tons (90% Confidence)		
			Low	Average	High
Paper	Uncoated Corrugated Cardboard	27.3%	37	46	56
	White Office Paper	2.1%	2	4	5
	Mixed Paper	12.0%	16	20	25
	Paper Board	4.9%	7	8	9
	Old Newspaper	2.7%	4	5	6
Plastic	PET	2.2%	3	4	4
	PET Thermoform	1.0%	2	2	2
	Natural HDPE	0.8%	1	1	2
	Pigment HDPE	0.9%	1	2	2
	Polypropylene #5	0.7%	1	1	1
	Mixed Plastic #3, 4, 6, 7	0.5%	1	1	1
	Rigid Plastic	0.9%	1	2	2
	Film Plastic	1.8%	2	3	4
Glass	Mixed Glass	6.9%	9	12	15
Metal	Bi Metal	5.8%	8	10	11
	Aluminum	0.7%	1	1	1
	Aluminum - Other	0.6%	<0.5	1	2
Organics	Organics	3.3%	4	6	7
Other	HHW	0.0%	<0.5	0	0
	Batteries	0.0%	<0.5	0	0
	Medical Waste	0.4%	<0.5	1	1
	Manufactured Products	0.9%	1	2	2
	Polystyrene	0.1%	<0.5	0	0
	Aseptic Lined Containers	0.6%	1	1	1
	Refuse	22.7%	34	39	43
Total		100.0%		170	
Contamination (noted in grey shading above)		30% +/- 6.3%	40	51	62

Refuse Characterization

The residual in Marina's recycling stream are 30 percent of incoming recyclables which includes 22.7 percent refuse. **Exhibit 23** presents the visual characterization of refuse materials in SSR. The most prevalent material is Textiles/Leather at 5.7 percent. Other materials represents four percent and Other Plastic represents 3.3 percent of materials in SSR.

Exhibit 23. Composition of Residuals from Marina



The residuals varied significantly by sector as presented in **Exhibit 24**, with residential loads having 30.8 percent residuals compared to the commercial load which had 22.1 percent residuals in 2021.

Exhibit 24. Proportion of Residuals from Marina by Sector

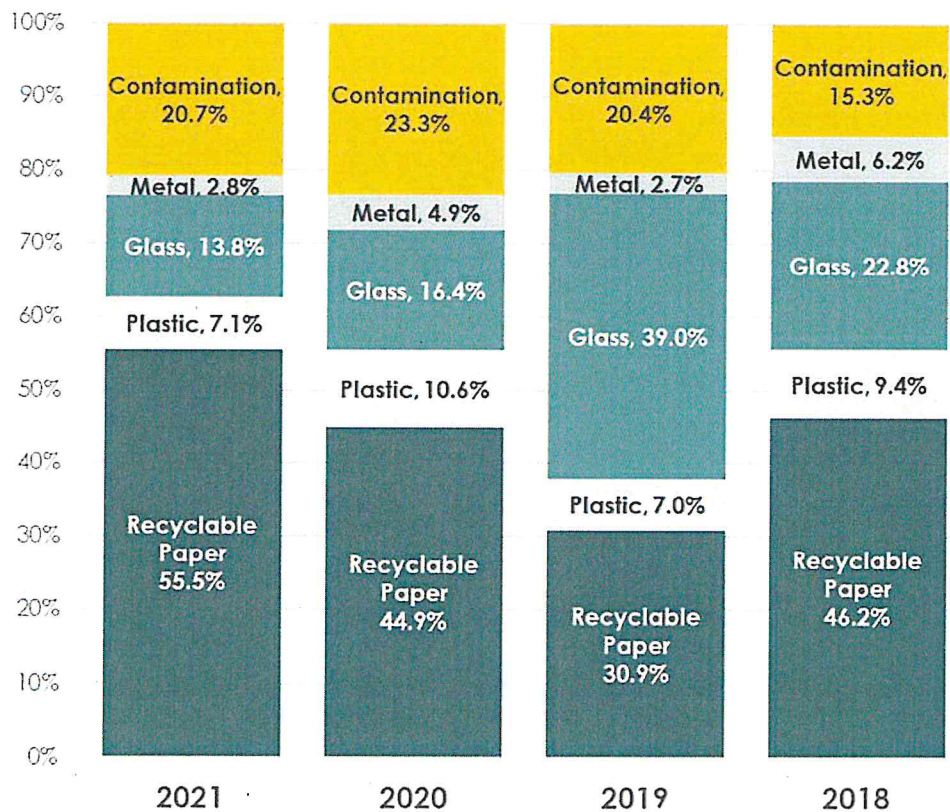
Sector	Number of Samples			Contamination		
	2021	2020	2019	2021	2020	2019
Residential	9	9	6	30.8%	29.3%	11.5%
Commercial	1	1	1	22.1%	11.2%	92.9%
Mixed Loads	0	0	3	NA	NA	31.0%
Total	10	10	10	30.0%	27.5%	25.5%

3.2.4 Pacific Grove

Recycling Composition

The composition of Pacific Grove’s recycling stream by category is presented in **Exhibit 25**. Based on the samples collected, the most prevalent material category by percentage is Recyclable Paper, representing 55.5 percent of the overall recycling stream. Contamination represents the second most prevalent material category at 20.7 percent, which is slightly less than in 2020.

Exhibit 25. Composition of Recyclable Loads from Pacific Grove, 2018 to 2021



A detailed breakdown of Pacific Grove’s recycling stream by material type and associated monthly tonnage is presented in **Exhibit 26**.

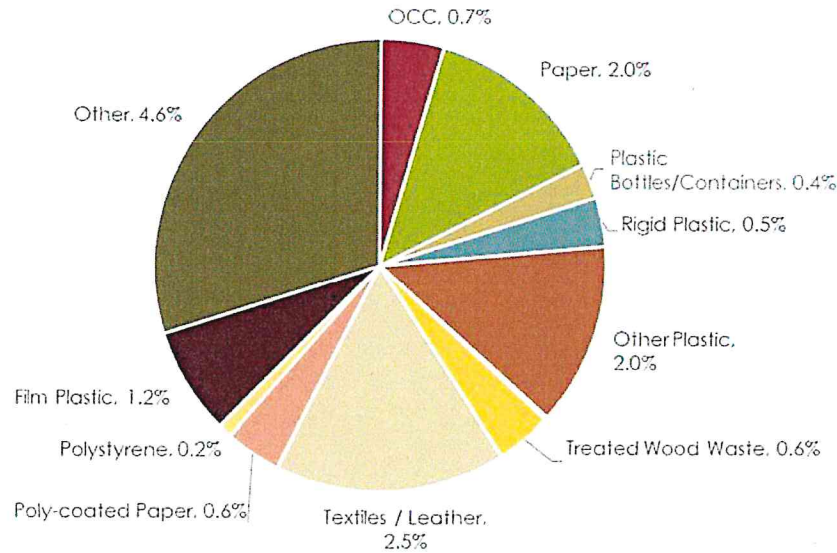
Exhibit 26. Detailed Recycling Composition from Pacific Grove

PACIFIC GROVE					
Category	Material Type	Average Composition	Monthly Tons (90% Confidence)		
			Low	Average	High
Paper	Uncoated Corrugated Cardboard	28.8%	42	50	58
	White Office Paper	1.3%	2	2	3
	Mixed Paper	14.8%	21	26	31
	Paper Board	5.0%	8	9	10
	Old Newspaper	5.6%	8	10	12
Plastic	PET	2.4%	4	4	5
	PET Thermoform	1.2%	2	2	2
	Natural HDPE	0.5%	1	1	1
	Pigment HDPE	0.7%	1	1	1
	Polypropylene #5	0.7%	1	1	1
	Mixed Plastic #3, 4, 6, 7	0.5%	1	1	1
	Rigid Plastic	1.2%	1	2	3
	Film Plastic	1.2%	2	2	2
Glass	Mixed Glass	13.8%	21	24	27
Metal	Bi Metal	1.7%	2	3	3
	Aluminum	0.9%	1	2	2
	Aluminum - Other	0.2%	<0.5	0	0
Organics	Organics	1.5%	2	3	3
Other	HHW	0.3%	<0.5	0	1
	Batteries	0.0%	<0.5	0	0
	Medical Waste	0.5%	<0.5	1	1
	Manufactured Products	1.3%	2	2	3
	Polystyrene	0.1%	<0.5	0	0
	Aseptic Lined Containers	0.6%	1	1	1
	Refuse	15.3%	21	27	32
Total		100.0%		175	
Contamination (noted in grey shading above)		20.7% +/- 6.3%	25	36	47

Refuse Characterization

The residual in Pacific Grove's recycling stream are 20.7 percent of incoming recyclables which includes 15.3 percent refuse. **Exhibit 27** presents the visual characterization of refuse materials in SSR. The most prevalent material is Textiles/Leather at 4.6 percent. Other represents 4.5 percent and OCC represents 2.0 percent of SSR.

Exhibit 27. Composition of Residuals from Pacific Grove



Residential loads were targeted for sampling. There were no samples from commercial recycling loads in 2021 nor in 2020. In 2019 the samples were split between residential and mixed loads, but there was not a significant difference in the proportion of contamination by sector.

