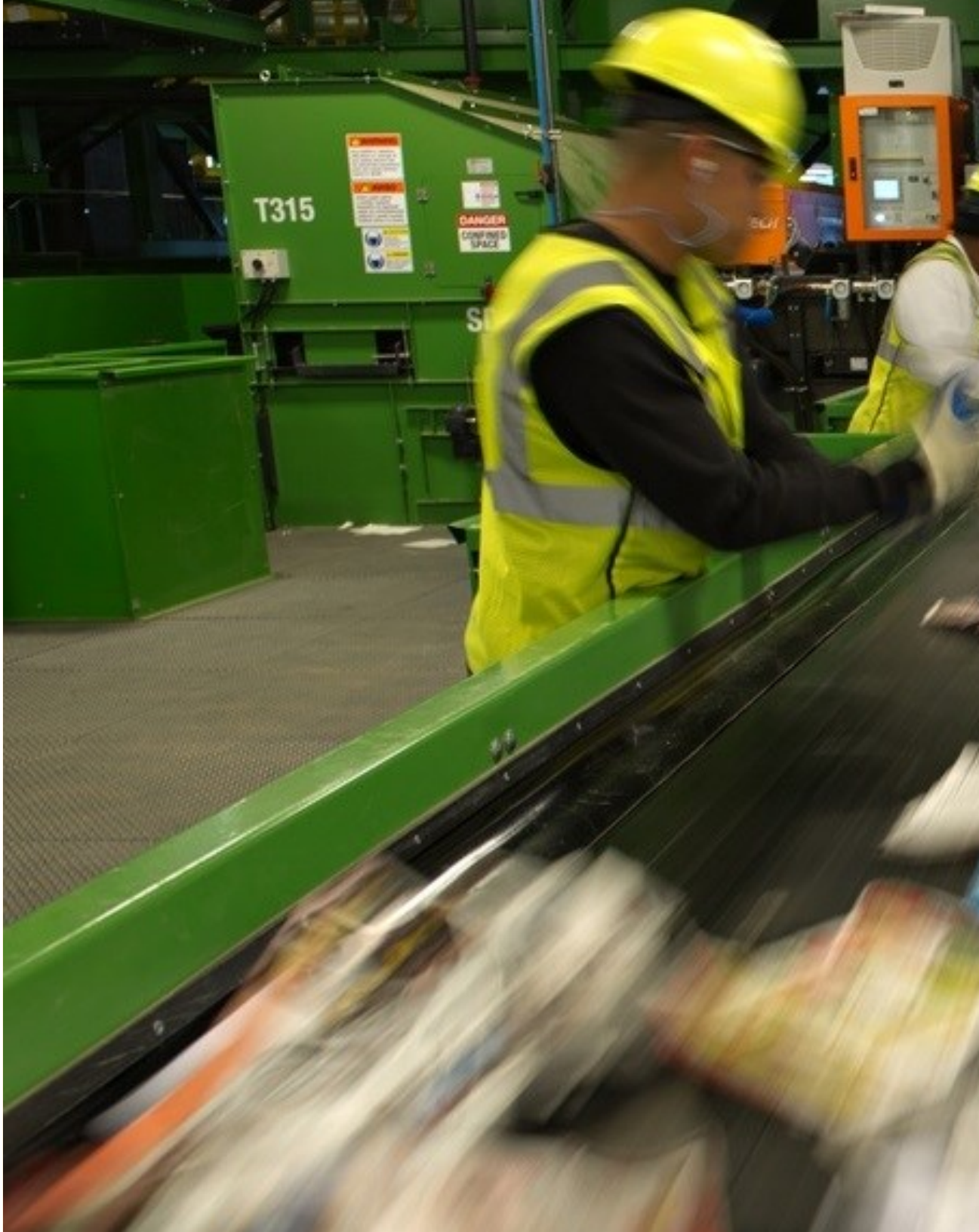
chapter five

waste reduction

CHAPTER 5:

WASTE & RECYCLING



Our Situation

Oklahoma City residents and businesses "throw away" most of what they use on a daily basis. The problem is that "away" means buried in a landfill. In *Waste & Recycling*, we examine the economic, environmental, and public health impacts of landfilling a majority of Oklahoma City's waste, market factors that affect recycling, and the industries that recover and reuse materials. We propose to enhance existing recycling programs, expand efforts to recover materials in sectors beyond single-family residential, and emphasize the role of producer responsibility in waste generation and reduction.

