



# 3

## Solid Waste Data and Trends

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# Chapter 3 Solid Waste Data and Trends

## Overview

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Seattle is a data-driven city. Over the last three decades, Seattle has built one of the most extensive solid waste datasets in the United States. SPU uses existing data to assess current solid waste facilities and services. As part of the solid waste planning process, SPU also uses its data to run sophisticated models that forecast future waste generation, diversion, and disposal and to project how different sets of services will perform. This chapter describes the data Seattle measures and how it analyzes them to inform design and development of solid waste facilities, policies, and services. The chapter covers:

- Types and sources of waste
- How SPU measures and models Seattle's waste
- Demographic, economic, and environmental factors that affect planning
- Waste generation trends and forecasts for commercial, residential, and self-haul waste
- Recycling and composting trends and forecasts for commercial, residential, and self-haul waste
- Capture rate estimates for commercial, residential, and self-haul waste
- Waste composition study results
- Trends and forecasts for construction and demolition (C&D) debris waste generation and recycling

## Types and Sources of Waste

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Solid waste includes all the garbage, recycling, organics (yard and food waste), and construction and demolition debris collected within Seattle and hauled to the City's recycling and disposal (transfer) stations. It includes waste generated by commercial, residential, and self-haul customers as well as waste from construction and demolition projects (called C&D debris) that

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is managed separately from commercial, residential, and self-haul waste. Because C&D debris contains substantially different materials and is typically managed separately, Seattle has historically tracked and reported C&D debris separately from commercial, residential, and self-haul waste.<sup>1</sup> In some cases, commercial, residential, and self-haul waste includes some C&D materials, if disposed of at North and South Transfer Stations or placed in residential or business garbage containers.



*Residential carts in front of a house are ready for collection (Source: SPU Image Library)*

Seattle's waste is generated by five sectors:

- 1 Commercial includes nonresidential customers, such as businesses and nonprofit organizations. Typically, dumpsters are picked up as needed by the account that serves commercial buildings. For the past 21 years, the commercial sector has generated the most waste of any non-C&D debris sector, ranging from 40% to 52% of waste generated by commercial, residential, and self-haul customers.
- 2 Single-family residential includes waste from homes that have cans or carts picked up at the curb. These residences are typically single-family homes, up to and including fourplexes. The single-family sector generates the second most tons of non-C&D debris waste, around 26% to 33% in recent years.

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<sup>1</sup> Previous versions of *Seattle's Solid Waste Plan* and annual *Waste Prevention and Recycling Reports* used the term "municipal solid waste (MSW)" to mean all commercial, residential, and self-haul waste. The 2022 *Plan Update* no longer uses that term (except in selected appendices) in order to align with Washington State's legal definition of municipal solid waste as "a subset of solid waste which includes unsegregated garbage, refuse and similar solid waste material discarded from residential, commercial, institutional and industrial sources and community activities, including residue after recyclables have been separated" in Washington Administrative Code ([WAC 173-350-100](#)).

- 3 Self-haul includes residents and businesses who bring waste they create for drop-off at City-owned transfer stations. It also includes waste from nonresidential generators that do not use the City's solid waste contractors, including the Seattle Housing Authority, University of Washington, and military establishments. In recent years, self-haul waste has accounted for about 9% to 17% of non-C&D debris waste.
- 4 Multifamily residential includes waste picked up from residential buildings or complexes that have dumpster or detachable container service. Typically, these buildings have five or more housing units. This sector consistently generates the least waste of any non-C&D debris sector, with 9% to 12% of tons.
- 5 Construction and demolition (C&D) and landclearing debris includes wood waste, metals, asphalt roofing, gypsum, and other materials generated by construction, demolition, or landclearing activities that are not disposed of at City-owned transfer stations or mixed with commercial, residential, and self-haul waste. In 2020, C&D sector generated more tons overall than any other sector for the 10th straight year.

The Hazardous Waste Management Program in King County, which is a joint program supported and implemented by Seattle, King County, Public Health – Seattle and King County, and the Suburban Cities Association, manages **moderate risk waste**. **Moderate risk waste** includes household hazardous waste from residents and small quantity generator waste from businesses, which is discussed briefly in Chapter 6, *Solid Waste Handling Collection and Removal*.

**Other categories of waste** are not allowed in commercial, residential, and self-haul waste, such as biomedical, asbestos, biosolids, and dangerous wastes. These wastes require special handling and disposal due to regulatory requirements or other reasons such as toxicity or specific safe handling methods. Proper disposal options for these other wastes are discussed in Chapter 6, *Solid Waste Handling Collection and Removal*.

SPU uses sector-specific collection and disposal data to assess current and plan for future solid waste facilities and services. SPU's customer services, particularly those around outreach and education, are developed specifically around the four generating sectors or customer audiences. The following sections describe how Seattle gets data on sector-specific waste or discarded material. Measurement of prevented waste is discussed in Chapter 4, *Waste Prevention and Reuse*.

## Measuring and Modeling Seattle's Waste

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This section details how SPU collects sector-specific solid waste data and then uses those data to forecast service performance using sophisticated modeling. SPU uses a range of data and modeling tools to track recycling progress and analyze future services. Data sources include routine reports from SPU's contracted collectors and processors and yearly reports from recycling businesses. Seattle analyzes the data for many reasons, such as evaluating the efficacy of its services and policies, identifying service gaps or areas for improvement, supporting policy development, and identifying patterns and trends that inform customer outreach and education.

To further understand waste in Seattle, SPU conducts waste composition studies on roughly four- to six-year cycles by sector. These studies show what people are putting in the waste streams and help SPU assess the efficacy of its services and policies and identify opportunities to improve. SPU also gathers waste prevention data on a project-by-project basis, as noted in Chapter 2, *Maximizing and Measuring Impact: Moving Upstream Beyond the Recycling Rate*. This section concludes by describing the two key models SPU uses to analyze and forecast recycling performance:

- The Seattle Discards Model analyzes past recycling performance
- The Recycling Potential Assessment Model analyzes future services, including those recommended in the *2022 Solid Waste Plan Update (2022 Plan Update)*

## Commercial Waste

Commercial waste includes garbage, recycling, and food and yard waste discarded by businesses, schools, and other institutions in Seattle that is collected in containers at those locations and not self-hauled by the generator to the transfer stations or a recycling site.

Data for commercial garbage come from reporting requirements built into collection contracts to assess contractor performance. SPU has data for each truck trip on a commercial collection route to the transfer stations. Weekly trip data provides SPU with the total tons of all materials collected under City contract as garbage, recycling, and food and yard waste.<sup>2</sup> SPU summarizes

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<sup>2</sup> Note that few commercial customers have recycling and/or food and yard waste collected under the City's contract.

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the data quarterly (showing monthly data) and posts the summaries on SPU's [Solid Waste Reports](#) webpage.<sup>3</sup>

Data on “open market” or non-contracted commercial and C&D recycling and commercial composting can be difficult to obtain and analyze but are important to help Seattle understand the citywide recycling rate. Per state law, businesses and nonprofit organizations can choose to use City-contracted recycling and food and yard waste haulers for commercial collection, or they can hire any hauler on the open market.

SPU obtains open market recycling data through the annual [City of Seattle Recycler License](#) requirement.<sup>4</sup> Seattle requires recycling collectors and processors operating in the city to submit an annual report to maintain their City of Seattle Recycler License. They must report annual tons recycled, by material, and end-location or end-use of the material.

SPU analyzes the reports to minimize the double counting of tons (where the recycler who collected material and the processor who received it both report tons for that material). SPU relies on annual self-reporting of open market commercial and C&D recycling and commercial composting from recycling collectors and processors to estimate the commercial and C&D recycling rates each year.

In addition to the recyclers' reports, SPU receives detailed trip-level data for tons of recycling and food and yard waste collected from nonresidential customers under SPU's collection contracts to assess contractor performance. SPU combines these tons with the information from the recyclers' reports to report progress on reducing waste in the annual *Waste Prevention & Recycling Report*.<sup>5</sup>



*SPU staff members inspect commercial garbage and recycling carts (Source: SPU Image Library)*

<sup>3</sup> <http://www.seattle.gov/utilities/about/reports/solid-waste-reports>

<sup>4</sup> <http://www.seattle.gov/utilities/about/reports/solid-waste-reports/recycler-annual-reports>

<sup>5</sup> Seattle Public Utilities, “2020 Annual Waste Prevention & Recycling Report,” October 2021, [https://www.seattle.gov/Documents/Departments/SPU/Documents/Recycling\\_Rate\\_Report\\_2020.pdf](https://www.seattle.gov/Documents/Departments/SPU/Documents/Recycling_Rate_Report_2020.pdf).

## Residential Waste

SPU's residential waste data come from reporting requirements built into collection contracts to assess contractor performance. SPU has data for each truck trip through a Seattle neighborhood to a processing center. Weekly trip data provides SPU with the total tons of all materials collected as garbage, recycling, and food and yard waste. SPU summarizes the data quarterly (showing monthly data) and posts the summaries on SPU's [Solid Waste Reports](#) webpage.<sup>6</sup>

To assess progress on food and yard waste recovery, SPU estimates the amount of food waste versus yard waste in residential food and yard waste collection using the Seattle Discards Model (described below). This statistical model uses historical data and current conditions to model waste generation, including projecting yard waste tons based on annual variations in weather.

SPU measures onsite (backyard) food and yard waste management as waste prevention because these materials never enter the collection system. In the past, Seattle has primarily relied on the Home Organics Survey to measure onsite or backyard management of food and yard waste.<sup>7</sup> Historically, SPU has conducted this survey approximately every five years to update information on how many households compost at their homes and recycle their grass by leaving their mower clippings on the lawn (also called “grasscycling” or “mulch mowing”).

Home Organics Survey data were combined with other data on average amounts of yard and food waste collected per household through the food and yard waste collection program. SPU uses all these data to estimate the number of tons of food and yard waste diverted from landfill. Since SPU conducts the Home Organics Survey roughly every five years, estimates for tons diverted through management at home remain constant until SPU has new data to re-estimate the tons diverted.

## Self-Haul Waste

When self-haul customers enter and leave the City's transfer stations, they drive across a scale and interact with SPU staff at the scale house. SPU counts the number of customers (trips) and weighs the tons of garbage and yard waste they bring to understand waste generation for this sector.

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<sup>6</sup> <http://www.seattle.gov/utilities/about/reports/solid-waste-reports>

<sup>7</sup> Seattle Public Utilities, prepared by FBLK Research, “2018 Home Organics Waste Management Survey Report,” May 2018, [www.seattle.gov/Documents/Departments/SPU/Documents/Home\\_Organics\\_Survey\\_2018.pdf](http://www.seattle.gov/Documents/Departments/SPU/Documents/Home_Organics_Survey_2018.pdf).

SPU also has data on the amount of organic material hauled from the transfers stations to processing facilities. Having both sets of data serve as a check on the total tons of organic material. SPU reports food and yard waste tons quarterly (as monthly data) in the *Residential Organics Report*.

Recycling in the self-haul sector consists of self-haul yard waste (for composting) and a variety of other recyclable materials placed in drop boxes. For self-haul recycling, customers typically do not cross the scale to weigh their vehicles. Instead, SPU obtains outbound weight reports from the trucks that haul recyclables away from the transfer stations to processors.



*Customers drive across a scale at the North Transfer Station (Source: SPU Image Library)*

## Construction and Demolition Debris

Seattle requires C&D debris recyclers and processors to submit annual facility reports to SPU and to document the facilities to which they sent material, along with the quantities of material diverted. C&D debris recyclers must also submit the same annual recycling and reuse report as commercial recyclers, as described above, to obtain a Recycler License. All Seattle Department of Construction and Inspection permit applicants for new construction, remodeling, and demolition through the must submit a Waste Diversion Report to SPU.