Exhibit 28. Proportion of Residuals from Pacific Grove by Sector

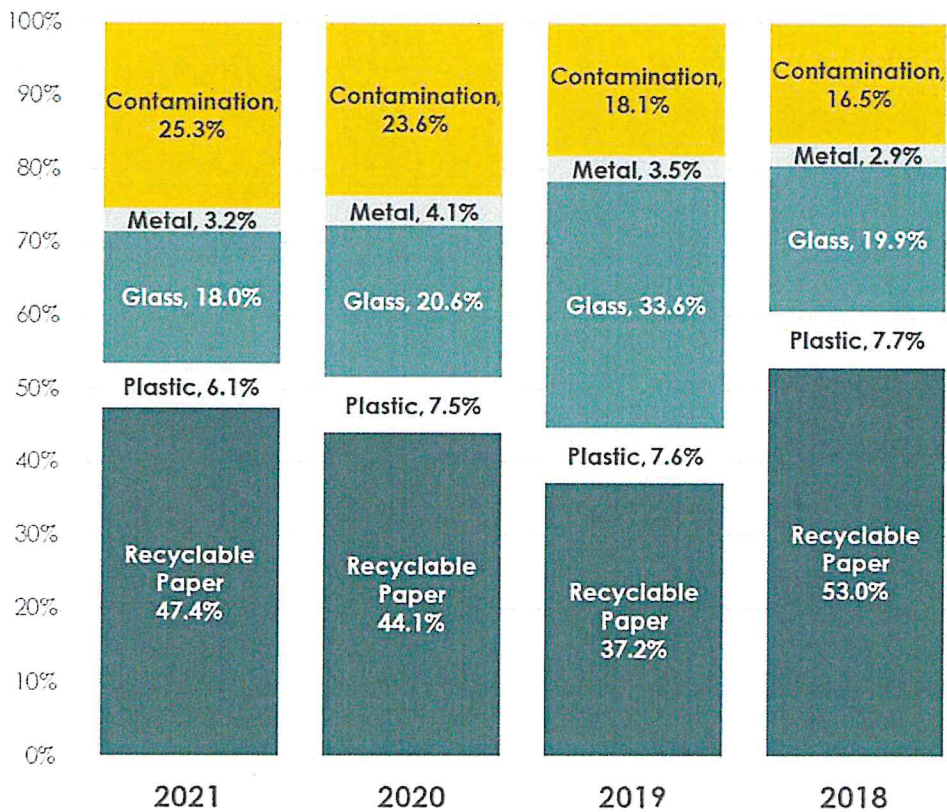
Sector	Number of Samples			Contamination		
	2021	2020	2019	2021	2020	2019
Residential	10	10	5	20.7%	23.3%	21.5%
Commercial	0	0	0	NA	NA	NA
Mixed Loads	0	0	5	NA	NA	19.2%
Total	10	10	10	20.7%	23.3%	20.4%

3.2.5 Pebble Beach

Recycling Composition

The composition of Pebble Beach's recycling stream by category is presented in **Exhibit 29**. Based on the samples collected, the most prevalent material category, by weight, is Recyclable Paper, representing 47.4 percent of the overall recycling stream. Contamination represents the second most prevalent material category at 25.3 percent.

Exhibit 29. Composition of Recyclable Loads from Pebble Beach, 2018 to 2021



A detailed breakdown of Pebble Beach's recycling stream by material type and associated monthly tonnage is presented in **Exhibit 30**.

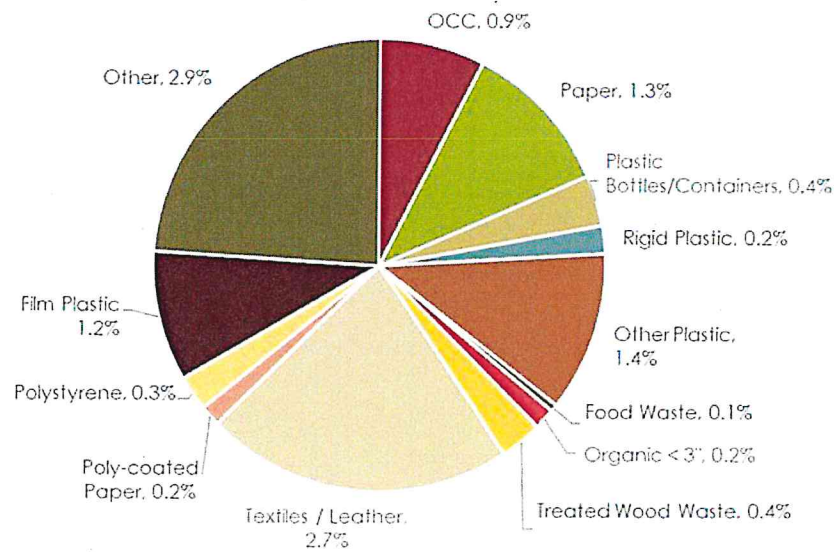
Exhibit 30. Detailed Recycling Composition from Pebble Beach

PEBBLE BEACH					
Category	Material Type	Average Composition	Monthly Tons (90% Confidence)		
			Low	Average	High
Paper	Uncoated Corrugated Cardboard	18.5%	18	20	23
	White Office Paper	3.5%	2	4	5
	Mixed Paper	14.7%	14	16	18
	Paper Board	5.0%	5	6	6
	Old Newspaper	5.6%	5	6	7
Plastic	PET	1.9%	2	2	2
	PET Thermoform	0.9%	1	1	1
	Natural HDPE	0.4%	<0.5	0	1
	Pigment HDPE	0.6%	1	1	1
	Polypropylene #5	0.6%	1	1	1
	Mixed Plastic #3, 4, 6, 7	0.4%	<0.5	0	1
	Rigid Plastic	1.3%	1	1	2
	Film Plastic	2.0%	2	2	2
Glass	Mixed Glass	18.0%	17	20	23
Metal	Bi Metal	2.4%	2	3	3
	Aluminum	0.7%	1	1	1
	Aluminum - Other	0.1%	<0.5	0	0
Organics	Organics	5.6%	4	6	8
Other	HHW	0.1%	<0.5	0	0
	Batteries	0.0%	<0.5	0	0
	Medical Waste	0.7%	1	1	1
	Manufactured Products	3.9%	2	4	7
	Polystyrene	0.1%	<0.5	0	0
	Aseptic Lined Containers	0.5%	<0.5	1	1
	Refuse	12.2%	11	13	15
Total		100.0%		110	
Contamination (noted in grey shading above)		25.3% +/- 5.9%	21	28	34

Refuse Characterization

The residual in Pebble Beach’s recycling stream is 25.3 percent of incoming recyclables which includes 12.2 percent refuse. **Exhibit 31** presents the visual characterization of refuse materials in SSR. The most prevalent material is Refuse Less than 3-Inches at 5.44.5 percent. Textiles/Leather represents 3.6 percent and Film Plastic represents 1.7 percent of materials in SSR.

Exhibit 31. Composition of Residuals from Pebble Beach



Residential loads were targeted for sampling in 2020 and 2021. There were no samples from commercial recycling loads. In 2019, there were two samples from mixed loads.

Exhibit 32. Proportion of Residuals from Pebble Beach by Sector

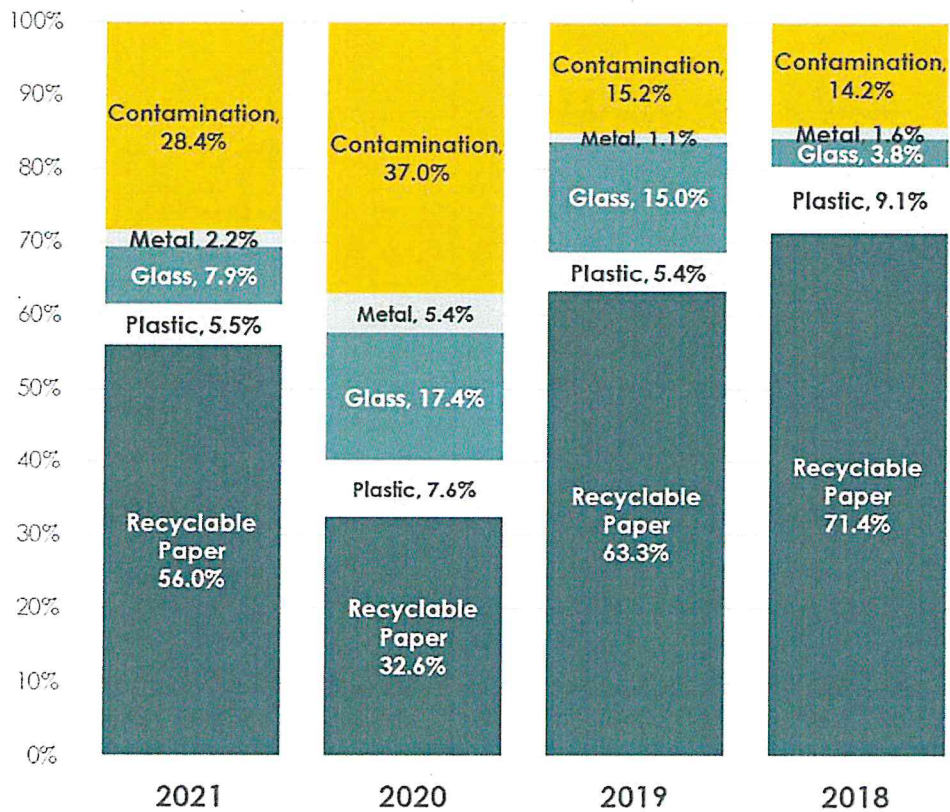
Sector	Number of Samples			Contamination		
	2021	2020	2019	2021	2020	2019
Residential	10	10	8	25.3%	23.6%	19.0%
Commercial	0	0	0	NA	NA	NA
Mixed Loads	0	0	2	NA	NA	14.7%
Total	10	10	10	25.3%	23.6%	18.1%

3.2.6 Sand City

Recycling Composition

The composition of Sand City's recycling stream by category is presented in **Exhibit 33**. Based on the samples collected, the most prevalent material category by percentage is Recyclable Paper representing 56 percent of the overall recycling stream. Contamination represents the second most prevalent material category at 28.4 percent of the overall recycling stream.