From FY15 to FY17, an average of more than 97% of the total materials collected at the curbside, including bulk waste and recycling collections, were sent to landfills. In those three years, Oklahoma City residents sent an annual average of more than 295,000 tons of waste materials from their curbsides to landfills in the city. That equates to about 3,077 pounds of landfilled waste per Oklahoma City recycling customer (192,389) annually – more than double the 1,352 pounds of landfilled trash per recycling customer in Austin, Texas and 1,400 pounds more than the U.S. average of 1,635 pounds per person (**Figure WR-1**).

Oklahoma City's land area and low population density means waste haulers need to drive more to collect and deliver trash and recycling. More heavy trucks driving further distances means higher costs to the waste company, City, and, ultimately, residents. Burying waste under existing mountains of trash might seem cost-effective today, but this method of waste management degrades nearby land values and disproportionately impacts low-income residents.

The nearly 300,000-ton annual average for residential waste collected at the curbside during that time frame represents only 18% of the total tonnage received at these three landfills. This effectively means about 82% of the materials arriving at landfills in Oklahoma City originates from non-residential uses or other municipalities.

Each year, Norman and Moore send a combined average of nearly 122,000 tons of residential waste to Southeast Landfill (about 22% of Southeast Landfill's total average annual tonnage), while Midwest City and Edmond combined deliver around 99,000 tons of residential waste to East Oak Landfill (about 25% of East Oak's total average annual tonnage). Yukon and Mustang both bury residential trash in a Union City landfill owned by Oklahoma Environmental Management Authority, a public trust that serves communities outside Oklahoma City.

Including Oklahoma City tonnage, residential curbside trash collections from municipalities in the metro area with more than 50,000 residents (Moore, Norman, Edmond, and Midwest City) comprise approximately 32% of the average annual tonnage received at the three active landfills in Oklahoma City. As such, it's apparent that most of the materials delivered to these landfills originates from sources beyond curbside residential solid waste customers, such as commercial (office, multi-family, retail, etc.), industrial, construction/demolition.

In addition to routine waste generation, the effects of Oklahoma's severe weather can produce spikes in the amount of waste sent to landfills. Following severe weather and tornado events in May 2013, Oklahoma City crews collected and landfilled more than 798,000 tons of debris which is more than 2.7 times the average annual amount of waste generated by all the City's residential curbside solid waste customers. Including storm debris from other cities affected by the disaster declaration, the tonnage sent to two landfills in Oklahoma City increased by a combined 47% (34% and 61%) over the previous year.