## Waste Composition Studies

SPU conducts waste composition studies to measure the quantity and type of materials discarded in Seattle, sorting waste into dozens of categories. Seattle staggers its studies of

waste composition on four- to six-year cycles. Table 3.1 shows most recent years that Seattle conducted composition studies by sector and waste stream. Study reports are available on the [SPU's Solid Waste Reports webpage](#).<sup>8</sup>

**Table 3.1     Most Recent Seattle Waste Composition Studies by Study Year**

SECTOR	GARBAGE	RECYCLING	FOOD & YARD
Single-family residential	2020–2021	2020–2021	2016
Multifamily residential	2020–2021	2020–2021	2016
Commercial	2016	NA	2016
Self-haul	2017-2018	NA	NA
C&D debris	2013-14	NA	NA

*Note: Years represent when data were collected, not when reports were published*

The studies help Seattle measure progress toward waste prevention and recycling rate goals and identify opportunities to reduce or recycle more materials. They also provide key data for the Recycling Potential Assessment Model (described below and in Appendix E, *Recycling Potential Assessment and Environmental Benefits Analysis*, to evaluate and prioritize recommendations utilized in each solid waste plan update, including the *2022 Plan Update*. The most recent published composition data are presented in Waste Composition Study Results starting on page 3.34. Results from the 2020–2021 residential garbage and recycling study have not yet been published.

## Seattle Discards Model

The Seattle Discard Model is not technically a data source, but an analytical tool that uses readily available data on commercial, residential, and self-haul waste to understand the effects of policy or program interventions on behavior. SPU uses the Seattle Discards Model to analyze recycling program performance. The Seattle Discards Model establishes a relationship between monthly collection quantities of garbage, recycling, and food and yard waste, as well as the factors that affect these discarded amounts. For instance, one calculation in the model estimates the effect of changes in household size or income on the amount of waste that households discard in the curbside recycling stream. Another part of the calculation estimates the impacts on residential garbage from similar changes. The Seattle Discards Model contains a

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<sup>8</sup> <http://www.seattle.gov/utilities/about/reports/solid-waste-reports>

set of calculations around expected garbage, recycling, and food and yard waste quantities, depending on factors such as:

- Unemployment rate
- Housing prices
- Household size
- Household income
- Average and marginal fees for collection
- Other factors such as temperature and precipitation

If a new factor, or a “shock to the system” emerges, such as the introduction of a disposal ban, the Seattle Discards Model can isolate the tonnage impact of the ban from the other factors that are also affecting waste tonnage. The Seattle Discards Model includes calculations for residential garbage, residential recycling, residential food and yard waste, self-haul garbage, and commercial garbage. Each calculation has its own set of factors, which explain the various garbage and recycling streams. Variables in the calculations have changed over time, but the overall methodology is the same. SPU continually works to refine and improve the model.

## Recycling Potential Assessment Model

The Recycling Potential Assessment Model forecasts potential increases in recycling from a combination of programs, referred to as scenarios. The model starts with an econometric (mathematical economic) forecast of waste generation based on demographic and economic forecasts. It uses data from waste composition studies about what is left in the waste stream. The model estimates new recycling diversion based on assumptions about how effective each program could be for each affected material. Recycling Potential Assessment Model results include forecasted recycling rates through 2040, as well as the costs and avoided costs of each program and scenario.

The Recycling Potential Assessment Model also calculates estimated new or incremental costs associated with implementing and running each program. Examples of costs are new staff, customer education, and equipment and contractor payments. In addition, the model calculates the savings from each of the programs when the new tons recycled do not have to be collected, transferred, and disposed. This is called the “avoided cost,” or the financial benefit, to recycling. For a description of and details about the Recycling Potential Assessment Model analysis, as well as the Measuring Environmental Benefits Calculator, commonly known as MEBCalc, a second analysis SPU uses to calculate the economic value of environmental benefits associated with recycling, see Appendix E, *Recycling Potential Assessment and Environmental Benefits Analysis*.

## Demographic, Economic, and Environmental Factors in Planning

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Seattle considers a variety of demographic, economic, and environmental factors to understand, plan for, and forecast waste trends and to inform the design and implementation of customer services. For instance, Seattle looks at population and economic activity, including employment trends, to better understand and predict waste generation. Waste generation trends and forecasts play a key role in SPU's design of solid waste facilities, for example, where long-range tonnage forecasts help determine capacity, equipment, and staffing requirements. Changes in customer population including growth, changing demographics, and shifting of housing types, such as single-family to multifamily, affect the types and amounts of waste discarded by customers as well as awareness and ability to participate in diversion programs. SPU examines demographic data on race, housing trends, and language to better understand who its customers are and ensure its services are accessible to all.



*An SPU staff member outside of a multifamily building in Seattle (Source: SPU Image Library)*

## Population

Population growth is a key factor that affects waste generation. In the past decade, Seattle grew at a staggering rate. During the so-called “Amazon Boom” of the past 11 years (2010-2020), Seattle grew by 25%, or 152,000 residents, from about 609,000 to 761,000 people. This represents more newcomers to the city than in the previous 30 years combined. Seattle ranked as the fastest-growing major city in 2020 and was the fastest-growing major city for the overall period from 2010 to 2020.<sup>9</sup>

Seattle’s rapid growth was faster than forecasted, with the population in 2020 (761,000) nearly reaching earlier official projections for 2035 (765,000).<sup>10</sup> Those official projections forecasted that in 2040 Seattle would have nearly 798,000 residents and 397,000 households. As of October 2021, updated forecasts are not available for Seattle, but regional forecasts for King, Pierce, Snohomish, and Kitsap counties project the population will grow by 37% and households will grow by 46% from 2020 to 2050.<sup>11</sup>

Recent and projected population changes include continued anticipated growth in the multifamily sector and changing demographics, such as tech sector growth, increase in millennials, increase in housing density, changing immigrant populations, increase of retirees, and population turnover. Approaches used in the past may not be as effective or resonate with new audiences. For example, residents in apartment units may require more tailored tools for food scrap collection because the kitchen space available for a container may be limited.

With a total area of approximately 142 square miles, of which more than 40% are water, Seattle’s current population density is approximately 9,500 people per square mile. As the population grows and density increases in the city, new collection challenges arise. For example:

- Increased density reduces the areas available for container setouts
- Types and sizes of new buildings require review of solid waste service options
- Curbside collection options can be impacted by competing uses for street space, such as bike lanes, tree areas, pedestrian ways, and parking

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<sup>9</sup> Gene Balk / FYI Guy, " Surprise! Seattle was the fastest-growing big U.S. city in 2020," Seattle Times, 27 May 2021, <https://www.seattletimes.com/seattle-news/data/surprise-seattle-was-the-fastest-growing-big-u-s-city-in-2020> Accessed 20 October 2021.

<sup>10</sup> Puget Sound Regional Council, “Land Use Vision version 2 (LUV.2) Dataset,” Accessed 12 August 2019, <https://www.psrc.org/projections-cities-and-other-places>.

<sup>11</sup> Puget Sound Regional Council, “2018 Regional Macroeconomic Forecast,” Accessed 20 October 2021, <https://www.psrc.org/regional-macroeconomic-forecast>.

Maintaining good street access for staging containers and collection, particularly for dumpsters, presents many challenges. The new trend in building larger multifamily buildings as well as multi-use buildings, which combine residential and commercial spaces, will impact which solid waste service strategies and designs are effective. In addition, intermingling of mixed-use multifamily and single-family residences in historically single-family neighborhoods increases collection truck traffic, as different types of trucks are needed to service dumpsters versus curbside carts. City traffic slows collection overall, and heavy collection trucks cause wear and tear on streets and alleys that require ongoing maintenance.

## Language

According to the most recent American Community Survey, 79% of Seattle's population speaks English only.<sup>12</sup> About 5% are a “limited English-speaking household,” which is defined by the U.S. Census Bureau as “a household in which no person 14-years-old and over speaks only English, and no person 14-years-old and over who speaks a language other than English speaks English ‘very well’.”<sup>13</sup> Seattle maintains a map that shows the percentage of the population that speaks a language other than English by census tract: *Race and Social Justice Initiative/Inclusive Outreach and Public Engagement Language Maps* ([RSJI/IOPE Language Maps](#)).<sup>14</sup> Table 3.2 summarizes the categories of non-English spoken at home in Seattle. Understanding language use throughout the city enables SPU to provide culturally relevant communications to its diverse communities.

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<sup>12</sup> U.S. Census Bureau, “American Community Survey, 2015-2019 American Community Survey 5-Year Estimates,” Accessed March 2, 2021, <https://data.census.gov/cedsci/table?q=ACSST5Y2017.S1601&g=1600000US5363000&tid=ACSST5Y2019.S1601>.

<sup>13</sup> U.S. Census Bureau, “American Community Survey, 2015-2019 American Community Survey 5-Year Estimates,” Accessed March 2, 2021. <https://data.census.gov/cedsci/table?q=language&g=1600000US5363000&tid=ACSST5Y2019.S1602>

<sup>14</sup> City of Seattle, “RSJI/IOPE Languages Spoken,” Accessed August 23, 2019, <http://seattlecitygis.maps.arcgis.com/apps/MapSeries/index.html?appid=d21c05ff5c9f41b98c2585497072586a>.

**Table 3.2 Seattle Languages Spoken at Home**

<b>SPEAK A LANGUAGE OTHER THAN ENGLISH</b>		<b>% OF POPULATION</b>
Speak a language other than English		21.3%
Spanish		4.1%
Other Indo-European language		4.2%
Asian and Pacific Island languages		10.2%
Other languages		2.8%

*Source: 2019 American Community Survey Five-Year Estimates.*

## Race and Ethnicity

Table 3.3 presents Seattle demographics by race. Some respondents identify with two or more races in combination. Nearly 11% of Seattle's population identified as Hispanic or Latino in 2020.<sup>15</sup> Understanding race and ethnicity throughout the city enables SPU to provide culturally relevant communications to its diverse communities.

**Table 3.3 Seattle Racial Identity**

<b>RACE</b>	<b>% OF POPULATION</b>
White alone	55.5%
Asian alone	18.0%
Two or more races in combination	10.6%
Black or African American alone	8.8%
Some other race alone	5.3%
Native Hawaiian and other Pacific Islander alone	0.9%
American Indian and Alaska Native alone	0.8%

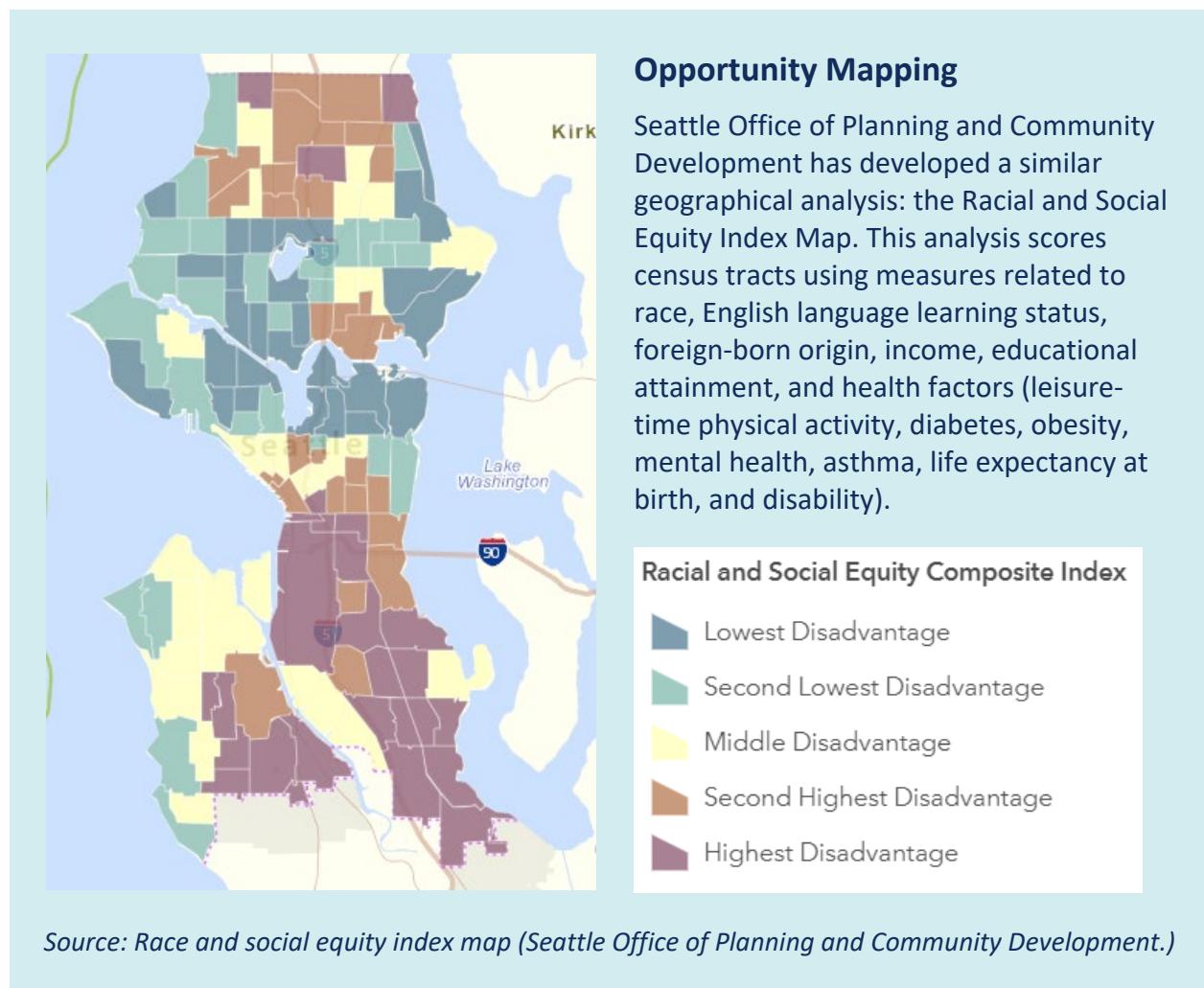
*Source: 2020 Census Redistricting Data (Public Law 94-171.)*