Exhibit 33. Composition of Recyclable Loads from Sand City, 2018 to 2021



A detailed breakdown of Sand City's recycling stream by material type and associated monthly tonnage is presented in **Exhibit 34**.

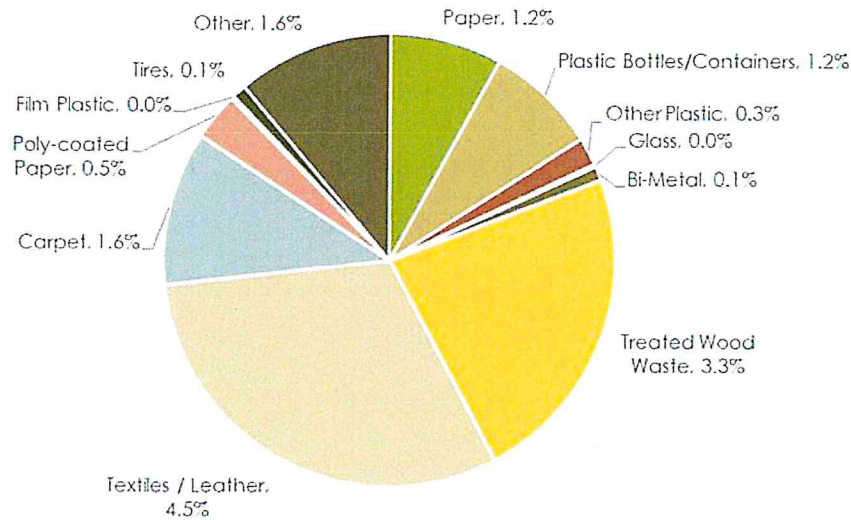
Exhibit 34. Detailed Recycling Composition from Sand City

SAND CITY					
Category	Material Type	Average Composition	Monthly Tons (90% Confidence)		
			Low	Average	High
Paper	Uncoated Corrugated Cardboard	42.0%	4	4	5
	White Office Paper	0.8%	<0.5	0	0
	Mixed Paper	11.3%	1	1	1
	Paper Board	1.4%	<0.5	0	0
	Old Newspaper	0.5%	<0.5	0	0
Plastic	PET	1.4%	<0.5	0	0
	PET Thermoform	0.4%	<0.5	0	0
	Natural HDPE	0.4%	<0.5	0	0
	Pigment HDPE	1.3%	<0.5	0	0
	Polypropylene #5	0.7%	<0.5	0	0
	Mixed Plastic #3, 4, 6, 7	0.3%	<0.5	0	0
	Rigid Plastic	0.9%	<0.5	0	0
	Film Plastic	1.6%	<0.5	0	0
Glass	Mixed Glass	7.9%	1	1	1
Metal	Bi Metal	1.8%	<0.5	0	0
	Aluminum	0.3%	<0.5	0	0
	Aluminum - Other	0.1%	<0.5	0	0
Organics	Organics	5.0%	<0.5	1	1
Other	HHW	2.9%	<0.5	0	1
	Batteries	0.0%	<0.5	0	0
	Medical Waste	1.0%	<0.5	0	0
	Manufactured Products	3.0%	<0.5	0	1
	Polystyrene	0.0%	<0.5	0	0
	Aseptic Lined Containers	0.4%	<0.5	0	0
	Refuse	14.5%	1	1	2
Total		100.0%		10	
Contamination (noted in grey shading above)		28.4% +/- 4.5%	2	3	3

Refuse Characterization

The residual in Sand City's recycling stream is 28.4 percent of incoming recyclables which includes 14.5 percent refuse. **Exhibit 35** presents the visual characterization of refuse materials in SSR. The most prevalent material is Textiles/Leather at 4.5 percent. Treated Wood Waste represents 3.3 percent and Carpet and Other Materials each represent 1.6 percent of materials in SSR.

Exhibit 35. Composition of Residuals from Sand City



The residuals varied only slightly by sector in 2021 as presented in **Exhibit 36**, with commercial loads having 26.2 percent residuals compared to mixed loads which had 29.9 percent residuals.

Exhibit 36. Proportion of Residuals from Sand City by Sector

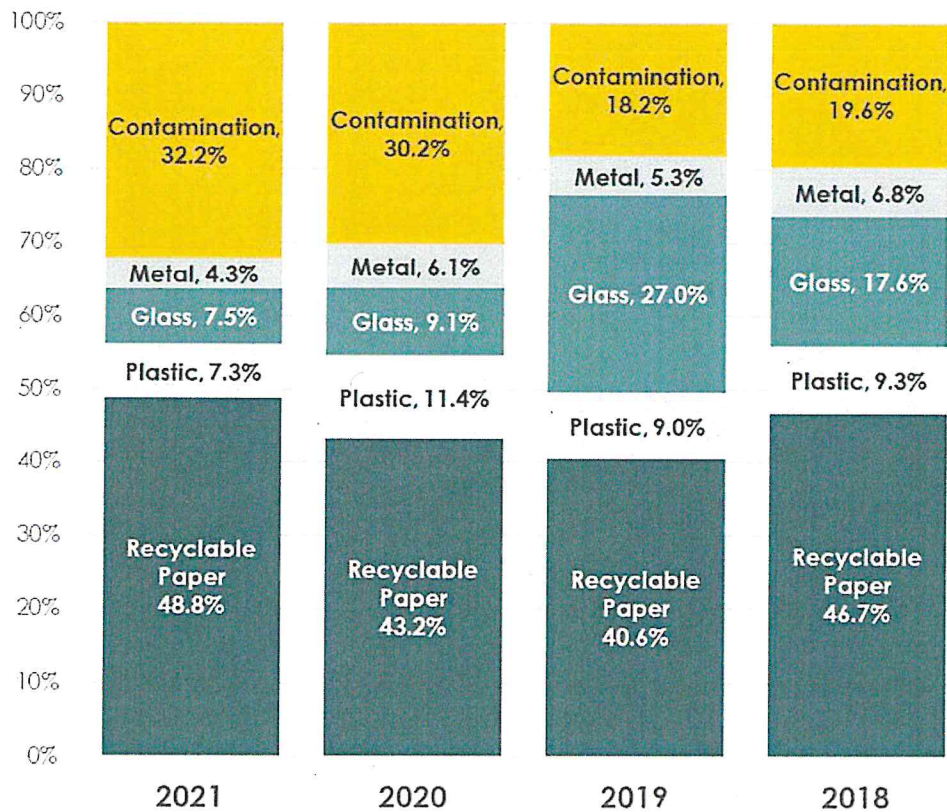
Sector	Number of Samples			Contamination		
	2021	2020	2019	2021	2020	2019
Residential	0	0	4	NA	NA	13.4%
Commercial	2	1	1	26.2%	45.1%	22.1%
Mixed Loads	3	4	0	29.9%	34.9%	NA
Total	5	5	5	28.4%	37.0%	15.2%

3.2.7 Seaside

Recycling Composition

The composition of Seaside’s recycling stream by category is presented in **Exhibit 37**. Based on the samples collected, the most prevalent material category by percentage is Recyclable Paper, representing 48.8 percent of the overall recycling stream. Contamination is the second most prevalent material category representing 32.2 percent of the overall recycling stream.

Exhibit 37. Composition of Recyclable Loads from Seaside, 2018 to 2021



A detailed breakdown of Seaside’s recycling stream by material type and associated monthly tonnage is presented in **Exhibit 38**.

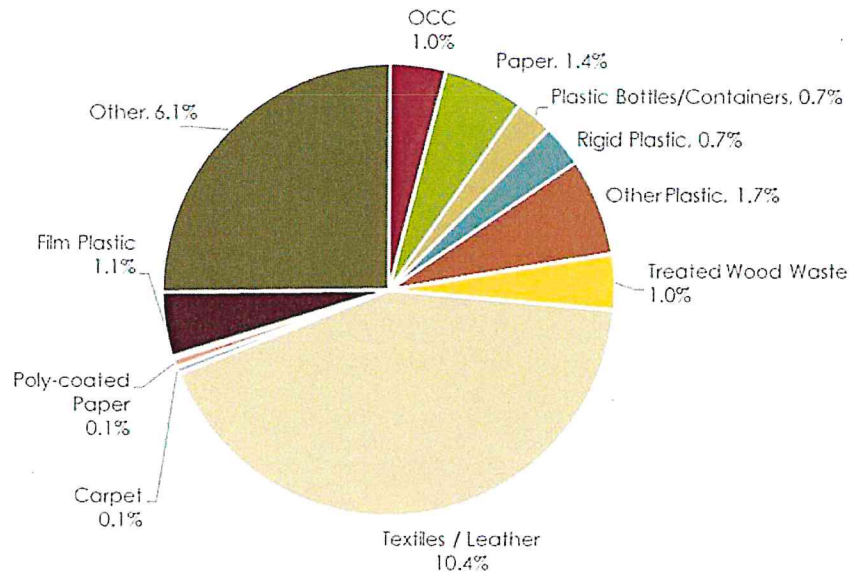
Exhibit 38. Detailed Recycling Composition from Seaside

SEASIDE					
Category	Material Type	Average Composition	Monthly Tons (90% Confidence)		
			Low	Average	High
Paper	Uncoated Corrugated Cardboard	29.3%	70	78	85
	White Office Paper	3.2%	2	8	15
	Mixed Paper	9.6%	22	25	29
	Paper Board	4.8%	12	13	14
	Old Newspaper	2.0%	4	5	6
Plastic	PET	2.2%	5	6	6
	PET Thermoform	0.8%	2	2	3
	Natural HDPE	0.6%	1	2	2
	Pigment HDPE	1.1%	3	3	3
	Polypropylene #5	0.8%	2	2	2
	Mixed Plastic #3, 4, 6, 7	0.5%	1	1	2
	Rigid Plastic	1.2%	2	3	4
	Film Plastic	1.9%	4	5	6
Glass	Mixed Glass	7.5%	15	20	25
Metal	Bi Metal	3.5%	7	9	12
	Aluminum	0.6%	1	2	2
	Aluminum - Other	0.1%	<0.5	0	0
Organics	Organics	3.2%	6	8	11
Other	HHW	0.3%	1	1	1
	Batteries	0.0%	<0.5	0	0
	Medical Waste	0.9%	1	2	3
	Manufactured Products	0.9%	1	2	3
	Polystyrene	0.2%	<0.5	0	1
	Aseptic Lined Containers	0.6%	1	1	2
	Refuse	24.4%	59	65	70
Total		100.0%		265	
Contamination (noted in grey shading above)		32.2% +/- 4.4%	73	85	97

Refuse Characterization

The residual in Seaside's recycling stream are 32.9 percent of incoming recyclables which includes 15.7 percent refuse. **Exhibit 39** presents the visual characterization of refuse materials in SSR. The most prevalent material is Refuse Less than 3-Inches at 3.7 percent. Textiles/Leather represents 3.4 percent and Textiles/Leather and Compostable Paper each represent 2.5 percent of materials in SSR.