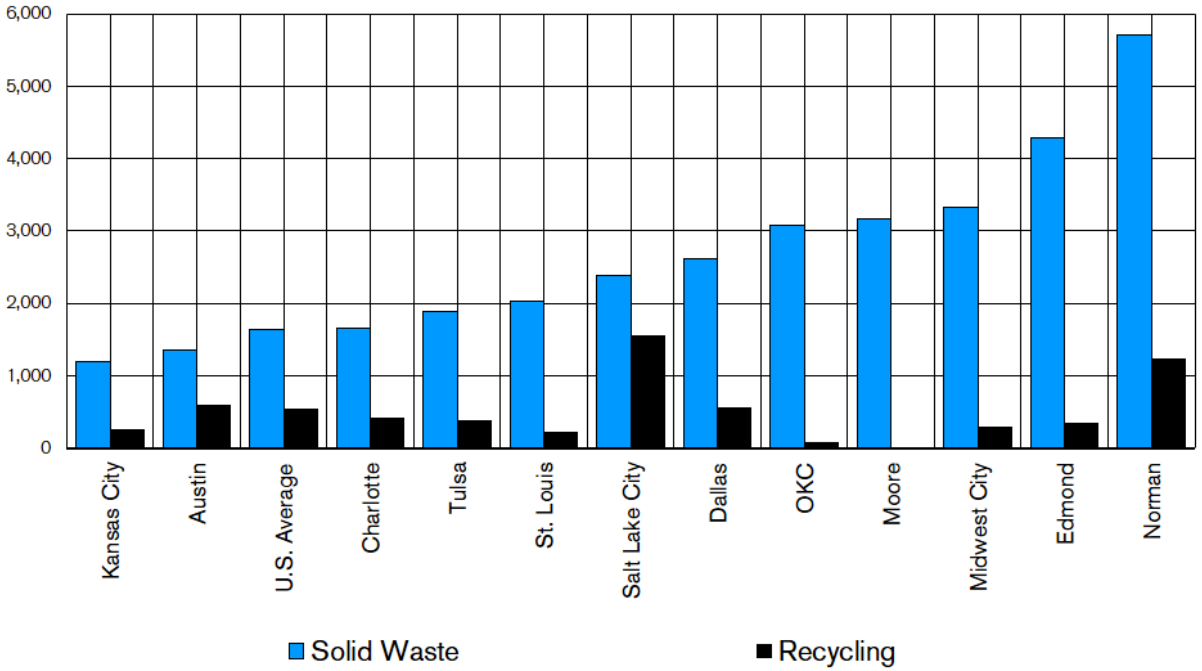
The most prominent alternative to landfills is recovery of materials through recycling. In addition to delaying costly landfill expansions, recycling conserves natural resources by reducing demand for

raw materials and supports several industry sectors associated with the collection, separation, cleaning, production, distribution, storage, and transportation of paper, metals, plastics, glass, rubber, construction and demolition materials, electronics, and organics. Materials made from recycled content reduce energy needs and produce less pollution compared to manufacturing new products using virgin materials when considering the embodied energy required to extract and process raw resources like ore, oil, or wood. Aluminum production, for example, uses a tremendous amount of heat and electricity – more than any other manufactured product in the U.S. – to isolate the aluminum metal from aluminum ore. If a manufacturer is using recycled aluminum metal, the metal skips this energy-intensive extraction and refinement process and requires 94% less energy to produce aluminum from ore.

In Oklahoma City, more than 90% of the City's solid waste customers in single-family residential households have access to curbside recycling and customers outside the curbside program area can recycle at drop-off locations. In July 2018, the City introduced 96-gallon rolling carts to replace 18-gallon containers. Through the first year of collections, this drastic capacity boost increased the amount of recyclable materials diverted from landfills by 134% compared to FY18 (7,348.98 tons collected July 2017 to June 2018).

The success of the expanded residential recycling program is a testament to the desire of residents to recycle more of the materials they "throw away." Commercial and multifamily properties generate higher volumes of waste than residential properties, but there is no public collection or incentive program to increase landfill diversion from these sites. In Oklahoma City, one in four residents (159,327) live in properties with more than two residential units and are unlikely to have convenient access to recycling. Of 136 multifamily properties contacted by phone in the summer of 2018, only 10% said they offer recycling service to tenants. With few exceptions, most commercial and multifamily property owners choose to only pay for hauling of waste to landfills as required by state law (41 OK Stat § 41-118).

Figure WR-1: Average Pounds of Landfilled Solid Waste Per Municipal Recycling Customer, FY15 - FY17



Oklahoma City residents with access to the curbside recycling program landfill more materials per customer than many peer cities across the U.S., but account for less landfilled waste per customer than other cities in the metro area. The pounds landfilled per person is expected to decrease as the available data does not include the introduction of the larger-capacity recycling carts. Despite this positive change, the data highlights a need for a broader shift in perception and greater diversion of materials beyond the curbside recycling program.

Recycling viability has long been subject to the fluctuations of economic markets as the value of recovered materials are tied to commodity prices and industry demand for processing and manufacturing. However, the industry is facing unprecedented challenges due to tighter regulations and outright bans on some materials from scrap export destinations like China, Vietnam, Thailand, Malaysia, and Indonesia. Most recyclables collected in Oklahoma City are processed in the U.S. or Mexico, but increased scrutiny abroad has led to a flood of new materials arriving at domestic processing facilities. These surplus materials and global market shifts have sunk commodity prices and tightened domestic contamination thresholds.