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<sup>15</sup> U.S. Census Bureau, “2020 Census Redistricting Data (Public Law 94-171),” Accessed October 5, 2021, <https://data.census.gov/cedsci/table?q=hispanic%20latino%20in%20seattle&tid=DECENNIALPL2020.P2&hidePrevious=true>.

## Opportunity

In 2018, Puget Sound Regional Council (PSRC) updated its Opportunity Mapping data, which uses several factors to assess opportunity by geography across PSRC's four-county region (King, Snohomish, Kitsap, and Pierce counties).<sup>16</sup> PSRC uses indicators to assess opportunity, including level of education, economic health, neighborhood and housing quality, mobility and transportation, and public and environmental health to show where conditions and outcomes vary across a range of opportunity measures. SPU can use this analysis to inform its decision-making and assessments of service equity across the city. For example, by collecting zip code data during customer satisfaction surveys, SPU can assess whether levels of satisfaction vary geographically in a way that correlates with this map to identify potential equity issues.



<sup>16</sup> Puget Sound Regional Council, "Opportunity Mapping Technical Addendum," July 2019, <https://www.psrc.org/sites/default/files/opportunitymapping.pdf>.

## Employment

Waste generation directly correlates with economic cycles. For example, solid waste (garbage, recycling, and food and yard waste) generated by commercial, residential, and self-haul sources decreased with the recession after the economic high of 2007. Generation has risen again as the economy recovered and as population has increased, offset somewhat by the effects of waste prevention programs. Recently, waste generation has been in decline despite population growth. With the COVID-19 pandemic, generation reached its lowest point in many years, owing to the economic recession and restrictions on business activity.

Employment in Seattle grew by 23% over the past 20 years, from 502,000 employees in 2000 to 620,000 employees in 2019.<sup>17</sup> Official forecasts conducted in 2017 show Seattle employment, an economic indicator, rising through the year 2040 (Table 3.4).<sup>18</sup> The number of employees in each commercial sector factors into the volumes and types of waste generated from businesses. The finance, insurance, real estate, and services sector employs more than half of all workers in Seattle. Forecasts project that all employment sectors will rise except manufacturing, suggesting that waste generation will also increase. As of October 2021, updated forecasts were not available for Seattle. Regional forecasts for King, Pierce, Snohomish, and Kitsap counties project employment will grow by 44% from 2020 to 2050.<sup>19</sup>

**Table 3.4 Forecasted Seattle Employment Trends by Sector through 2040**

	2025	2030	2035	2040
Construction, Resources	20,505	20,320	21,039	22,316
Education	15,272	15,788	16,196	16,624
Finance, Insurance, Real Estate, Services	352,136	365,322	393,386	435,478
Government	80,225	79,130	77,634	77,222
Manufacturing, Wholesale, Trade, Utilities	64,726	61,706	61,774	63,572
Retail, Food Services	107,383	110,662	122,427	135,986
<b>Total</b>	<b>640,247</b>	<b>652,928</b>	<b>692,456</b>	<b>751,198</b>

Source: Puget Sound Regional Council Land Use Vision 2 Dataset, April 2017.

<sup>17</sup> Washington State Employment Security Department, Quarterly Census of Employment and Wages, nd. Figures represent employment in industries covered by unemployment insurance.

<sup>18</sup> Puget Sound Regional Council, "Land Use Vision version 2 (LUV.2) Dataset," 2017, <https://www.psrc.org/projections-cities-and-other-places>.

<sup>19</sup> Puget Sound Regional Council, "2018 Regional Macroeconomic Forecast," Accessed 20 October 2021, <https://www.psrc.org/regional-macroeconomic-forecast>.

## Consumption

Changes in customer population and consumption habits affects the type and quantity of material that residents and businesses set out for collection. Examples include continued shifts away from manufacturing businesses toward more service and office-type businesses, growth of the technology sector, population increases, in-migration from out-of-state, and aging of the baby boomer population. SPU frequently identifies and responds to changes in the waste stream as producers continually introduce new products and materials. One example is increased use of non-recyclable lightweight plastic bubble-wrap envelopes for shipping by online retailers instead of heavyweight, recyclable cardboard. By assessing possible future scenarios based on these trends, SPU is better positioned to provide resilient collection services and customer programs.

## Building Permits

Trends in new construction and demolition activities affect generation of C&D debris as well as commercial, residential, and self-haul waste. Seattle's Office of Planning and Community Development tracks housing growth and demolition citywide and by neighborhood, providing this information in the online [Housing Growth Report](#).<sup>20</sup> Table 3.5 shows permitting data for residential units from 2016 through 2020.

**Table 3.5 Building Construction Units by Year of Final Inspection 2016–2020**

	2016	2017	2018	2019	2020
New residential construction	7,561	10,626	10,853	11,965	8,815
Residential demolition	610	1,553	666	650	484
<b>Total</b>	<b>8,171</b>	<b>12,179</b>	<b>11,519</b>	<b>12,615</b>	<b>9,299</b>

*Source: Seattle Building Construction Permits from SDCI Permit Data Warehouse.*

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<sup>20</sup> Seattle Office of Planning & Community Development, "Housing Growth Report," Accessed August 23, 2019, <http://seattlecitygis.maps.arcgis.com/apps/opsdaOKshboard/index.html#/1111d274c85e4ca48af719da4b26fe9f>.

## Commercial, Residential, and Self-Haul Waste Generation Trends and Forecasts

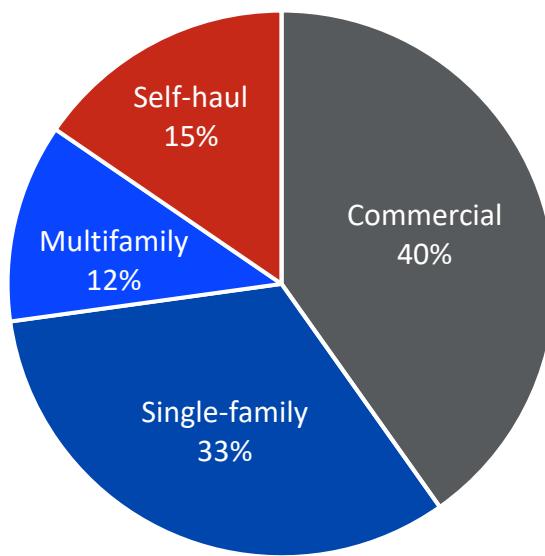
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This section describes past trends in Seattle's generation and forecasts for waste generation through 2040. Understanding past trends and future forecasts helps Seattle understand which sectors are responsible for creating the most waste, evaluate drivers of waste generation, and identify which sectors may need expanded services in the future.

### Total Generation Trends for Commercial, Residential, and Self-Haul Waste

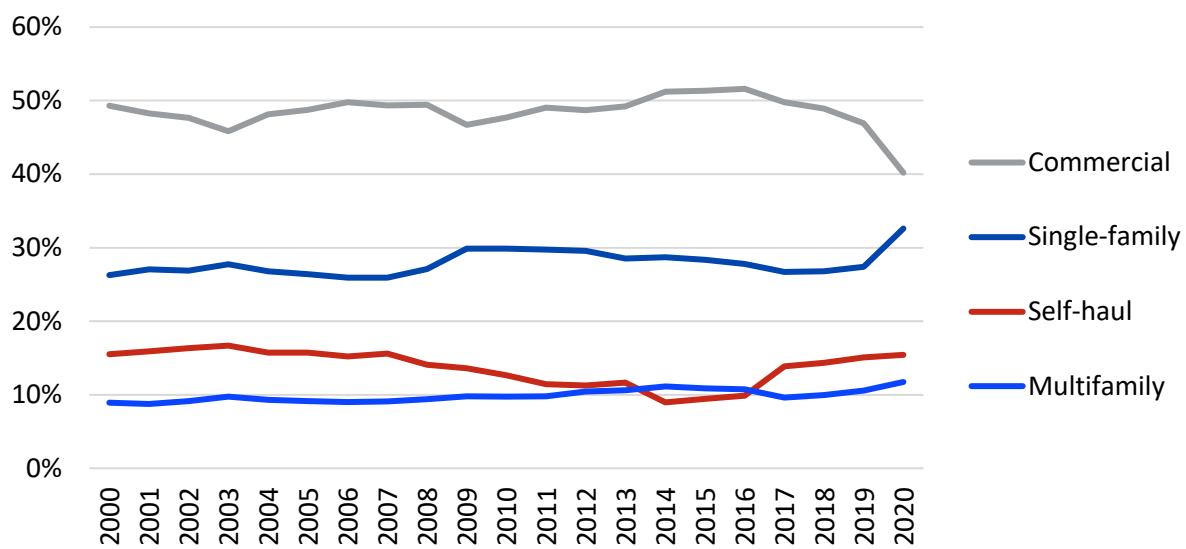
Overall generation of commercial, residential, and self-haul waste is the sum of each sector's share of all waste, which changes over time. Figure 3.1 shows the percentage of total commercial, residential, and self-haul waste generated by each sector in 2020, when the commercial sector discarded 40% of Seattle's non-C&D debris waste, single-family residents were responsible for approximately 33% of that waste while multifamily residents contributed 12%. Before the COVID-19 pandemic disruptions, the commercial sector generated a higher share of waste (47% in 2019). Residents and businesses that self-haul waste to Seattle's transfer stations generated 15% of total waste. Figure 3.2 shows the percentage of total commercial, residential, and self-haul waste generated by each sector from 2000 to 2020.

**Figure 3.1 Estimated Share of Commercial, Residential, and Self-Haul Waste Generated by Sector in 2020**



Source: SPU, "2020 Annual Waste Prevention & Recycling Report."

**Figure 3.2 Estimated Share of Commercial, Residential, and Self-Haul Waste Generated by Sector 2000–2020**



Source: SPU, "2020 Annual Waste Prevention & Recycling Report."

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Commercial, residential, and self-haul tons of generated waste in Seattle have trended downward since 2018 (Table 3.6).