Exhibit 39. Composition of Residuals from Seaside



Only residential loads were sampled in 2021, which is likely the reason the contamination increased for Seaside in 2021. In 2020, commercial contamination was lower at about 16.9 percent.

Exhibit 40. Proportion of Residuals from Seaside by Sector

Sector	Number of Samples			Contamination		
	2021	2020	2019	2021	2020	2019
Residential	10	8	6	32.2%	33.5%	19.2%
Commercial	0	2	0	NA	16.9%	NA
Mixed Loads	0	0	4	NA	NA	16.6%
Total	10	10	10	32.2%	30.2%	18.2%

3.3 HAULER: MONTEREY CITY DISPOSAL

Monterey City Disposal, Inc. is the hauler for the City of Monterey. In total, SCS completed 10 recycling stream samples from the City of Monterey. Of the material sampled, 84.6 percent is Recyclable and 15.4 percent is Contamination as shown in **Exhibit 41**.

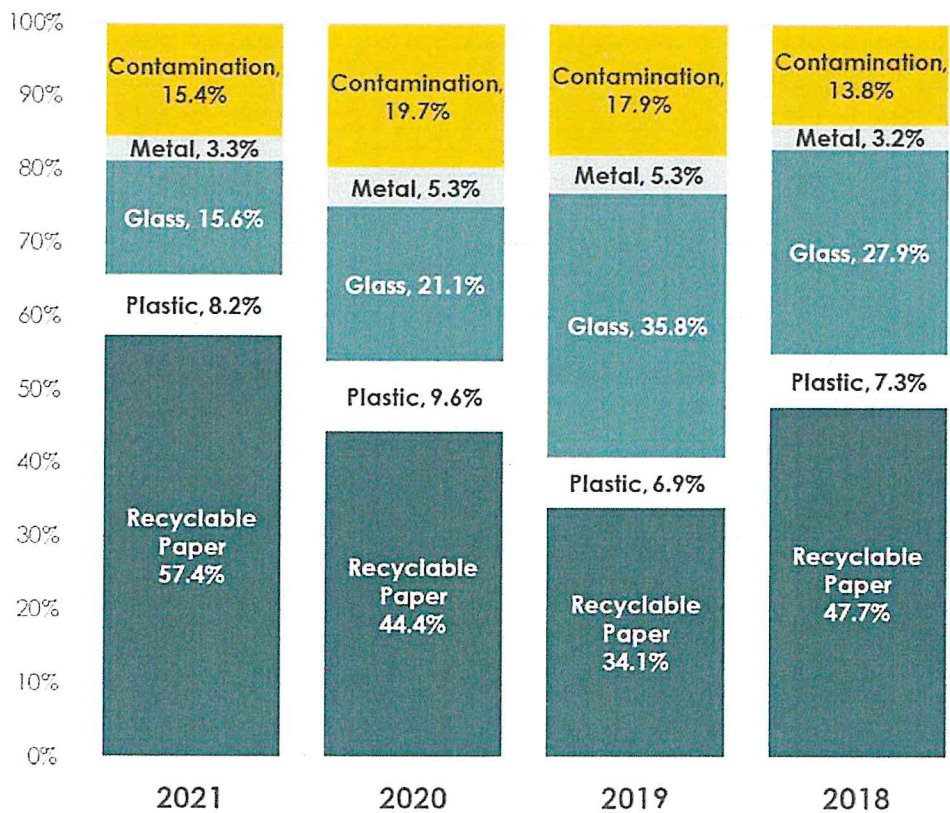
The following section examines the recycling composition by category and material type, the 90% confidence interval, and the visual characterization for the City of Monterey.

3.3.1 City of Monterey

Recycling Composition

The composition of Monterey City’s recycling stream by category is presented in **Exhibit 41**. Based on the samples collected, the most prevalent material category by percentage is Recyclable Paper, representing 57.4 percent of the overall recycling stream. Recyclable Glass is the second most prevalent material category representing 15.6 percent of the overall recycling stream. Contamination represents 14.4 percent of the overall recycling stream.

Exhibit 41. Composition of Recyclable Loads from City of Monterey, 2018 to 2021



A detailed breakdown of Monterey’s recycling stream by material type and associated monthly tonnage is presented in **Exhibit 42**.

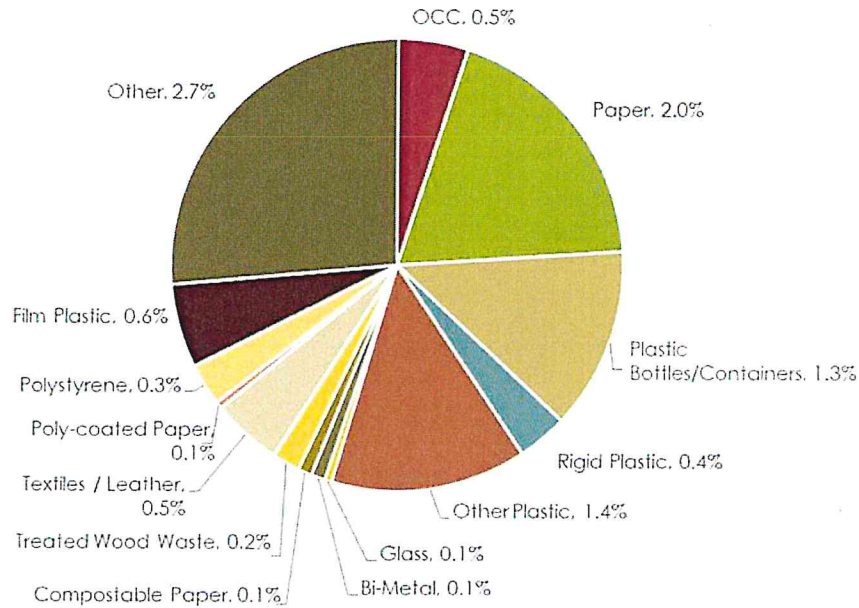
Exhibit 42. Detailed Recycling Composition from City of Monterey

CITY OF MONTEREY					
Category	Material Type	Average Composition	Monthly Tons (90% Confidence)		
			Low	Average	High
Paper	Uncoated Corrugated Cardboard	25.9%	40	45	51
	White Office Paper	2.6%	3	5	6
	Mixed Paper	19.6%	29	34	40
	Paper Board	5.2%	8	9	10
	Old Newspaper	4.1%	6	7	8
Plastic	PET	2.1%	3	4	4
	PET Thermoform	1.3%	2	2	2
	Natural HDPE	0.9%	1	2	2
	Pigment HDPE	0.9%	1	1	2
	Polypropylene #5	0.9%	1	2	2
	Mixed Plastic #3, 4, 6, 7	0.6%	1	1	1
	Rigid Plastic	1.7%	2	3	4
	Film Plastic	1.6%	2	3	3
Glass	Mixed Glass	15.6%	25	27	30
Metal	Bi Metal	2.3%	3	4	5
	Aluminum	0.8%	1	1	2
	Aluminum - Other	0.2%	<0.5	0	0
Organics	Organics	1.9%	2	3	5
Other	HHW	0.2%	<0.5	0	1
	Batteries	0.0%	<0.5	0	0
	Medical Waste	0.1%	<0.5	0	0
	Manufactured Products	0.4%	1	1	1
	Polystyrene	0.1%	<0.5	0	0
	Aseptic Lined Containers	0.6%	1	1	1
	Refuse	10.4%	15	18	21
Total		100.0%		175	
Contamination (noted in grey shading above)		15.4% +/- 3.6%	21	27	33

Refuse Characterization

The residual in Monterey's recycling stream are 15.4 percent of incoming recyclables which includes 10.4 percent refuse. **Exhibit 43** presents the visual characterization of refuse materials in SSR. The most prevalent material is Refuse Less than 3-Inches at 3.9 percent. Compostable Paper represents 2.2 percent and OCC represents 1.6 percent of materials in SSR.

Exhibit 43. Composition of Residuals from City of Monterey



In 2021, sampling included residential, commercial, and mixed loads. There was not a significant difference in contamination between residential and commercial loads

Exhibit 44. Proportion of Residuals from City of Monterey by Sector

Sector	Number of Samples			Contamination		
	2021	2020	2019	2021	2020	2019
Residential	6	0	7	16.1%	NA	19.0%
Commercial	2	0	0	17.5%	NA	NA
Mixed Loads	2	10	3	11.3%	19.7%	15.3%
Total	10	10	10	15.4%	19.7%	17.9%

3.4 HAULER: WASTE MANAGEMENT

Waste Management is the hauler for Unincorporated Monterey County and King City. In total, SCS completed 50 recycling stream samples from these areas that Waste Management services. Of the material sampled, 72.3 percent is Recyclable and 27.7 percent is Contamination as shown in Exhibit 45.