To establish a sustainable, circular economy and mitigate negative land use impacts associated with waste disposal, we must provide more recycling access to residents and businesses, compost/mulch more green waste, and seize economic development opportunities to incubate local processing capacity.

Landfills

There are three active, privately-owned landfills within Oklahoma City: Southeast Oklahoma City Landfill owned (majority share – 45%) by Republic Services, Inc.; East Oak Landfill owned by Waste Management, Inc.; and OKC Waste Disposal Landfill owned by Waste Connections, Inc. A fourth landfill, Northeast Landfill, owned by WCA, operates outside the city limits in Spencer and only accepts construction and demolition debris. Oklahoma City spends about $5 million each year for these four landfills to accept residential and commercial waste.

While landfills may not be the most desirable long-term option for waste disposal, the regulations governing the design and operation of modern landfills have significantly advanced since the days when city dumps employed thousands of hogs. Siting location specifications, hazardous material prohibitions, engineered structure designs, and reclamation and reuse requirements all foster greater environmental protection from use of landfills. Modern landfill design also requires protective liners of clay or plastic to support collection and treatment of any liquid (also known as leachate) that could contaminate groundwater.

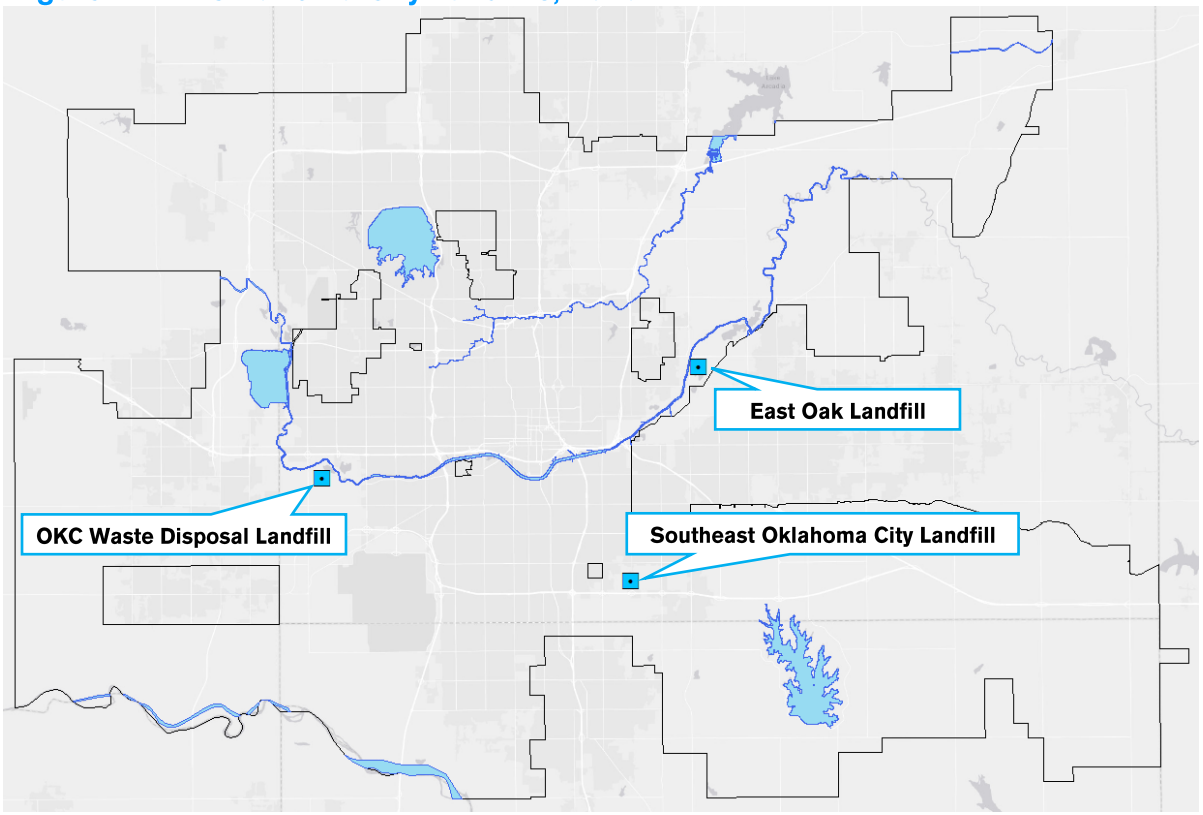
As landfills near capacity, owners can either close or seek to expand the boundary of the site which also affords additional vertical capacity. If the owner decides to close a landfill, the waste is typically sealed under a polyethylene cap, compacted soil, and grass seed. State law requires the entity that owns the landfill to maintain financial assurance of the site after closure and provide post-closure care for a minimum of 30 years. Alternatively, this presents development opportunity for the site to continue to provide community benefit, such as park space, golf courses, or energy production.