**Table 3.6    Estimated Total Waste Generation for Commercial, Residential, and Self-Haul Waste 2000–2020**

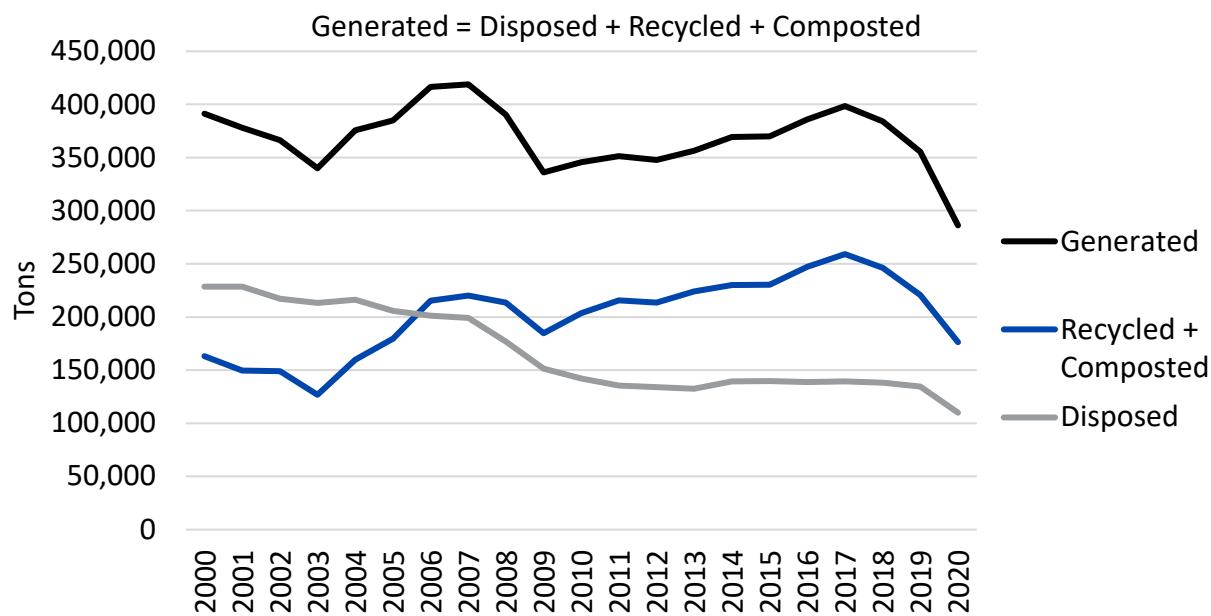
YEAR	COMMERCIAL TONS	SINGLE-FAMILY RESIDENTIAL TONS	SELF-HAUL TONS	MULTIFAMILY RESIDENTIAL TONS	OVERALL CITYWIDE TONS
2000	391,406	208,468	123,024	70,944	793,842
2001	377,927	211,982	124,453	68,611	782,974
2002	366,224	206,474	125,620	70,144	768,462
2003	339,844	205,748	123,597	72,149	741,337
2004	375,739	209,132	122,835	72,640	780,346
2005	385,093	208,675	124,364	72,325	790,456
2006	416,564	216,946	127,444	75,545	836,499
2007	418,979	220,128	132,545	77,108	848,759
2008	390,267	213,889	111,309	74,223	789,688
2009	335,992	215,015	97,893	70,524	719,424
2010	345,692	216,484	91,618	70,675	724,469
2011	351,214	212,861	81,776	70,145	715,996
2012	347,673	211,030	80,568	74,549	713,821
2013	356,480	206,603	84,341	76,960	724,385
2014	369,407	206,992	64,681	80,189	721,269
2015	370,037	204,397	67,993	78,278	720,705
2016	385,846	207,804	73,923	80,478	748,051
2017	398,422	213,709	111,098	77,150	800,380
2018	384,139	210,289	112,550	78,245	785,223
2019	355,453	207,538	114,234	80,241	757,466
2020	286,036	232,038	109,844	83,701	711,619

Source: SPU, "2020 Annual Waste Prevention & Recycling Report."

## Commercial Waste Generation Trends

Figure 3.3 graphically shows estimated total tons of waste generated as well as tons of garbage, recycling, and food and yard waste from Seattle's commercial sector through 2020. With Washington State on lockdown for most of the year due to the COVID-19 pandemic, waste generation in the commercial sector decreased 20% from 2019 to 2020 levels. At just 286,000 tons, the sector produced the lowest number of tons in 21 years.

**Figure 3.3 Estimated Commercial Waste Generation 2000–2020**

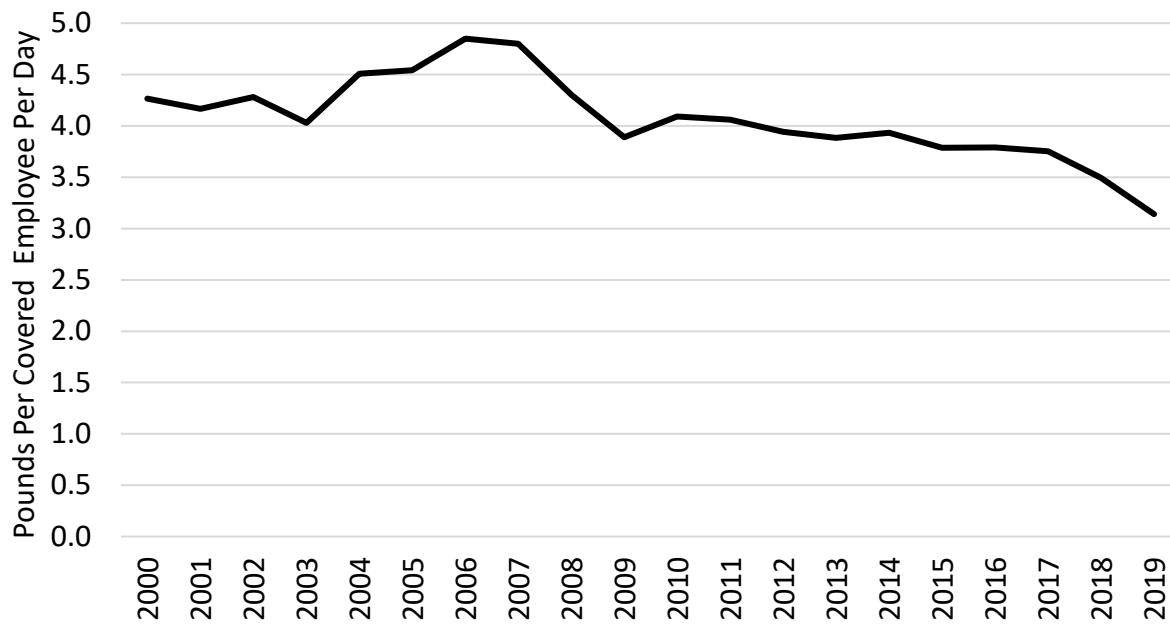


Source: SPU, "2020 Annual Waste Prevention & Recycling Report."

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While people working in Seattle increased by 23% between 2000 and 2019, commercial waste generation increased by only 10% because the amount of waste generated per employee decreased by 26%, from 4.27 pounds per employee per day to 3.14 pounds per covered employee per day (Figure 3.4).<sup>21</sup>

**Figure 3.4    Estimated Commercial Waste Generation per Covered Employee 2000–2019**



Source: SPU, Solid Waste Planning & Program Management Division unpublished data, 2020.

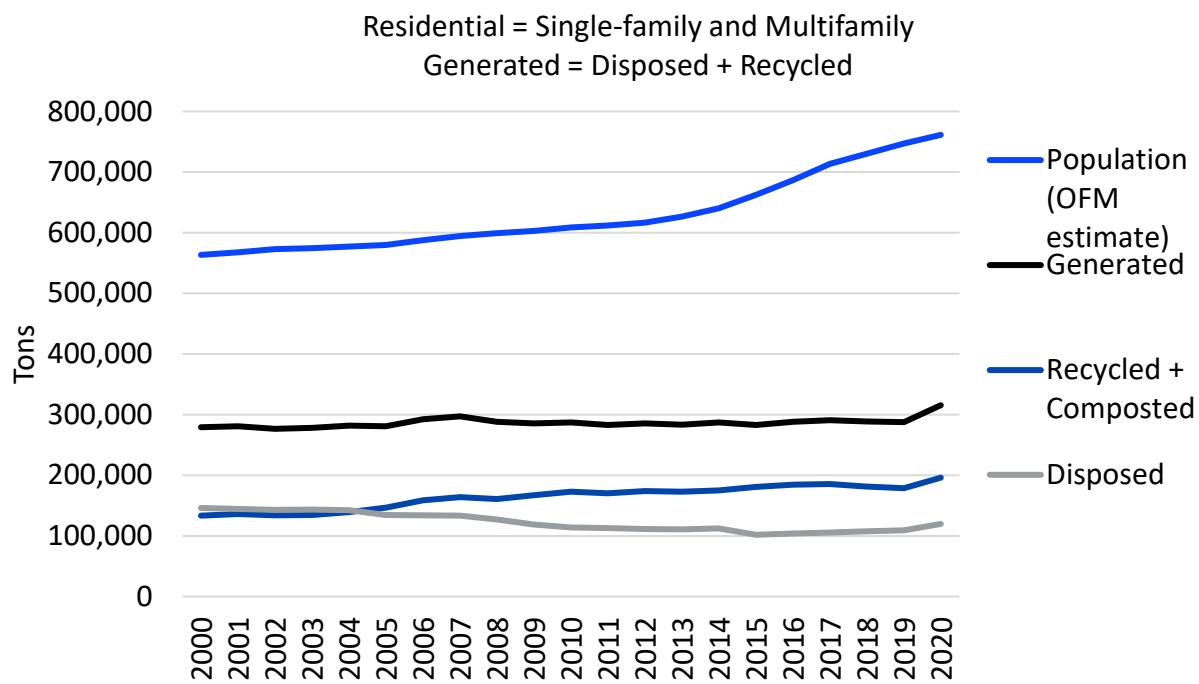
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<sup>21</sup> Covered Employment refers to positions covered by the Washington Unemployment Insurance Act. The Act exempts the self-employed, proprietors and corporate officers, military personnel, and railroad workers, so those categories are not included in the dataset. Covered Employment accounts for approximately 85% to 90% of all employment.

## Residential Waste Generation Trends

Figure 3.5 graphically shows total tons of waste generated as well as tons of garbage, recycling, and food and yard waste from the residential sector (including both single-family and multifamily residents). While Seattle's residential population increased by 35% between 2000 and 2020, residential waste generation increased by 13%.

**Figure 3.5 Residential Waste Generation 2000–2020**

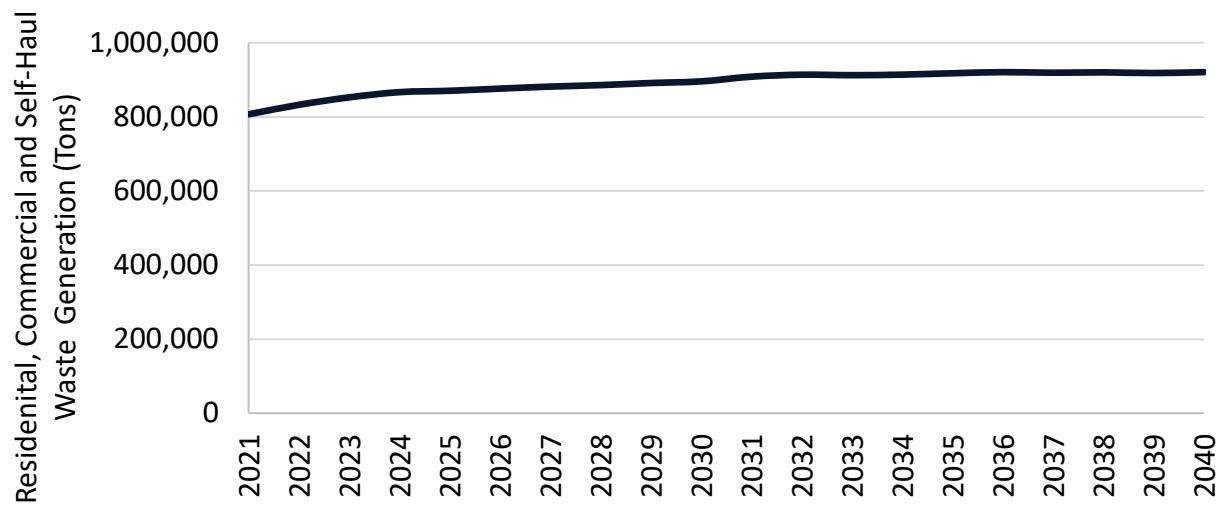


Source: SPU, “2020 Annual Waste Prevention & Recycling Report.”

## Waste Generation Forecasts for Commercial, Residential, and Self-Haul Waste

Following a dip in waste generation during the COVID-19 pandemic, SPU expects overall generation of commercial, residential, and self-haul waste to rebound and to steadily increase over the next roughly 20 years (Figure 3.6).