Exhibit 45. Detailed Recycling Composition of Loads Hauled by Waste Management

Waste Management					
Category	Material Type	Average Composition	Monthly Tons (90% Confidence)		
			Low	Average	High
Paper	Uncoated Corrugated Cardboard	33.6%	177	505	292
	White Office Paper	2.1%	5	31	34
	Mixed Paper	7.5%	88	112	139
	Paper Board	4.8%	36	72	50
	Old Newspaper	1.4%	22	21	44
Plastic	PET	1.7%	16	25	22
	PET Thermoform	0.8%	7	13	10
	Natural HDPE	1.3%	3	19	6
	Pigment HDPE	1.7%	6	26	10
	Polypropylene #5	0.6%	5	9	7
	Mixed Plastic #3, 4, 6, 7	0.8%	3	11	5
	Rigid Plastic	2.0%	5	30	14
	Film Plastic	1.7%	12	26	19
Glass	Mixed Glass	9.0%	94	134	174
Metal	Bi Metal	4.5%	18	68	36
	Aluminum	0.3%	5	5	8
	Aluminum - Other	0.2%	<0.5	3	4
Organics	Organics	4.5%	22	68	55
Other	HHW	0.2%	<0.5	3	10
	Batteries	0.0%	<0.5	1	0
	Medical Waste	1.0%	2	16	9
	Manufactured Products	2.5%	1	38	28
	Polystyrene	0.1%	<0.5	2	1
	Aseptic Lined Containers	0.3%	4	5	5
	Refuse	17.2%	113	257	183
Total		100.0%		1,500	
Contamination (noted in grey shading above)		27.7%	192	416	272

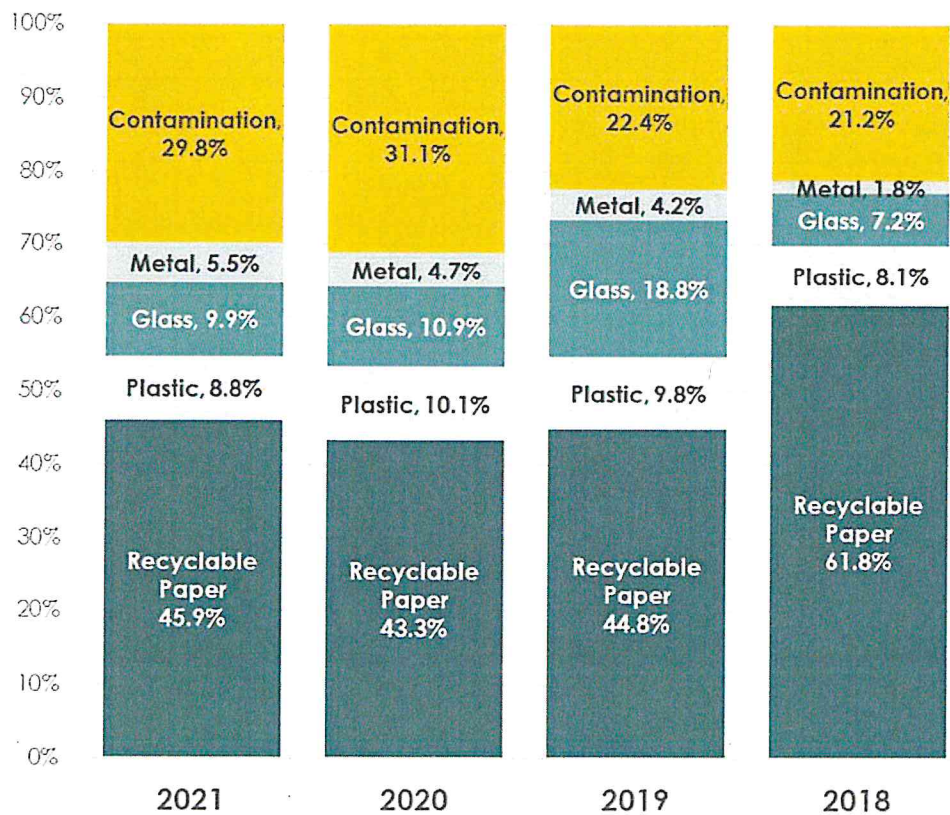
The following section examines the recycling composition by category and material type, the 90% confidence interval, and the visual characterization for cities that Waste Management services.

3.4.1 Unincorporated Monterey County

Recycling Composition

The composition of Unincorporated Monterey County's recycling stream by category is presented in **Exhibit 46**. Based on the samples collected, the most prevalent material category by percentage is Recyclable Paper, representing 45.9 percent of the overall recycling stream. Contamination is the second most prevalent material category representing 29.8 percent of the overall recycling stream.

Exhibit 46. Composition of Recyclable Loads from Unincorporated Monterey County, 2018 to 2021



A detailed breakdown of Unincorporated Monterey County's recycling stream by material type and associated monthly tonnage is presented in **Exhibit 47**.

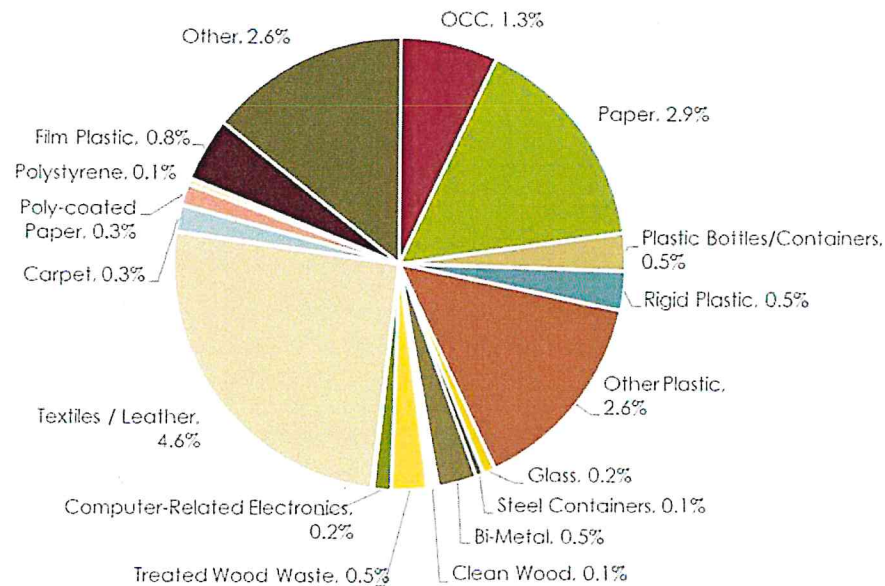
Exhibit 47. Detailed Recycling Composition from Unincorporated Monterey County

UNINCORPORATED MONTEREY COUNTY					
Category	Material Type	Average Composition	Monthly Tons (90% Confidence)		
			Low	Average	High
Paper	Uncoated Corrugated Cardboard	28.2%	366	381	396
	White Office Paper	2.3%	25	31	37
	Mixed Paper	8.4%	108	113	118
	Paper Board	5.4%	70	72	75
	Old Newspaper	1.7%	21	22	24
Plastic	PET	1.9%	24	25	27
	PET Thermoform	1.0%	12	13	14
	Natural HDPE	1.0%	13	14	15
	Pigment HDPE	1.3%	16	17	18
	Polypropylene #5	0.7%	8	9	10
	Mixed Plastic #3, 4, 6, 7	0.9%	10	12	15
	Rigid Plastic	2.1%	26	28	29
	Film Plastic	1.8%	23	24	26
Glass	Mixed Glass	9.9%	125	134	144
Metal	Bi Metal	4.9%	62	66	71
	Aluminum	0.4%	5	5	6
	Aluminum - Other	0.2%	3	3	3
Organics	Organics	5.3%	67	72	76
Other	HHW	0.3%	3	4	5
	Batteries	0.0%	1	1	1
	Medical Waste	1.2%	15	16	18
	Manufactured Products	2.6%	31	35	39
	Polystyrene	0.1%	2	2	2
	Aseptic Lined Containers	0.4%	5	5	6
	Refuse	18.1%	235	244	252
Total		100.0%		1,350	
Contamination (noted in grey shading above)		29.8% +/- 3%	361	402	443

Refuse Characterization

The residual in Unincorporated Monterey County's recycling stream are 29.8 percent of incoming recyclables which includes 18.1 percent refuse. **Exhibit 48** presents the visual characterization of refuse materials in SSR. The most prevalent material is Textiles/Leather at 4.6 percent. Paper represents 2.9 percent and Other Plastic and Other materials each represent 2.6 percent of materials in SSR.

Exhibit 48. Composition of Residuals from Unincorporated Monterey County



Even though there were only three commercial loads, the commercial samples showed a higher proportion of contamination than in previous years as presented in **Exhibit 49**. Contamination in residential loads was slightly lower in 2021 than 2020.