In Atlanta, Republic Services used a dual-purpose landfill closure system that included a 10-acre solar array atop Hickory Ridge Landfill to both meet regulatory requirements of closure and provide enough electricity to meet the needs of 224 homes. Balloon Park in Albuquerque, Tifft Nature Preserve in Buffalo, Cesar Chavez Park in Berkeley, McAlpine Creek Soccer Complex in Charlotte, and Rogers Park Golf Course in Tampa are just a few examples of highly-successful parks created in the place of closed landfills. As data is scarce for disposal sites closed prior to 1990, Oklahoma City officially has one closed landfill, Fillsand, which is owned by Republic Services, Inc. and located north of I-40 between Council Road and Morgan Road. Fillsand's location offers several reuse possibilities with Oklahoma City's West River Trail winding along its western edge and proximity to OG&E's Mustang power plant.

Closing a landfill presents opportunities for redevelopment, but also creates new, more expensive challenges: deciding where to place the next one and how to efficiently route refuse trucks to the new location. Living next door to the metro area's buried trash is less than ideal for most homeowners and moving the landfill to the outskirts of the city can drastically increase fuel and maintenance costs for haulers and subsequently residents.

Expanding a landfill often involves rezoning nearby properties to widen the base which allows the landfill to grow taller, too. Most recently, Oklahoma City Council approved a zoning change in 2012 to allow expansion of Southeast Oklahoma City Landfill near SE 59th and South Bryant from 153 acres to 373.96 acres. The approval and expansion extended the estimated year of closure per annual regulatory

Figure WR-2: Oklahoma City Landfills, 2019



Three landfills, all privately-owned and operated, are currently permitted within Oklahoma City.

reports to the EPA from 2021 to 2053, avoiding closure of the site and eventual opening of another landfill in or around the city.

While expansion can delay major investments and a lengthy public process needed to create a new site to bury materials, landfill growth increases the number of households whose property values are negatively affected by proximity to a high-volume disposal site.

Property values are important, even for a sales tax-reliant city, as they directly affect a municipality's ability to leverage debt through general obligation bonds.

Landfill Gas Capture. As organic materials break down over time at these landfills, a potentially dangerous byproduct is produced – landfill gas. Landfill gas is largely a combination of carbon dioxide and methane, both potent greenhouse gasses that trap heat in the atmosphere and contribute to climate change.

Landfills in Oklahoma are required to limit methane emissions to 5% by volume and the Clean Air Act requires larger facilities with gas emissions greater than 55 tons per year to install a system to collect and either destroy or reuse landfill gas. All three active landfills in Oklahoma City have installed gas-capture technology and can provide profitable opportunities for industrial or manufacturing near the landfill or can be used to fuel refuse truck fleets, displacing diesel fuel and reducing smog-causing NOx emissions.

Most recently, Republic Services partnered with Aria Energy and BP PLC to capture, refine, and sell methane produced at Southeast Landfill. According to developers of the $25 million project, the facility is expected to offset more than 16,000 tons of methane emissions. At the East Oak Landfill, a joint venture called ENVIA between Waste Management, NRG, Ventech, and Velocys constructed a gas-to-liquids plant that can simultaneously process both landfill gas and natural gas to produce diesel, synthetic waxes, kerosene, synthetic motor oil, and other oils used in fuel blending and processing. The products made from this process do not contain aromatics or sulfur so they burn cleaner than petroleum-derived fuels with lower emissions of nitrogen oxides, sulfur oxides, and particulates.