**Figure 3.6 Forecast for Commercial, Residential, and Self-Haul Waste Generation through 2040**



*Source: SPU, Seattle's Solid Waste Forecasting Model, last updated December 2020, reviewed October 2021.*

SPU forecasts waste generation using an econometric model that projects generation by sector. The projection for 2021–2040 is based on model data from 2018, as well as some updates made in 2020. Note that the model does not incorporate 2020 Census data or COVID-19 pandemic impacts. Table 3.7 shows the commercial, residential, and self-haul waste generation forecast by sector and overall.

**Table 3.7 Forecast for Commercial, Residential, and Self-Haul Waste Generation through 2040 by Sector**

YEAR	COMMERCIAL TONS	SINGLE-FAMILY RESIDENTIAL TONS	SELF-HAUL TONS	MULTIFAMILY RESIDENTIAL TONS	OVERALL CITYWIDE TONS
2018 (actual)	384,139	210,289	112,550	78,245	785,223
2019 (actual)	355,453	207,538	114,234	80,241	757,466
2020 (actual)	286,036	232,038	109,844	83,701	711,619
2021	380,168	228,855	112,041	86,325	807,389
2022	403,983	226,371	112,900	89,768	833,022
2023	419,034	228,241	114,347	91,481	853,103
2024	426,920	229,132	115,411	95,638	867,100
2025	430,360	229,315	115,387	95,769	870,830
2026	433,858	231,032	115,825	95,935	876,650
2027	436,753	234,314	116,214	94,841	882,121
2028	438,823	234,414	117,054	95,806	886,097
2029	441,279	238,728	116,834	94,890	891,731
2030	442,993	236,962	117,075	99,124	896,154
2031	450,096	241,297	117,546	99,923	908,862
2032	452,048	239,937	117,965	104,257	914,207
2033	451,697	238,604	117,803	104,750	912,854
2034	451,936	236,607	117,865	108,015	914,423
2035	453,328	238,111	117,891	108,762	918,092
2036	454,048	239,889	118,134	108,969	921,039
2037	452,681	241,831	117,812	107,175	919,498
2038	452,664	241,899	117,715	108,212	920,490
2039	451,188	243,728	117,570	106,144	918,629
2040	451,644	241,343	117,656	110,411	921,053

Source: SPU, Seattle's Solid Waste Forecasting Model, last updated December 2020, reviewed October 2021.

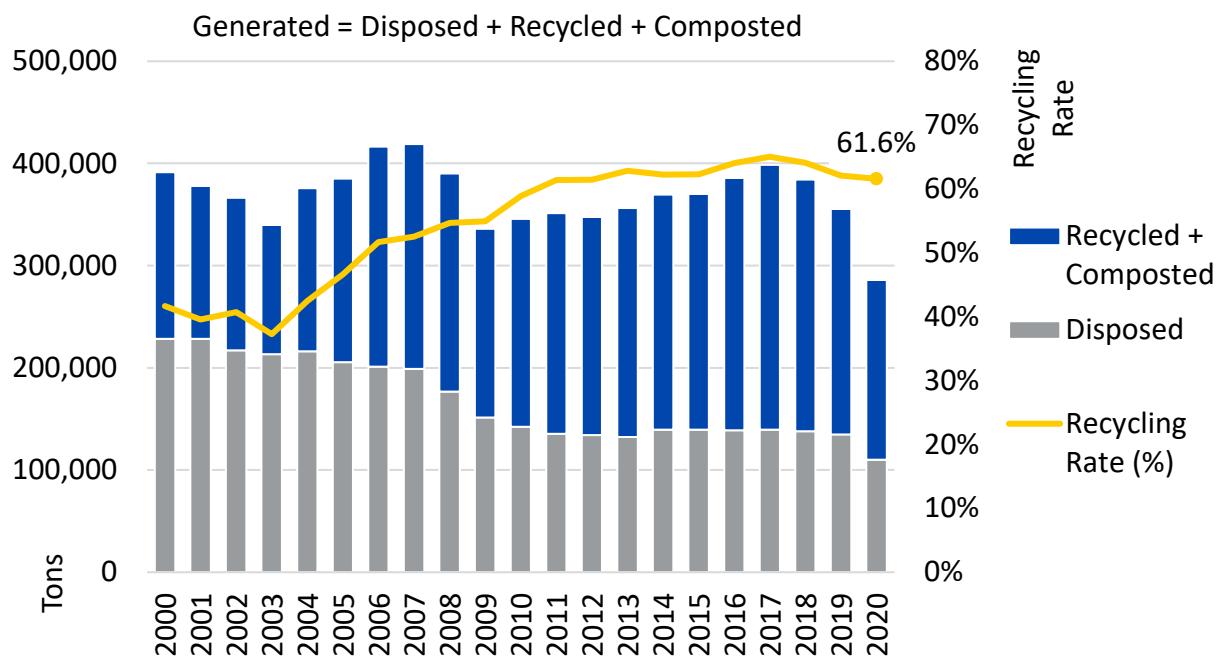
## Commercial, Residential, and Self-Haul Waste Recycling and Composting Trends and Forecasts

Since 2000, Seattle has made substantial progress toward the weight-based recycling rate goals that the City Council set in the *2007 Zero Waste Resolution (#30990)* and revised in 2013. The citywide goal is to recycle 70% of commercial, residential, and self-haul waste through single-stream recycling or composting of food and yard waste by 2022. Within that overall goal, each sector had its own target and varying success toward reaching the target. SPU's annual *Waste Prevention & Recycling Report*, most recently published for 2020, provides additional detail on progress toward recycling rate goals.

### Commercial

The estimated weight-based recycling rate for the commercial sector (40% of total generated waste in 2020) has increased since the *2011 Solid Waste Plan Revision (2011 Plan Revision)*, from 59% in 2010 to 62% in 2020 (Figure 3.7).

**Figure 3.7 Estimated Commercial Waste Recycled and Disposed 2000–2020**

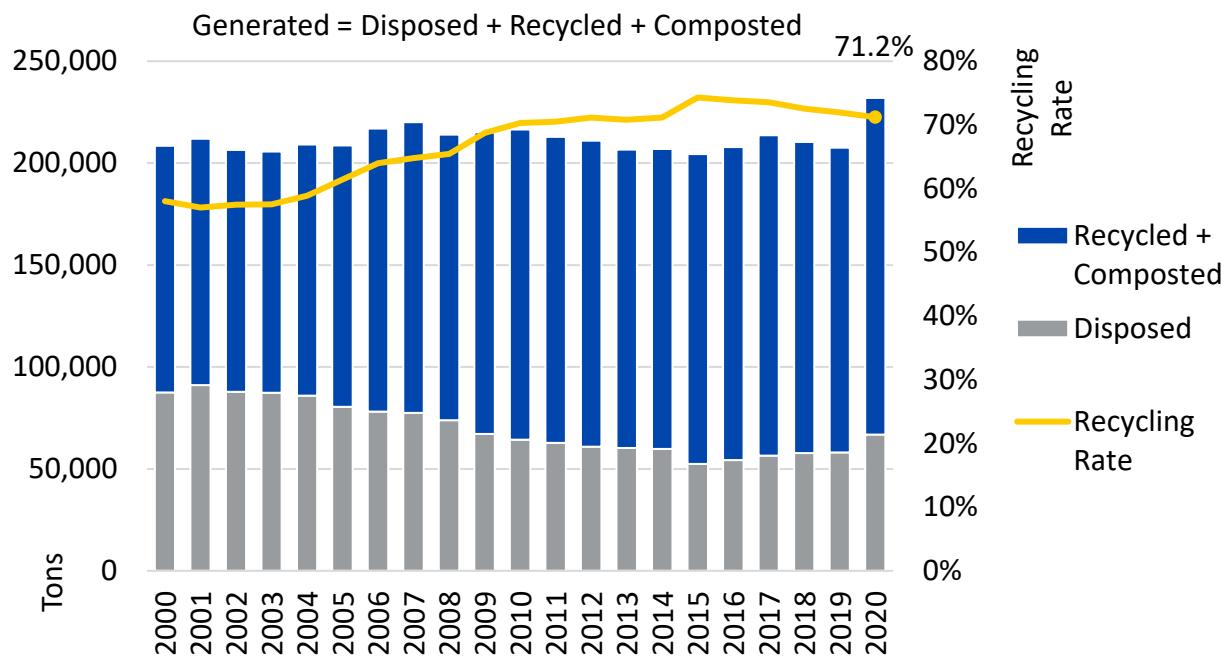


Source: SPU, "2020 Annual Waste Prevention & Recycling Report."

## Single-Family Residential

The weight-based recycling rate for Seattle's single-family sector (33% of total generated waste in 2020) reached 71% in 2020 (Figure 3.8). The single-family weight-based recycling rate has held relatively steady since 2014.

**Figure 3.8 Single-Family Waste Recycled and Disposed 2000–2020**

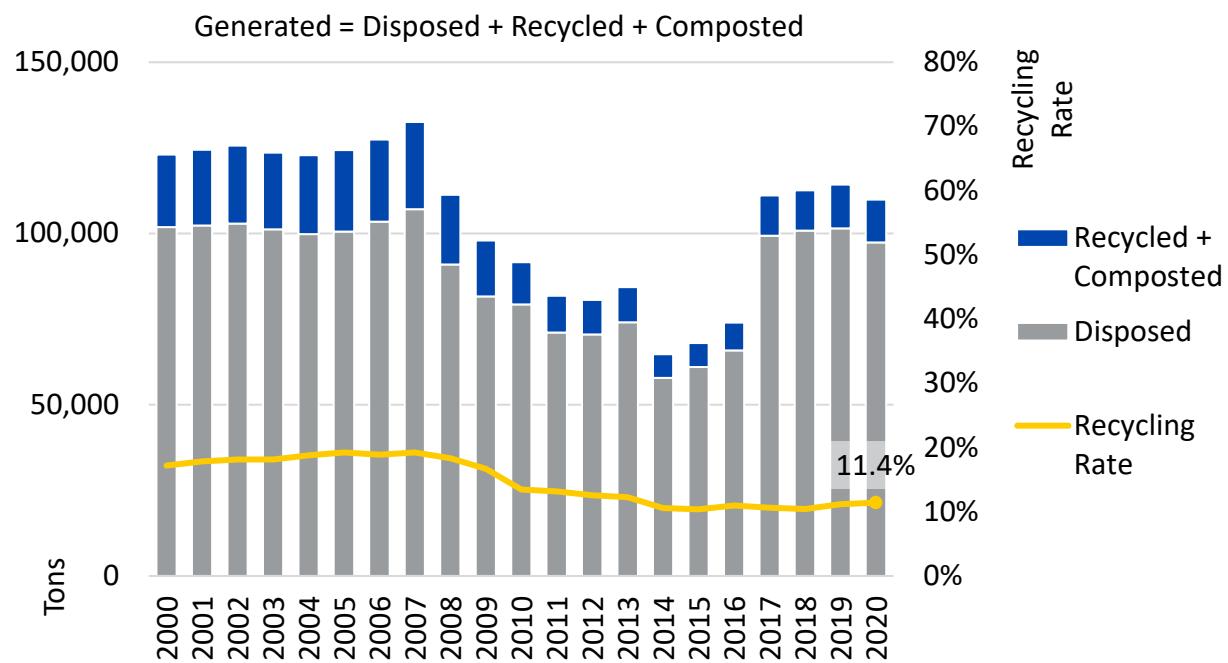


Source: SPU, "2020 Annual Waste Prevention & Recycling Report."

## Self-Haul

Self-haul recycling (15% of total generated waste in 2020) has decreased since the *2011 Plan Revision*, from 14% in 2010 to 11% in 2020 (Figure 3.9).