Exhibit 49. Proportion of Residuals from Unincorporated Monterey County by Sector

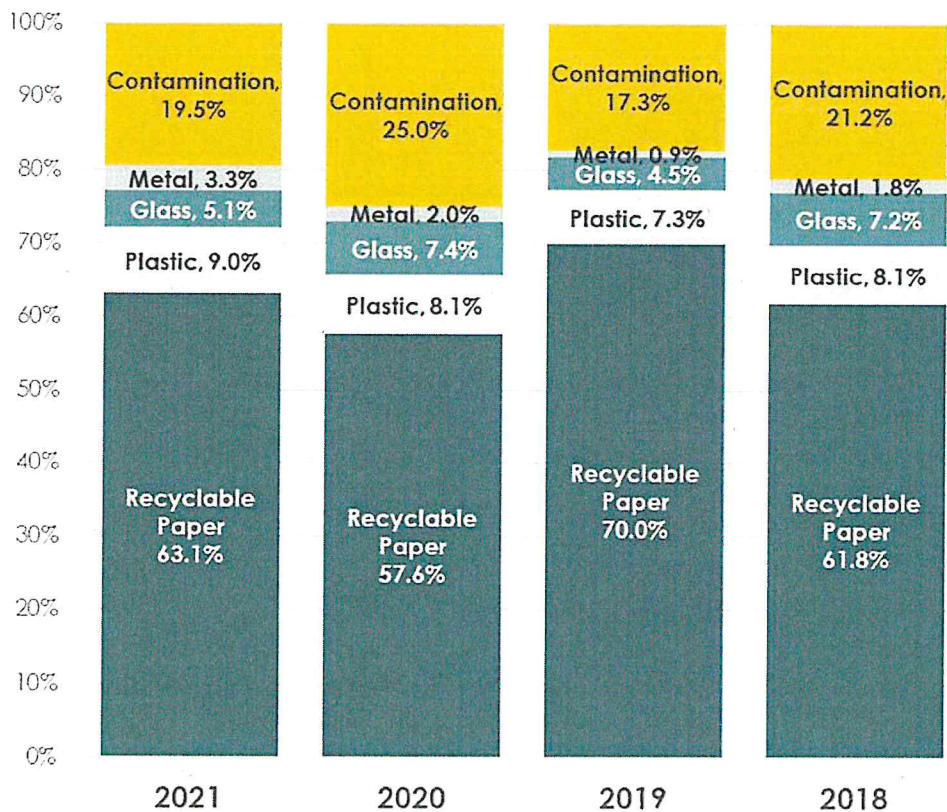
Sector	Number of Samples			Contamination		
	2021	2020	2019	2021	2020	2019
Residential	37	37	26	29.2%	31.4%	22.3%
Commercial	3	3	13	37.8%	27.4%	21.9%
Mixed Loads	0	0	1	NA	NA	30.0%
Total	40	40	40	29.8%	31.1%	22.4%

3.4.2 King City Commercial Recycling Study Results

Recycling Composition

The composition of King City's commercial recycling stream by category is presented in **Exhibit 50**. Based on the samples collected, the most prevalent material category by percentage is Recyclable Paper, representing 63.1 percent of the overall recycling stream. Contamination is the second most prevalent material category at 19.5 percent of the overall recycling stream.

Exhibit 50. Composition of Recyclable Loads from King City, 2018 to 2021



A detailed breakdown of King City's recycling stream by material type and associated monthly tonnage is presented in **Exhibit 51**.

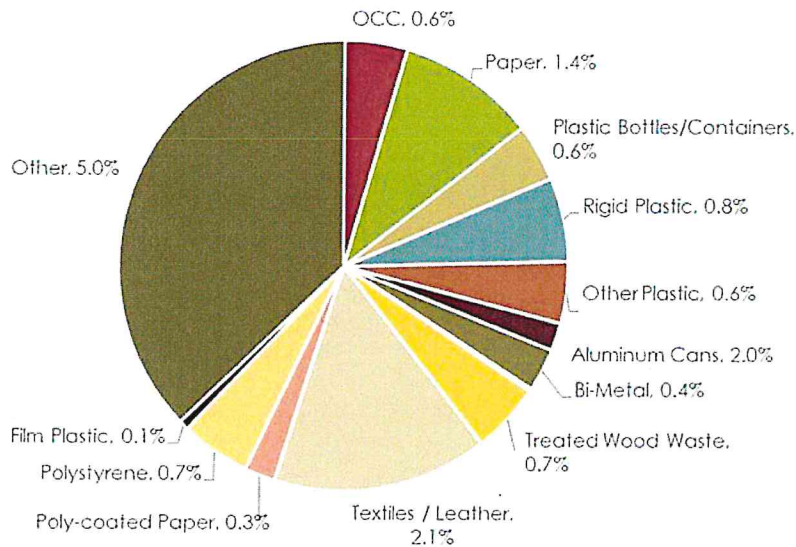
Exhibit 51. Detailed Recycling Composition from King City

KING CITY					
Category	Material Type	Average Composition	Monthly Tons (90% Confidence)		
			Low	Average	High
Paper	Uncoated Corrugated Cardboard	55.3%	74	83	92
	White Office Paper	1.2%	1	2	3
	Mixed Paper	3.8%	4	6	8
	Paper Board	2.5%	2	4	5
	Old Newspaper	0.3%	<0.5	0	1
Plastic	PET	0.8%	1	1	2
	PET Thermoform	0.3%	<0.5	0	1
	Natural HDPE	2.1%	3	3	4
	Pigment HDPE	3.6%	3	5	8
	Polypropylene #5	0.3%	<0.5	0	1
	Mixed Plastic #3, 4, 6, 7	0.2%	<0.5	0	0
	Rigid Plastic	1.8%	1	3	4
	Film Plastic	1.5%	2	2	3
Glass	Mixed Glass	5.1%	6	8	9
Metal	Bi Metal	3.1%	2	5	7
	Aluminum	0.1%	<0.5	0	0
	Aluminum - Other	0.0%	<0.5	0	0
Organics	Organics	1.5%	2	2	3
Other	HHW	0.0%	<0.5	0	0
	Batteries	0.0%	<0.5	0	0
	Medical Waste	0.4%	<0.5	1	1
	Manufactured Products	2.4%	2	4	5
	Polystyrene	0.1%	<0.5	0	0
	Aseptic Lined Containers	0.1%	<0.5	0	0
	Refuse	13.5%	15	20	26
Total		100.0%		150	
Contamination (noted in grey shading above)		19.5% +/- 7.2%	18	29	40

Refuse Characterization

The residual in King City's recycling stream are 19.5 percent of incoming recyclables which includes 13.5 percent refuse. **Exhibit 52** presents the visual characterization of refuse materials in SSR. The most prevalent material is Other materials at five percent. Textiles/Leather represents 2.1 percent and Paper represents 1.4 percent of materials in SSR.

Exhibit 52. Composition of Residuals from King City



Contamination in residential loads is higher than that found in commercial loads as presented in **Exhibit 53**, with residential loads having 25.1 percent contamination and commercial loads having 17.1 percent residuals in 2021.

Exhibit 53. Proportion of Residuals from King City by Sector

Sector	Number of Samples			Contamination		
	2021	2020	2019	2021	2020	2019
Residential	3	2	0	25.1%	42.9%	NA
Commercial	7	8	8	17.1%	20.5%	16.8%
Mixed Loads	0	0	2	NA	NA	19.4%
Total	10	10	10	19.5%	25.0%	17.3%

3.5 HAULER: REPUBLIC SERVICES

Republic Services is the hauler for Salinas. In total, SCS completed 50 recycling stream samples from Salinas. Of the material sampled, 66.8 percent is Recyclable and 33.2 percent is contamination as shown in Exhibit 54.

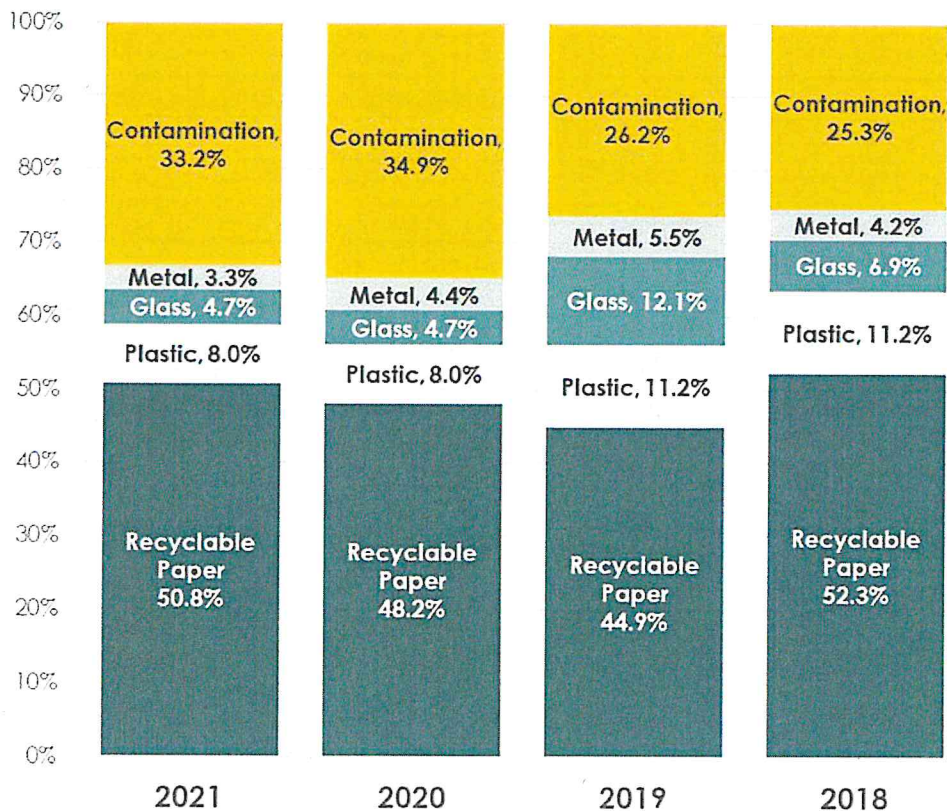
The following section examines the recycling composition by category and material type, the 90% confidence interval, and the visual characterization for Salinas.