ABOVE: HICKORY RIDGE LANDFILL IN ATLANTA, GEORGIA

Hickory Ridge Landfill reached capacity and was capped in 2011 by a $5 million investment by Republic Services, offset in-part by a $2 million grant from the Georgia Environmental Finance Authority (GEFA). 7,000 thin-film photovoltaic solar panels were attached to a geomembrane designed for roofing applications, and vertically-anchored to the sides of the landfill to provide a protective seal. This alternative to a traditional landfill cap not only generates revenue from obsolete land, but also reduce maintenance costs of mowing and soil replacement.

Land Use Impacts. Due to recent expansions, the landfills in Oklahoma City are not short on capacity today. OKC Waste Disposal has estimated capacity to operate for another 10 years while East Oak and Southeast have estimated capacity for 20 and 40 years, respectively. However, with each expansion, more existing properties are impacted and more land in the city is effectively unusable for development, at least until the landfill closes.

Multiple studies have documented the effect on property value based on proximity to landfills.

While these studies differ in methodology and cannot be reliably replicated within the context of Oklahoma City, the body of literature provides a foundation to understand what impact landfills might have on nearby development.

A 2010 study published in the *Journal of Real Estate Research* suggests the percentage of property value depressed is a function of the quantity of waste the landfill accepts per day. Landfills categorized as high-volume - defined as those receiving 500 tons or more per day - made the largest impact on property value in the study sample.

All three of the landfills in Oklahoma City meet this definition of high-volume with each averaging well over 1,000 tons per day. The following three pages feature each of the three active landfills within Oklahoma City mapped with corresponding radii to highlight residential development within. All show three boundaries based on distances of half-mile, one and a half miles, and two and a half miles from the landfill parcels. An outer limit of 2.5 miles was used as an average of outer limits applied in prior studies.

Additionally, Census data was pulled from EPA's EJSCREEN tool for information on the residents within these areas. While the addition of a new landfill in Oklahoma City is unlikely as existing landfills would pursue expansion rather than closure, there is an inescapable future wherein our waste compels the addition of a landfill.