**Figure 3.9 Self-Haul Waste Recycled and Disposed 2000–2020**

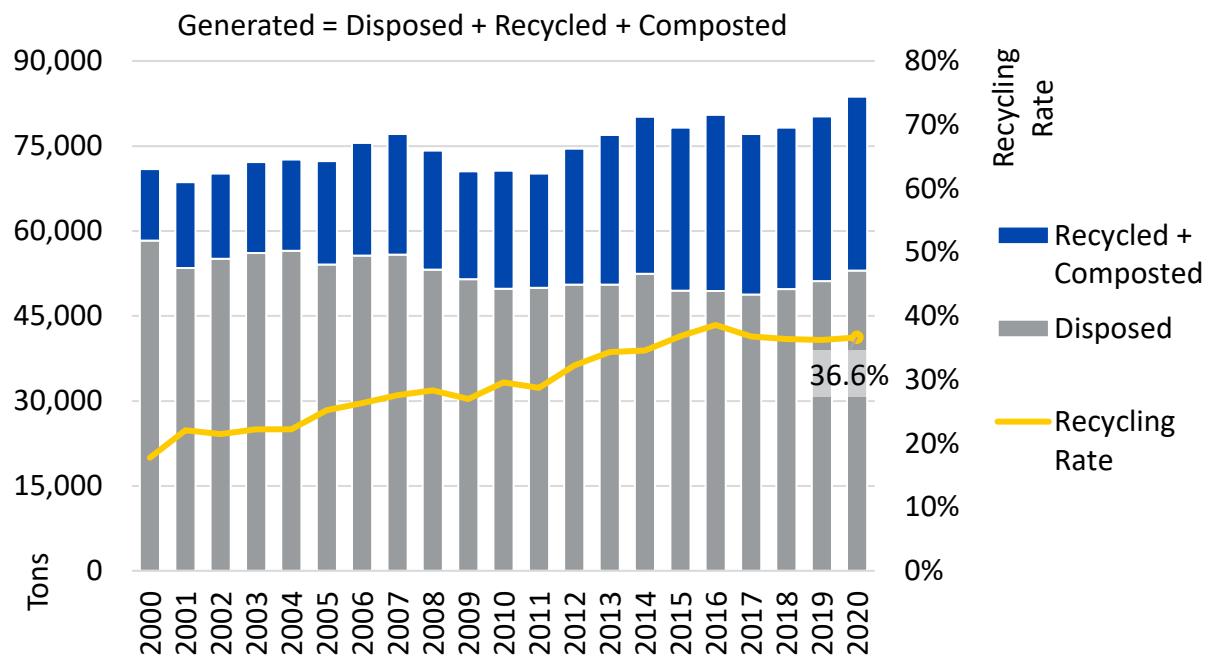


Source: SPU, "2020 Annual Waste Prevention & Recycling Report."

## Multifamily Residential

The weight-based recycling rate for the multifamily sector (12% of total generated waste in 2020) has increased since the *2011 Plan Revision*, from 30% in 2010 to 37% in 2020 (Figure 3.10). The multifamily weight-based recycling rate has been relatively steady since 2015.

**Figure 3.10 Multifamily Waste Recycled and Disposed 2000–2020**



Source: SPU, "2020 Annual Waste Prevention & Recycling Report."

## Commercial, Residential, and Self-Haul Waste Recycling Rate Forecasts

Table 3.8 shows the projected recycling rates through 2040 if the 39 recommendations in the 2022 Plan Update are implemented. The projections are based on the Recycling Potential Assessment, described briefly above and in detail in Appendix E, *Recycling Potential and Environmental Benefits Analysis*. The recommended programs have the potential to increase City of Seattle's recycling rate to 69% by 2040.

**Table 3.8 Weight-Based Recycling Rate Projections by Sector After Implementing Recommended Programs**

YEAR	COMMERCIAL	SINGLE-FAMILY RESIDENTIAL	SELF-HAUL	MULTIFAMILY RESIDENTIAL	OVERALL CITYWIDE
2018 (actual)	64.1%	72.5%	10.4%	36.4%	55.9%
2019 (actual)	62.1%	72.0%	11.1%	36.2%	54.4%
2020	65.9%	72.6%	10.6%	37.4%	57.3%
2025	72.9%	76.3%	12.6%	49.4%	63.3%
2030	76.7%	81.6%	15.1%	54.9%	67.7%
2035	78.0%	83.1%	17.2%	56.5%	68.9%
2040	78.0%	83.1%	17.2%	56.5%	69.0%
<b>2022 Goal</b>	<b>75.0%</b>	<b>83.0%</b>	<b>46.0%</b>	<b>54.0%</b>	<b>70.0%</b>

Source: SPU, *Recycling Potential Assessment Model*, August 2019.

## Capture Rate Estimates for Commercial, Residential, and Self-Haul Waste

Where the recycling rate measures how much recyclable material is recycled compared to the total amount of waste generated, capture rates measure how much recyclable material is recycled compared to the total amount of recyclable waste generated (discussed in Chapter 2, *Maximizing and Measuring Impact: Moving Upstream, Beyond the Recycling Rate*). Capture rates are the percent of recoverable materials that are captured, meaning collected, for recovery out of the total amount of recoverable materials generated. Examining capture rates by material type using information from waste composition studies and the Seattle Discards

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Model can identify where SPU has achieved success and where SPU may need to focus additional efforts. As part of forecasting using the Recycling Potential Assessment Model, SPU compiled available data from these sources to estimate capture rates (Table 3.9).

**Table 3.9    Estimated Capture Rates (Overall Commercial, Residential, and Self-Haul Waste) for Select Material Types**

MATERIAL	LANDFILLED TONS	RECYCLED OR COMPOSTED TONS	TOTAL WASTE TONS	CAPTURE RATE
Yard	4,931	114,537	119,467	96%
Newspaper	3,641	21,228	24,870	85%
Old Corrugated Cardboard and Kraft Paper	10,599	62,260	72,859	85%
Beverage Glass	4,357	23,746	28,103	84%
Mixed Scrap Paper	10,186	46,954	57,140	82%
Computer Office Paper	3,292	13,431	16,723	80%
Aluminum Beverage Cans	845	1,365	2,210	62%
Food Cans	1,259	1,658	2,918	57%
Food	69,584	88,049	157,633	56%
Other Container Glass	721	769	1,490	52%

Source: SPU, *Recycling Potential Assessment Model*, August 2019.<sup>22</sup>

SPU can identify continued opportunities for waste prevention, recycling, and composting by tracking priority material types and capture rates for these materials. For example, Seattle has a high capture rate for yard waste but substantial room to increase recovery of container glass, food waste, and food cans (Table 3.9). Seattle conducted residential waste characterization studies for garbage and recycling simultaneously in 2020-2021 specifically to measure capture rates by material.

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<sup>22</sup> Capture rate data based on SPU's modeling under the Recycling Potential Assessment for 2019, described in Appendix E, *Recycling Potential Assessment and Environmental Benefits Analysis*.

## Waste Composition Study Results

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SPU conducts waste composition studies to help highlight current recycling and disposal behaviors, prioritize specific materials for outreach and education programs, and inform SPU's annual *Waste Prevention & Recycling Report*. SPU could also use them to determine impacts of some waste prevention initiatives if the categories are specific enough, such as the plastic bag ban. SPU typically does waste composition studies on a four- to six-year cycle. Seattle staggers the studies for residential garbage (most recently in 2020–21), residential recycling (2020–2021), commercial garbage (2016), residential and commercial food and yard waste (planned to start in Q3 2021), self-haul garbage (2018), and C&D debris (2017). Results from the 2020–2021 studies are not yet finalized.

Examining the composition of garbage provides insights specifically into what recoverable materials sent to landfill could provide opportunities to increase recycling. The next sections provide data from the most recent garbage composition studies for the residential, commercial, self-haul, and C&D sectors. Data from these composition studies showed remaining opportunities to divert food from the garbage in the residential and commercial sectors and to divert clean wood in the C&D sector.

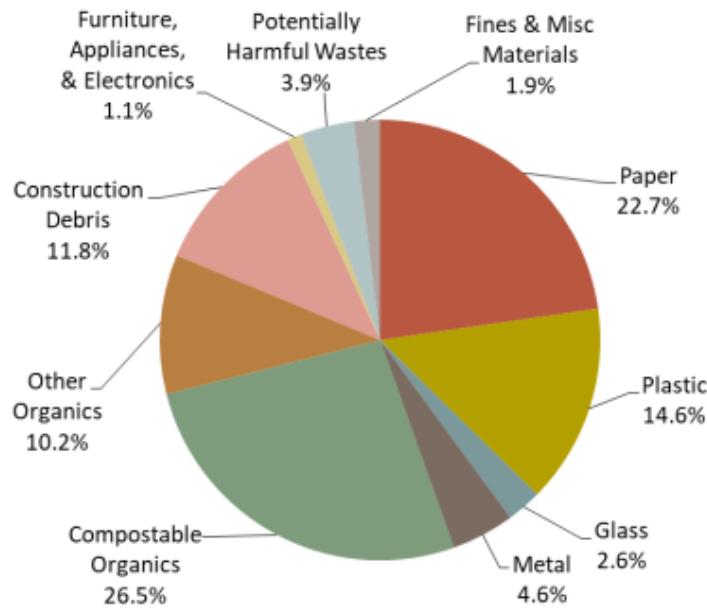
### Commercial Waste

The most recent commercial waste study was completed in 2016, which documented the types and quantities of materials that businesses place in the garbage for pickup collection.<sup>23</sup> As shown in Figure 3.9, commercial garbage was approximately one-quarter (26.5%) compostable organics (mainly food and yard waste), one-fifth (22.7%) paper, and nearly 15% plastics by weight. Some but not all of this paper and plastic could have been recycled or composted.

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<sup>23</sup> Seattle Public Utilities, prepared by Cascadia Consulting Group, "2016 Commercial Waste Stream Composition Study," 2017, <https://www.seattle.gov/Documents/Departments/SPU/Documents/2016CommercialWasteStreamCompositionStudy.pdf>.

**Figure 3.11 Seattle Overall Commercial Waste Composition by Material Class 2016**



*Reprinted from: SPU 2016 Commercial Waste Stream Composition Study*

Table 3.10 lists the 10 largest material components in commercial garbage by weight. Recoverable materials present in large quantities in the garbage included food, compostable/soiled paper, and plain old corrugated cardboard (OCC)/Kraft paper (including corrugated cardboard boxes and brown paper bags).

**Table 3.10 Top 10 Materials by Weight, Seattle Overall Commercial Waste 2016**

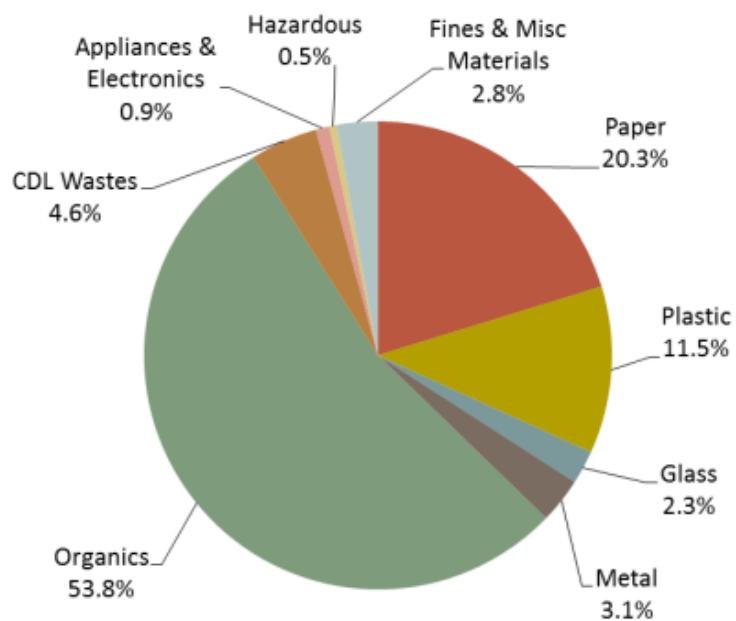
Class	Material	Est. Percent	Cum. Percent	Est. Tons
Compostable Organics	Food	24.5%	24.5%	29,935
Paper	Compostable/Soiled	8.1%	32.6%	9,879
Plastic	Other Film	6.5%	39.1%	7,877
Other Organics	Disposable Diapers	3.9%	43.0%	4,735
Paper	Plain OCC/Kraft	3.7%	46.7%	4,565
Potentially Harmful Wastes	Medical Wastes	3.5%	50.2%	4,253
Paper	Mixed Low-grade Paper	3.1%	53.3%	3,829
Other Organics	Textiles	2.2%	55.5%	2,652
Paper	Mixed/Other Paper	2.2%	57.7%	2,637
Other Organics	Animal By-products	2.1%	59.8%	2,621
Total		59.8%		72,982

*Reprinted from: SPU 2016 Commercial Waste Stream Composition Study*

## Residential Waste

At the time of this writing, SPU is completing a report of findings on residential garbage and recycling composition studies conducted in 2020–2021. The most recent residential composition study with published data on garbage was completed in 2014.<sup>24</sup> This study documented the types and quantities of materials that Seattle single-family and multifamily residents placed in the garbage for collection at their homes. As shown in Figure 3.12, most material was recyclable or compostable, with organics making up over half (53.8%) of Seattle's residential garbage and paper making up one-fifth (20.3%). Most but not all of these organics and paper could have been composted or recycled.