3.5.1 Salinas Recycling Composition

Recycling Composition

The composition of Salinas’s recycling stream by category is presented in Exhibit 54. Based on the samples collected, the most prevalent material category by percentage is Recyclable Paper, representing 50.8 percent of the overall recycling stream. Contamination is the second most prevalent material category representing 33.2 percent of the overall recycling stream.

Exhibit 54. Composition of Recyclable Loads from Salinas, 2018 to 2021



A detailed breakdown of Salinas’s recycling stream by material type and associated monthly tonnage is presented in Exhibit 55.

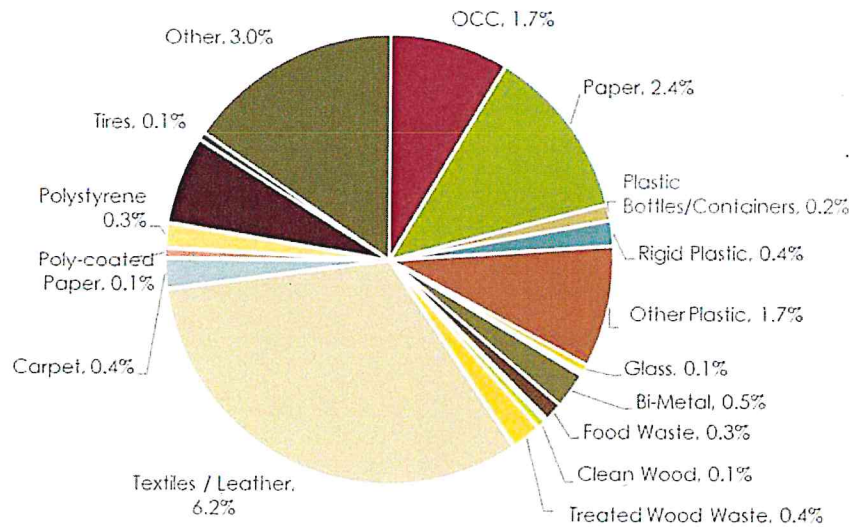
Exhibit 55. Detailed Recycling Composition from Salinas

SALINAS					
Category	Material Type	Average Composition	Monthly Tons (90% Confidence)		
			Low	Average	High
Paper	Uncoated Corrugated Cardboard	37.0%	575	592	609
	White Office Paper	1.3%	19	21	22
	Mixed Paper	7.4%	115	119	123
	Paper Board	3.8%	59	62	64
	Old Newspaper	1.2%	19	20	21
Plastic	PET	1.2%	18	19	19
	PET Thermoform	1.6%	24	26	27
	Natural HDPE	0.7%	11	12	12
	Pigment HDPE	1.3%	19	20	21
	Polypropylene #5	0.5%	7	7	8
	Mixed Plastic #3, 4, 6, 7	0.5%	7	7	8
	Rigid Plastic	2.3%	34	37	40
	Film Plastic	3.3%	49	53	58
Glass	Mixed Glass	4.7%	73	76	79
Metal	Bi Metal	2.9%	44	46	48
	Aluminum	0.2%	3	3	3
	Aluminum - Other	0.2%	2	2	3
Organics	Organics	6.4%	96	102	108
Other	HHW	0.3%	4	5	7
	Batteries	0.0%	1	1	1
	Medical Waste	1.2%	18	19	21
	Manufactured Products	2.1%	31	33	36
	Polystyrene	0.1%	2	2	2
	Aseptic Lined Containers	0.4%	6	6	6
	Refuse	19.3%	299	309	319
Total		100.0%		1,600	
Contamination (noted in grey shading above)		33.2% +/- 3.2%	481	531	582

Refuse Characterization

The residual in Salinas's recycling stream is 33.2 percent of incoming recyclables which includes 19.3 percent refuse. **Exhibit 56** presents the visual characterization of refuse materials in SSR. The most prevalent material is Refuse Less than 3-Inches at 7.0 percent. Textiles/Leather represents 6.2 percent and OCC represents 3.4 percent of refuse materials in SSR.

Exhibit 56. Composition of Residuals from Salinas



The residuals varied significantly by sector as presented in **Exhibit 57**, with residential and mixed loads having 36.3 and 35.7 percent contamination respectively compared to commercial loads which had 25.6 percent contamination in 2021.

Exhibit 57. Proportion of Residuals from Salinas by Sector

Sector	Number of Samples			Contamination		
	2021	2020	2019	2021	2020	2019
Residential	10	26	10	36.3%	40.1%	33.8%
Commercial	13	22	16	25.6%	29.0%	20.2%
Mixed Loads	27	2	24	35.7%	30.3%	27.1%
Total	50	50	50	33.2%	34.9%	26.2%

3.6 HAULER: CITY OF WATSONVILLE PUBLIC WORKS

The City of Watsonville is the hauler for Watsonville. In total, SCS completed 10 recycling stream samples from the City of Watsonville. Of the material sampled, 72.6 percent is Recyclable and 27.4 percent is Contamination as shown in Exhibit 58.

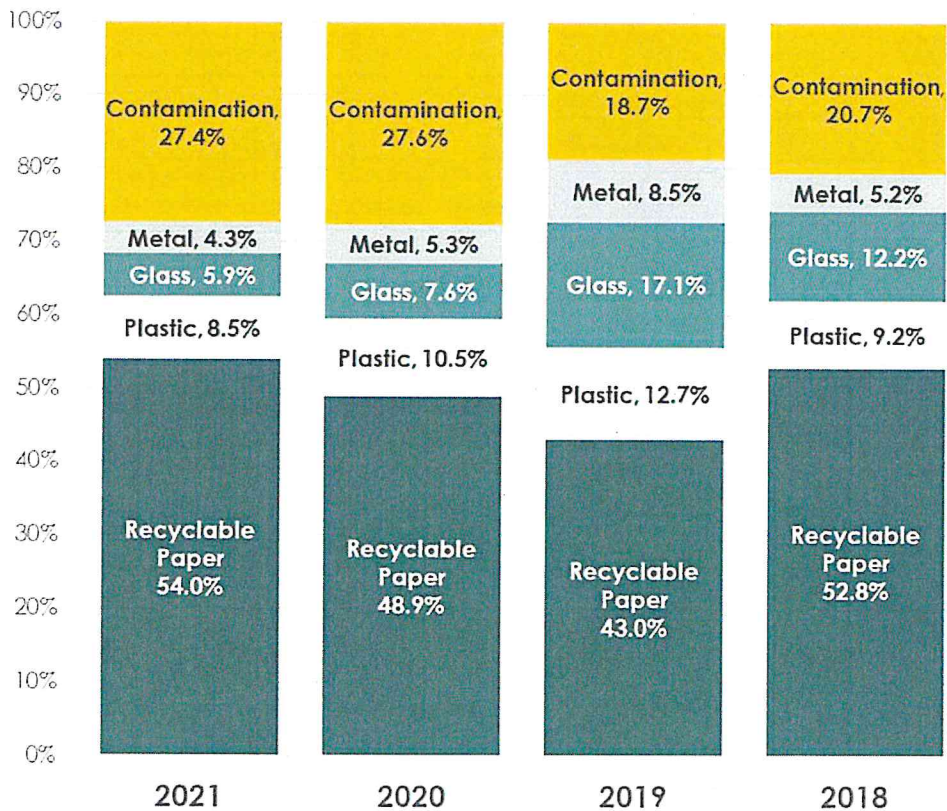
The following section examines the recycling composition by category and material type, the 90% confidence interval, and the visual characterization for Watsonville.

3.6.1 Watsonville

Recycling Composition

The composition of Watsonville commercial recycling stream by category is presented in Exhibit 58. Based on the samples collected, the most prevalent material category by percentage is Recyclable Paper, representing 54.0 percent of the overall recycling stream. Contamination is the second most prevalent material category representing 27.4 percent of the overall recycling stream.

Exhibit 58. Composition of Recyclable Loads from Watsonville, 2018 to 2021



A detailed breakdown of Watsonville’s recycling stream by material type and associated monthly tonnage is presented in Exhibit 59.

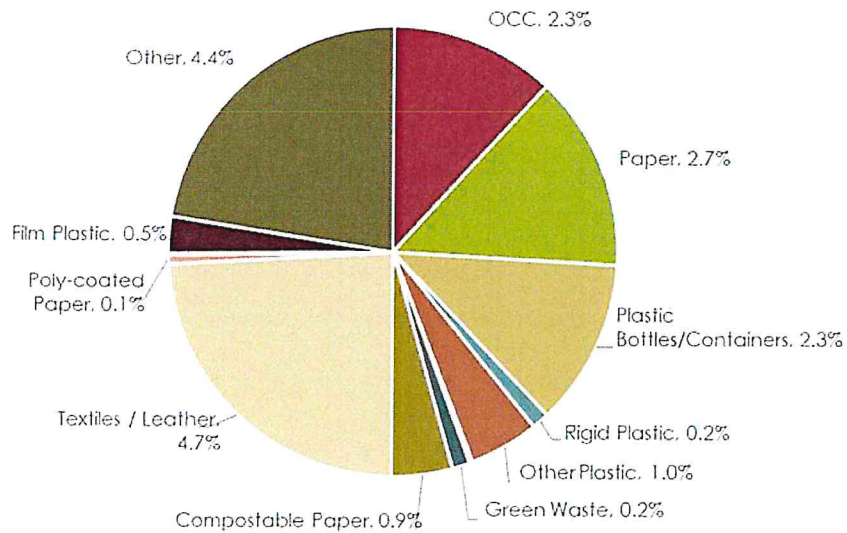
Exhibit 59. Detailed Recycling Composition from Watsonville