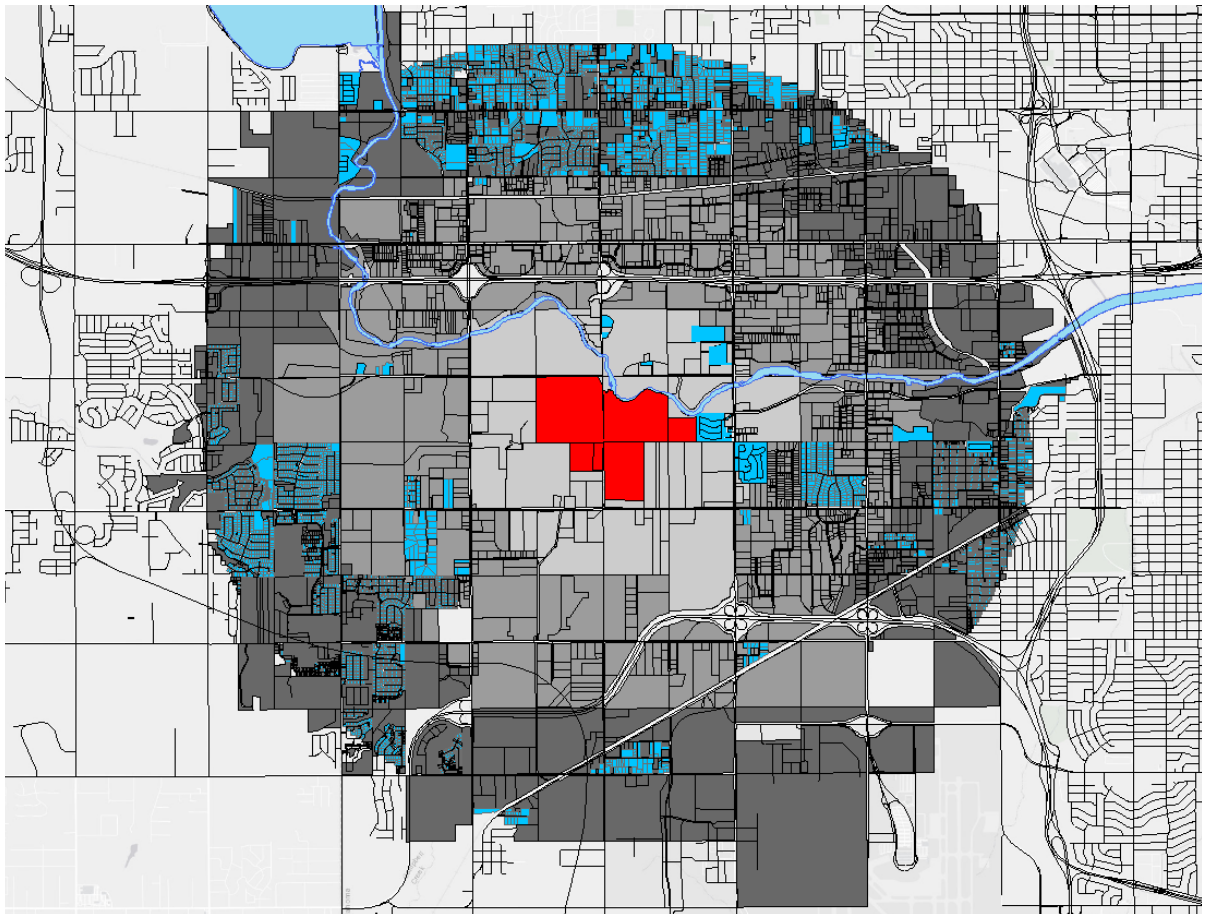
This reality will grow no easier as the years and decades progress and Oklahoma City - as well as abutting suburban communities - continue to expand within their corporate limits. The sprawling land area of Oklahoma City complicates waste service from a logistical (and therefore financial) perspective but, above all, the addition of any new landfill raises questions of environmental justice and how the selection of such a site might impact the properties and residents surrounding it. These are long-term but important questions about Oklahoma City's future growth.

It is important to recognize that rather than an argument against landfills, the application of this methodology to Oklahoma City is intended to demonstrate the potential return on greater waste diversion. The benefits are two-fold: first, a reduction in landfilled waste delays landfill expansion which would require additional parcels and increase the radii of impacted properties; and second, any depression of property value affects the amount of bonding debt the City can access through general obligation bonds for decennial operating and maintenance funds.

Source: Richard B. Meeks, the Oklahoman, 1946

The management of solid waste has progressed tremendously since the early-to-mid 20th century. This photo appeared in the January 10, 1946 edition of *The Oklahoman* as City leaders rebuffed accusations from County officials regarding the status of the dump as a "public nuisance and general health hazard."