**Figure 3.12 Seattle Overall Residential Garbage Composition by Material Class 2014**



*Reprinted from: SPU 2014 Residential Waste Stream Composition Study*

Table 3.11 lists the top 10 material components in residential garbage by weight. Recoverable materials present in large quantities included food and compostable/soiled paper.

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<sup>24</sup> Seattle Public Utilities, prepared by Cascadia Consulting Group, "2014 Residential Waste Stream Composition Study," 2015, <https://www.seattle.gov/Documents/Departments/SPU/Documents/ResidentialWasteStreamCompositionStudy2014.pdf>.

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**Table 3.11 Top 10 Materials by Weight in Seattle Residential Garbage 2014**

Material	Est. Percent	Cum. Percent	Est. Tons
Food	29.5%	29.5%	33,113
Animal By-products	10.7%	40.2%	12,054
Disposable Diapers	7.4%	47.6%	8,313
Compostable/Soiled Paper	6.4%	54.0%	7,169
Other Film	5.7%	59.7%	6,383
Mixed Low-grade Paper	4.3%	64.0%	4,806
Textiles/Clothing	2.9%	66.9%	3,207
Mixed/Other Paper	2.4%	69.3%	2,727
Newspaper	2.2%	71.5%	2,478
Miscellaneous Organics	1.7%	73.2%	1,899
<b>Total</b>	<b>73.2%</b>		<b>82,147</b>

*Reprinted from: SPU 2014 Residential Waste Stream Composition Study*

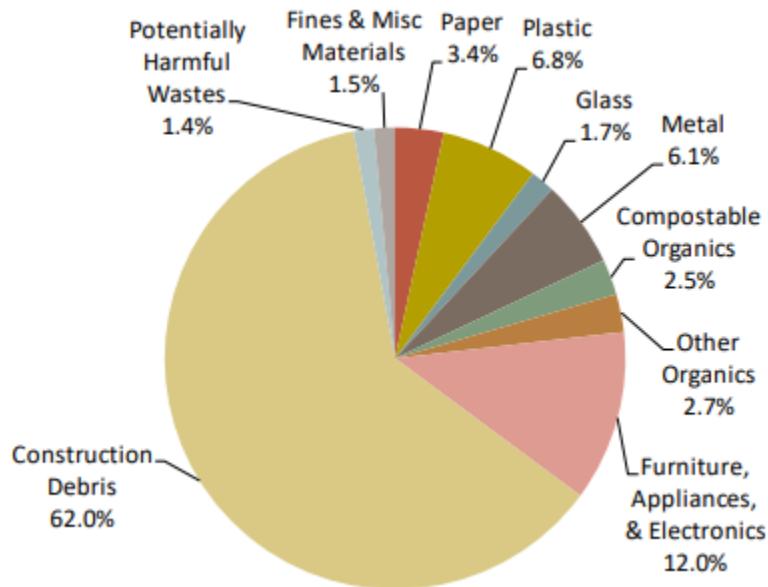


*Residential food and yard waste sampling conducted in September 2021 (Photo by Luis Hillon)*

## Self-Haul Waste

The most recent composition study for the self-haul sector was completed in 2018.<sup>25</sup> Figure 3.13 shows the composition of material brought to Seattle-owned transfer stations by the residents or businesses for disposal, or self-haul waste, by material class. As shown, construction debris made up over three-fifths (62%) of the self-haul waste stream, adding up to about 60,000 tons.

**Figure 3.13 Seattle Self-Haul Waste Composition by Material Class 2018**



*Reprinted from: SPU2017-2018 Self-haul Waste Stream Composition Study*

The largest material components of self-haul waste by weight are presented in Table 3.12. Current and potentially recoverable materials present in large quantities included clean dimensional lumber, furniture, clean engineered wood, carpet, and mattresses. Nearly 13,000 tons of self-haul waste in 2018 consisted of materials covered by existing C&D disposal bans.<sup>26</sup> Capturing this material for recycling would increase the self-haul recycling rate, which lags in comparison to other sectors, and better support meeting the City's recycling rate goals.

<sup>25</sup> Seattle Public Utilities, prepared by Cascadia Consulting Group, "2017-2018 Self-Haul Waste Stream Composition Study," 2018, <https://www.seattle.gov/Documents/Departments/SPU/Documents/18%20Self-Haul%20Waste%20Stream%20Composition%20Study.pdf>.

<sup>26</sup> C&D materials currently banned for disposal include asphalt paving, bricks, concrete, metal, cardboard, new construction gypsum scrap, and unpainted and untreated wood. See <http://www.seattle.gov/utilities/businesses-and-key-accounts/construction/construction-waste/recycling-requirements>.

**Table 3.12 Top 10 Materials by weight, Seattle Self-Haul Waste 2018**

Material	Est. Percent	Cum. Percent	Est. Tons
Clean Dimension Lumber	9.7%	9.7%	9,525
New Painted Wood	9.1%	18.8%	8,883
Contaminated Wood	8.3%	27.1%	8,150
Furniture	7.6%	34.8%	7,480
Clean Engineered Wood	5.8%	40.6%	5,686
Carpet	5.2%	45.8%	5,100
Other Construction	4.1%	49.9%	4,007
Mixed Metals/Material	3.5%	53.3%	3,379
Mattresses	3.3%	56.7%	3,266
Other Treated Wood	3.3%	59.9%	3,194
<b>Total</b>	<b>59.9%</b>		<b>58,669</b>

*Reprinted from: SPU 2017-2018 Self-haul Waste Stream Composition Study*

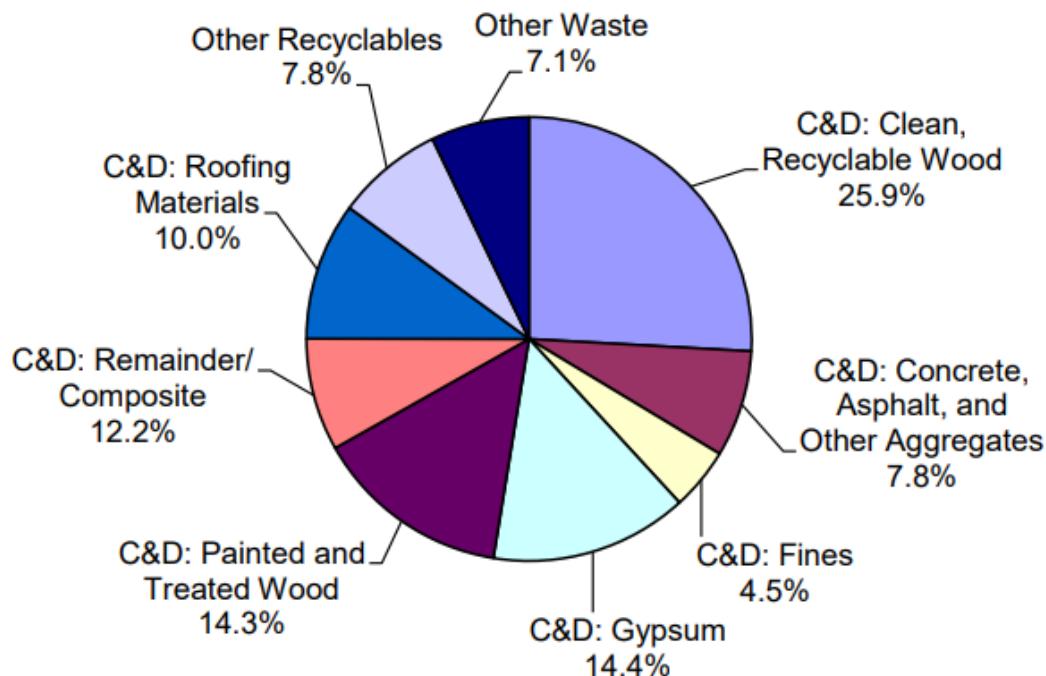
## Construction & Demolition Debris

SPU completed its last C&D waste composition study in 2013.<sup>27</sup> As shown in Figure 3.14, approximately one-quarter of the C&D waste stream was clean recyclable wood (25.9%). Clean recyclable wood could be diverted from disposal if managed appropriately and delivered to a certified recycling facility. Other materials making up a large portion of C&D waste in Seattle were gypsum (14.4%) and painted and treated wood (14.3%).

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<sup>27</sup> Seattle Public Utilities, prepared by Cascadia Consulting Group, “2013 Construction & Demolition Composition Study,” 2017, <https://www.seattle.gov/Documents/Departments/SPU/Documents/CDLWasteCompositionStudy2017.pdf>.

**Figure 3.14 Seattle Overall C&D Waste Composition by Material Class 2013**



*Reprinted from: SPU 2013 Construction & Demolition Waste Composition Study*

Table 3.13 shows the top 10 individual materials in the C&D waste stream by weight. Recoverable materials present in large quantities included clean engineered wood, clean dimensional lumber, other recyclable wood, pallets and crates, and clean gypsum board.

**Table 3.13 Top 10 Materials by Weight, Seattle Overall C&D Waste 2013**

Component	Mean	Cum. %	Tons
Painted/Stained Wood	13.1%	13.1%	11,993
Painted/Demolition Gypsum Board	9.9%	23.0%	9,073
Clean Engineered Wood	7.7%	30.7%	7,024
Remainder/Composite Building Materials	7.3%	38.0%	6,677
Clean Dimensional Lumber	6.8%	44.8%	6,185
Composition Roofing	6.7%	51.5%	6,135
Other Recyclable Wood	6.5%	57.9%	5,908
Pallets and Crates	5.0%	62.9%	4,561
Clean Gypsum Board	4.5%	67.4%	4,076
Dirt and Sand	3.9%	71.2%	3,536
<b>Total</b>	<b>71.2%</b>		<b>65,167</b>

*Reprinted as-is from: SPU 2013 Construction & Demolition Waste Composition Study*

# Construction and Demolition Debris Trends and Forecasts

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## Total Generation Trends

The amount of C&D debris generated annually has varied widely as construction activity increases and decreases. Generation of C&D material increased over the last decade since its low point in 2009 (288,551 tons). In 2020, C&D projects in Seattle generated an estimated 559,575 tons – an increase since the economic recession that started in December 2007 (Table 3.14).