WATSONVILLE					
Category	Material Type	Average Composition	Monthly Tons (90% Confidence)		
			Low	Average	High
Paper	Uncoated Corrugated Cardboard	37.7%	36	45	55
	White Office Paper	1.4%	1	2	2
	Mixed Paper	7.2%	7	9	10
	Paper Board	4.5%	4	5	6
	Old Newspaper	3.2%	3	4	5
Plastic	PET	1.2%	1	1	2
	PET Thermoform	1.0%	1	1	1
	Natural HDPE	1.4%	1	2	2
	Pigment HDPE	1.7%	2	2	3
	Polypropylene #5	0.8%	1	1	1
	Mixed Plastic #3, 4, 6, 7	0.8%	1	1	1
	Rigid Plastic	1.6%	1	2	3
	Film Plastic	2.1%	2	3	3
Glass	Mixed Glass	5.9%	6	7	8
Metal	Bi Metal	3.8%	4	5	6
	Aluminum	0.3%	<0.5	0	1
	Aluminum - Other	0.2%	<0.5	0	0
Organics	Organics	3.9%	3	5	6
Other	HHW	0.3%	<0.5	0	1
	Batteries	0.0%	<0.5	0	0
	Medical Waste	0.2%	<0.5	0	0
	Manufactured Products	0.8%	<0.5	1	1
	Polystyrene	0.1%	<0.5	0	0
	Aseptic Lined Containers	0.4%	<0.5	0	1
	Refuse	19.5%	19	23	28
Total		100.0%		120	
Contamination (noted in grey shading above)		27.4% +/- 7.6%	24	33	42

Refuse Characterization

The residual in Watsonville’s recycling stream is 27.4 percent of incoming recyclables which includes 19.5 percent refuse. **Exhibit 60** presents the visual characterization of refuse materials in SSR. The most prevalent materials are Textiles/Leather at 4.7 percent of SSR, followed by Other materials at 4.4 percent, Paper at 2.7 percent, and OCC and Plastic Bottles/Containers each representing 2.3 percent of materials in SSR.

Exhibit 60. Composition of Residuals from Watsonville



The residuals varied by sector in 2021 as presented in **Exhibit 61**, with residential loads having 30.9 percent residuals compared to commercial loads which had 22.0 percent residuals.

Exhibit 61. Proportion of Residuals from Watsonville by Sector

Sector	Number of Samples			Contamination		
	2021	2020	2019	2021	2020	2019
Residential	6	5	4	30.9%	28.4%	25.1%
Commercial	4	5	4	22.0%	26.8%	12.8%
Mixed Loads	0	0	2	NA	NA	18.0%
Total	10	10	10	27.4%	27.6%	18.7%

3.7 HAULER: RECOLOGY

Recology is the hauler for San Benito County. In total, SCS completed 20 recycling stream samples from San Benito County. Of the material sampled, 72.5 percent is Recyclable and 27.5 percent is Contamination as shown in Exhibit 62.

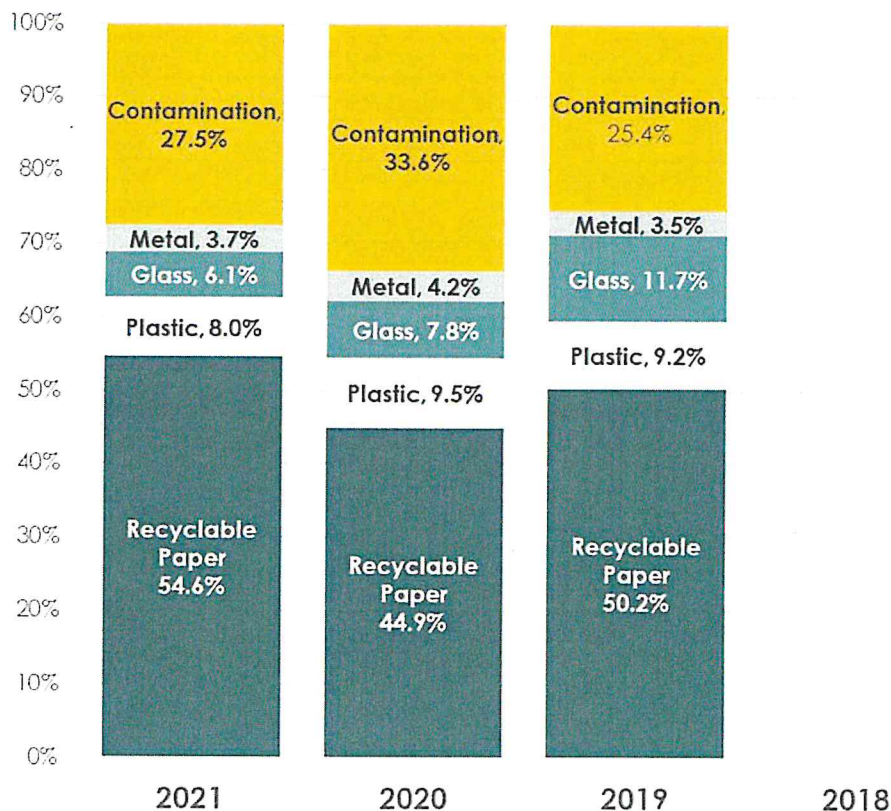
The following section examines the recycling composition by category and material type, the 90% confidence interval, and the visual characterization for San Benito County.

3.7.1 San Benito County

Recycling Composition

The composition of San Benito County's recycling stream by category is presented in Exhibit 62. Based on the samples collected, the most prevalent material category by percentage is Recyclable Paper, representing 54.6 percent of the overall recycling stream. Contamination is the second most prevalent material category representing 27.5 percent of the overall recycling stream.

Exhibit 62. Composition of Recyclable Loads from San Benito, 2018 to 2021



A detailed breakdown of San Benito County's recycling stream by material type and associated monthly tonnage is presented in Exhibit 63.

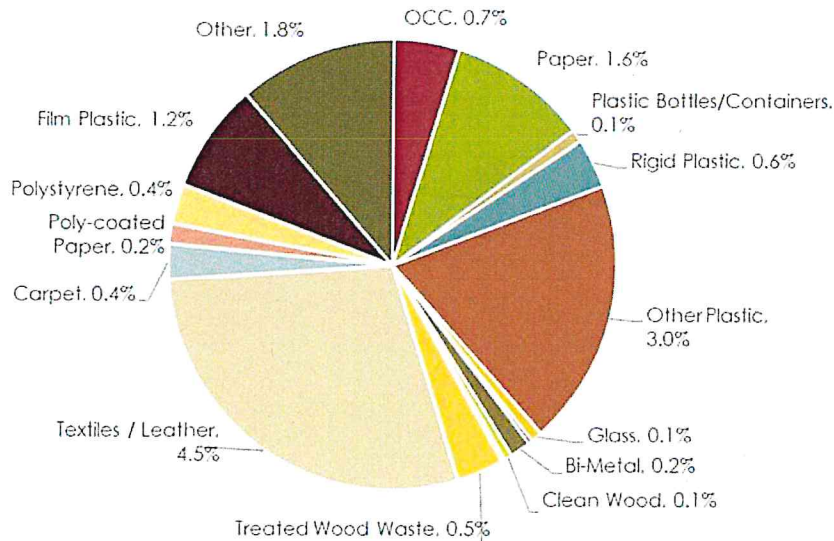
Exhibit 63. Detailed Recycling Composition from San Benito

SAN BENITO COUNTY					
Category	Material Type	Average Composition	Monthly Tons (90% Confidence)		
			Low	Average	High
Paper	Uncoated Corrugated Cardboard	41.4%	161	172	184
	White Office Paper	0.8%	2	3	4
	Mixed Paper	7.0%	26	29	32
	Paper Board	4.3%	16	18	20
	Old Newspaper	1.1%	4	5	5
Plastic	PET	1.6%	6	7	7
	PET Thermoform	0.7%	2	3	3
	Natural HDPE	0.9%	3	4	4
	Pigment HDPE	0.8%	3	3	4
	Polypropylene #5	0.5%	2	2	3
	Mixed Plastic #3, 4, 6, 7	0.4%	1	2	2
	Rigid Plastic	3.2%	11	13	16
	Film Plastic	2.8%	11	12	12
Glass	Mixed Glass	6.1%	23	25	28
Metal	Bi Metal	3.1%	11	13	15
	Aluminum	0.5%	2	2	2
	Aluminum - Other	0.1%	<0.5	0	0
Organics	Organics	5.6%	20	23	27
Other	HHW	0.1%	<0.5	1	1
	Batteries	0.0%	<0.5	0	0
	Medical Waste	1.0%	3	4	5
	Manufactured Products	2.0%	6	8	11
	Polystyrene	0.1%	<0.5	1	1
	Aseptic Lined Containers	0.3%	1	1	1
	Refuse	15.5%	60	64	69
Total		100.0%		416	
Contamination (noted in grey shading above)		27.5% +/- 4.1%	97	114	131

Refuse Characterization

The residual in San Benito County's recycling stream are 35.5 percent of incoming recyclables which includes 21 percent refuse. **Exhibit 64** presents the visual characterization of refuse materials in SSR. The most prevalent material is Refuse Less than 3-Inches at 6.4 percent. Textiles/Leather represents 2.9 percent and OCC represents 2.4 percent of refuse materials in SSR.

Exhibit 64. Composition of Residuals from San Benito



Unlike 2020, the residuals varied significantly by sector as presented in **Exhibit 65**, with residential loads having 33.0 percent residuals compared to commercial loads which had 22.0 percent residuals in 2020.

Exhibit 65. Proportion of Residuals from San Benito by Sector

Sector	Number of Samples			Contamination		
	2021	2020	2019	2021	2020	2019
Residential	10	12	11	33.0%	33.3%	28.0%
Commercial	10	8	4	22.0%	34.0%	8.1%
Mixed Loads	0	0	5	NA	NA	33.8%
Total	20	20	20	27.5%	33.6%	25.4%