Tonnages in 2020 are higher than in previous years, likely partially the result of Seattle's improved enforcement of and compliance with annual requirements to self-report recycling quantities. Seattle requires recycling collectors and processors to report their recycling activities to obtain a [Recycler License](#) that allows them to operate in the city.<sup>28</sup>

In 2020, an estimated 64% of all C&D materials were managed for recycling and beneficial use at certified, private mixed C&D processing facilities. About 23% of C&D materials were disposed of at private facilities as C&D debris. In 2020, an estimated 13% of C&D materials were disposed of with commercial, residential, and self-haul garbage. In 2010, before Seattle implemented new regulations that mandated the disposal and recycling of C&D material through certified facilities, about 21% of all C&D debris was disposed of in commercial, residential, and self-haul

**Table 3.14 Total Waste Generation for C&D Debris**

YEAR	C&D DEBRIS TONS
2007	415,801
2008	397,052
2009	288,551
2010	288,957
2011	359,390
2012	371,962
2013	386,200
2014	485,242
2015	437,883
2016	532,126
2017	514,858
2018	476,433
2019	507,793
2020*	559,575

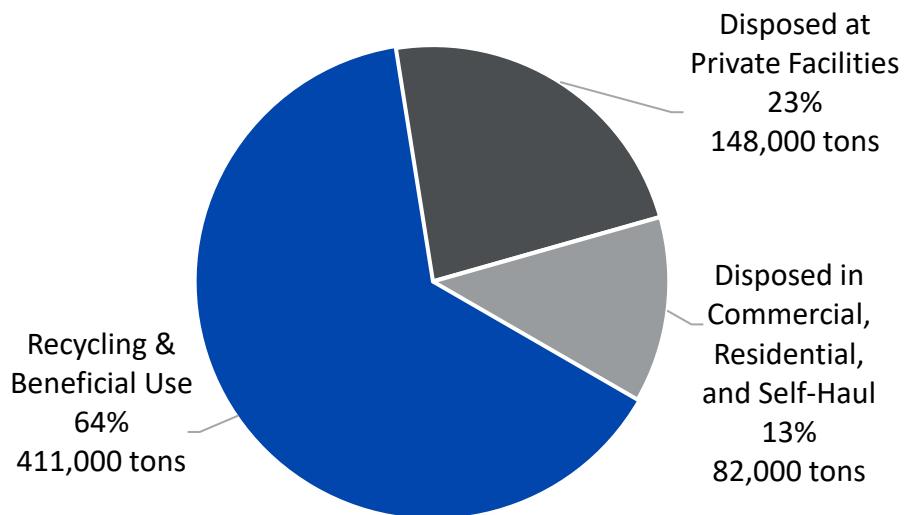
*Source: SPU, "2020 Annual Waste Prevention & Recycling Report,"*

*Notes: Tons include concrete and exclude C&D material types disposed of in residential, commercial, and self-haul garbage.*

<sup>28</sup> <http://www.seattle.gov/utilities/about/reports/solid-waste-reports/recycler-annual-reports>

waste. C&D materials handled in commercial, residential, and self-haul waste reduces those sector's recycling rate. The reduction particularly affects the self-haul sector (Figure 3.15 on page 3.40) because the self-haul sector does not have the ability to separate out commingled C&D debris.

**Figure 3.15 Estimated Share of C&D Debris by Management Method in 2020**

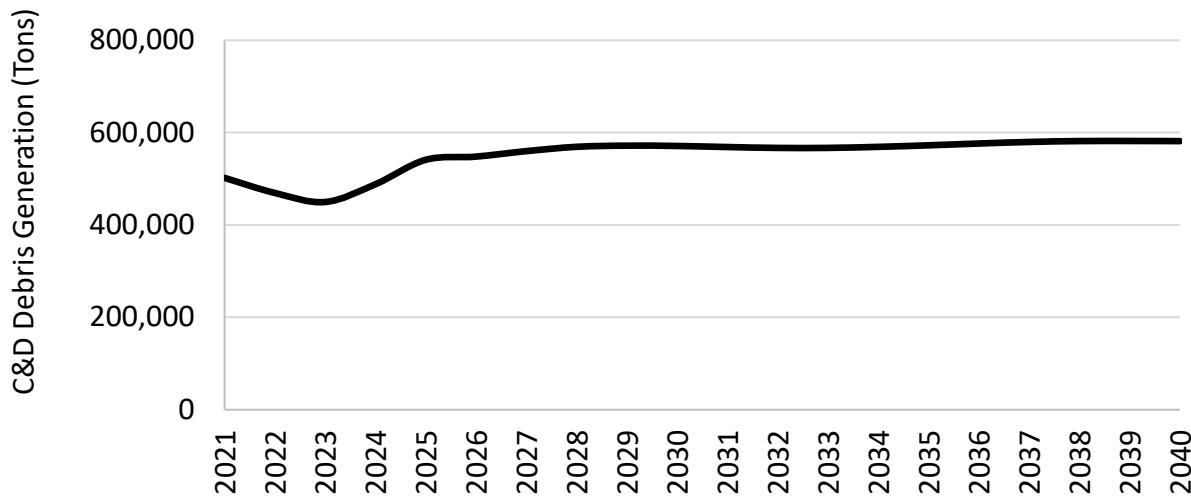


Sources: Seattle Public Utilities, “2020 Annual Waste Prevention & Recycling Report” and “2017-18 Self-Haul Waste Stream Composition Study.”

## Total Generation Forecast

Based on forecasts conducted pre-pandemic in 2019, SPU expects overall C&D debris generation over the next 20 years to fluctuate in the near-term (2021 through 2025), then stay relatively steady or increase slightly through 2040. (Figure 3.16). A table of forecasted tons is not presented because C&D debris generation has historically varied substantially, making exact forecasts unreliable.

**Figure 3.16 Forecast for C&D Debris Generation through 2040**



Source: SPU, *Seattle's Solid Waste Forecasting Model*, August 2019.

## Recycling Rate Trends

Seattle's goal in the *2007 Zero Waste Resolution #30990* is to recycle 70% of C&D debris by 2022 (Table 3.15). In 2020, an estimated 66% of C&D debris was recycled, including concrete.<sup>29</sup> When including beneficial use, which means waste materials that are not recycled nor reused but are used for some other purpose like industrial boiler fuel, SPU estimates over 73% of C&D debris from Seattle was diverted from landfill (Table 3.15 and Figure 3.17).<sup>30</sup> Seattle's C&D debris recycling rate increased after Seattle implemented disposal bans for specific C&D materials. C&D disposal bans are described in Chapter 8, *Construction and Demolition Debris*.

<sup>29</sup> Seattle Public Utilities, “2020 Annual Waste Prevention & Recycling Report,” October 2021, [https://www.seattle.gov/Documents/Departments/SPU/Documents/Recycling\\_Rate\\_Report\\_2020.pdf](https://www.seattle.gov/Documents/Departments/SPU/Documents/Recycling_Rate_Report_2020.pdf).

<sup>30</sup> C&D diversion includes recycling and beneficial use. SPU estimates diversion for the C&D stream.

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**Table 3.15 Estimated Waste Generation for Construction and Demolition Debris 2007-2020**

Year	Generated Tons	Disposed Tons*	Recycled Tons**	Beneficially Used Tons	Recycling Rate	Diversion Rate***
2007	415,801	201,156	204,907	9,738	49.3%	51.6%
2008	397,052	181,241	200,851	14,961	50.6%	54.4%
2009	288,551	115,446	162,742	10,362	56.4%	60.0%
2010	288,957	98,309	178,794	11,854	61.9%	66.0%
2011	359,390	118,216	227,049	14,125	63.2%	67.1%
2012	371,962	129,383	224,060	18,519	60.2%	65.2%
2013	386,200	127,040	234,982	24,178	60.8%	67.1%
2014	485,242	128,024	317,331	39,887	65.4%	73.6%
2015	437,883	117,343	280,205	40,336	64.0%	73.2%
2016	532,126	146,139	339,478	46,509	63.8%	72.5%
2017	514,858	125,074	342,755	47,029	66.6%	75.7%
2018	476,433	112,900	328,568	34,965	69.0%	76.3%
2019	507,793	110,275	348,032	49,486	68.5%	78.3%
2020	559,575	148,209	370,942	40,424	66.3%	73.5%
				<b>2022 Goal</b>	<b>70%</b>	<b>NA</b>

Source: SPU, "2020 Annual Waste Prevention & Recycling Report."

Notes:

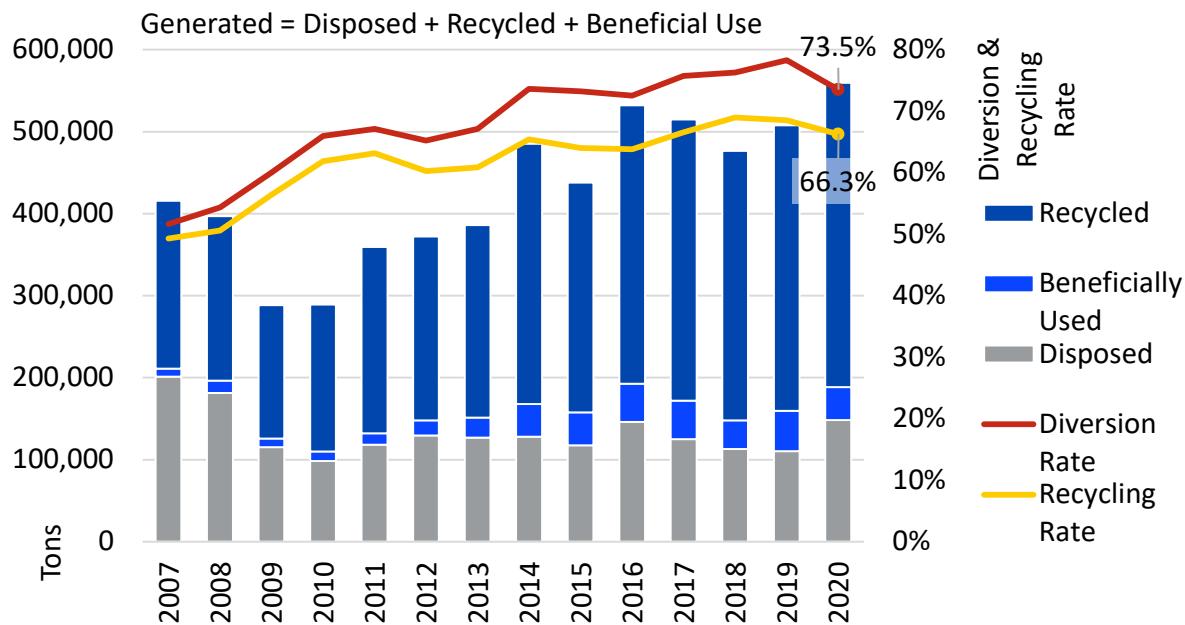
\* C&D disposal and beneficial use tons were estimated based on an analysis comparing self-reporting of C&D companies in the Qualified Facilities Monthly Reports and in the annual recycling reports.

\*\* C&D recycled tons are estimates based on self-reporting of recycling collectors and processors. They include concrete.

\*\*\* The diversion rate includes both recycled and beneficial use tons.

In 2020, SPU updated disposal estimates for 2018 and 2019 following additional data quality control and assurance activities and review of other disposal data.

**Figure 3.17 Estimated C&D Debris Diverted and Disposed 2007–2020**



Source: SPU, "2020 Annual Waste Prevention & Recycling Report."

A significant portion of recycled C&D material by weight in Seattle is concrete, which is easily recycled into gravel, new concrete, or other new structures. Without concrete recycling, the C&D debris weight-based recycling rate would be significantly lower. Table 3.16 shows C&D debris generation, disposal, recycling, and beneficial use without concrete. Looking at the data this way allows SPU to focus on materials that are harder to recycle.

**Table 3.16 Estimated Waste Generation for Construction and Demolition Debris Without Concrete 2015–2020**

YEAR	TOTAL GENERATED TONS	LANDFILLED TONS	RECYCLED TONS	RECYCLING RATE	BENEFICIALLY USED TONS	DIVERSION RATE
2015	223,453	117,343	65,775	29.44%	40,336	47.49%
2016	252,392	146,139	59,744	23.67%	46,509	42.10%
2017	226,183	125,074	54,080	23.91%	47,029	44.70%
2018	243,731	112,900	95,866	39.33%	34,965	53.68%
2019	241,924	110,275	82,163	33.96%	49,486	54.42%
2020	305,724	148,209	117,091	38.30%	40,424	51.52%

Source: SPU, Solid Waste Planning & Program Management Division unpublished data, 2020.

## Recycling Rate Forecast

Opportunities remain to increase Seattle's weight-based recycling rates for C&D debris. Recommendations in Chapter 8, *Construction and Demolition Debris*, include initiatives to increase recycling of C&D debris. Table 3.17 shows the projected recycling rate for C&D debris through 2040 if the recommended programs are implemented.

**Table 3.17 Weight-Based Recycling Rate Projections for C&D Debris After Implementing Recommended Programs**

YEAR	RECYCLING RATE INCLUDING CONCRETE
2018 (actual)	69.0%
2019 (actual)	68.5%
2020 (actual)	66.3%
2025	68.3%
2030	74.4%
2035	74.2%
2040	75.2%
<b>2022 Goal</b>	<b>70.0%</b>

Source: SPU, *Recycling Potential Assessment Model*, August 2019.