Figure WR-3: Residential Development Near OKC Waste Disposal Landfill



Landfill Parcels

Boundary One: 0 to 0.5 Miles from Landfill Parcels

Boundary Two: 0.5 to 1.5 Miles from Landfill Parcels

Boundary Three: 1.5 to 2.5 Miles from Landfill Parcels

Residential Parcels

OKC Waste Disposal Landfill

7600 SW 15th Street

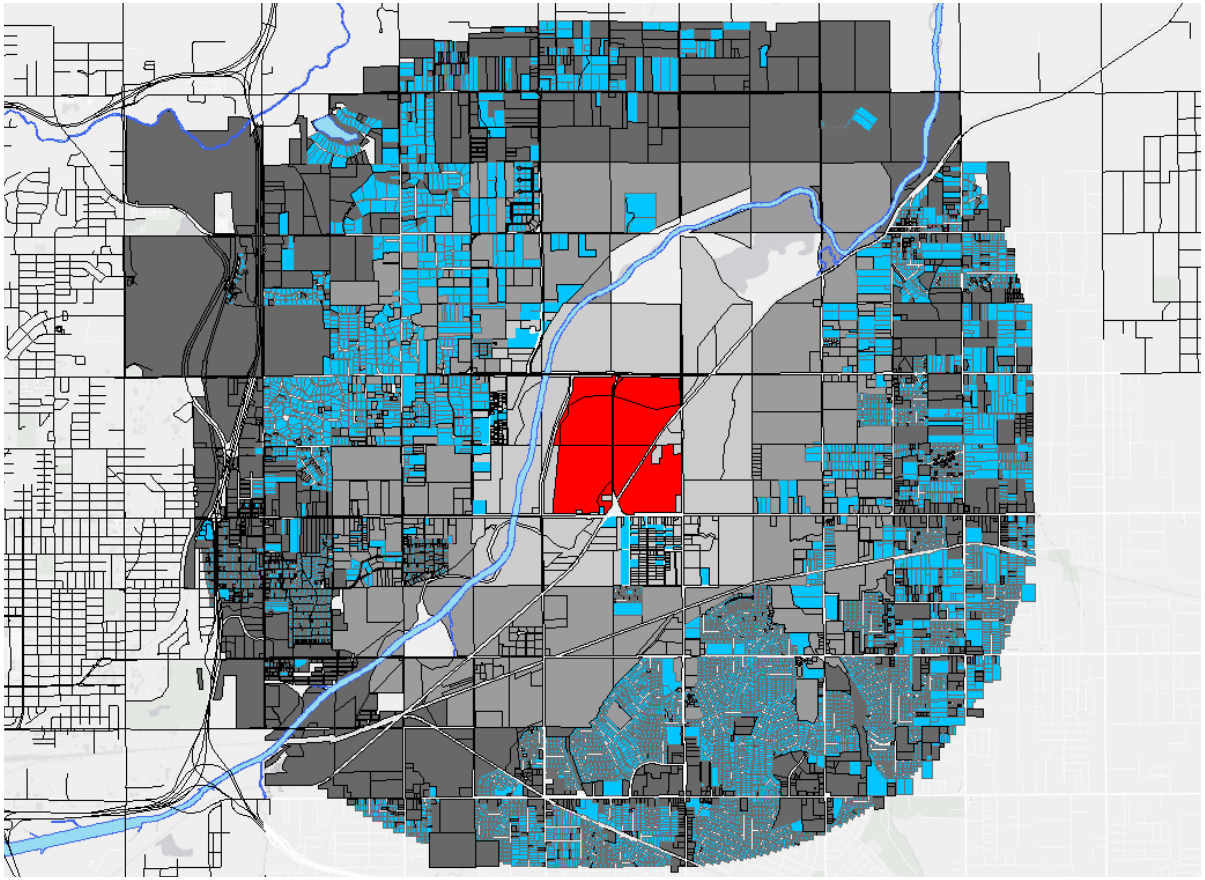
Opened:	1981
Estimated Closure:	2025
Surface Area of Waste:	136 acres
Waste Capacity:	9.7mm tons
Average Annual CO_2 Emissions:	257,138 tons

The entire area within 2.5 miles of the OKC Waste Disposal Landfill parcels is comprised of approximately 9,572 parcels of which about 55% are residential. Those residential parcels, however, only make up about 10% of land area as residential parcels are significantly smaller than commercial and industrial parcels. American Community Survey five-year estimates from 2012 to 2016 place the area's population at 25,702 with a 49% minority population.

Within Boundary One are 136 parcels of which 35 are residential, with the majority (77%) of these residential properties being mobile homes; however, these residential parcels are 4% of Boundary One's total acreage.

The 33 industrial parcels of Boundary One comprise almost 35% of the area and the 49 undeveloped parcels making up the largest share at about 47%. Boundary Two encompasses 1,753 parcels with 612, or about 35%, residential. Industrial is still a major use with 755 parcels making up almost half of Boundary Two's land area. In Boundary Three, 60% of parcels are residential but comprise just about 17% its land area.

Figure WR-4: Residential Development Near East Oak Landfill



Landfill Parcels

Boundary One: 0 to 0.5 Miles from Landfill Parcels

Boundary Two: 0.5 to 1.5 Miles from Landfill Parcels

Boundary Three: 1.5 to 2.5 Miles from Landfill Parcels

Residential Parcels

East Oak Landfill

3201 Moseley Road

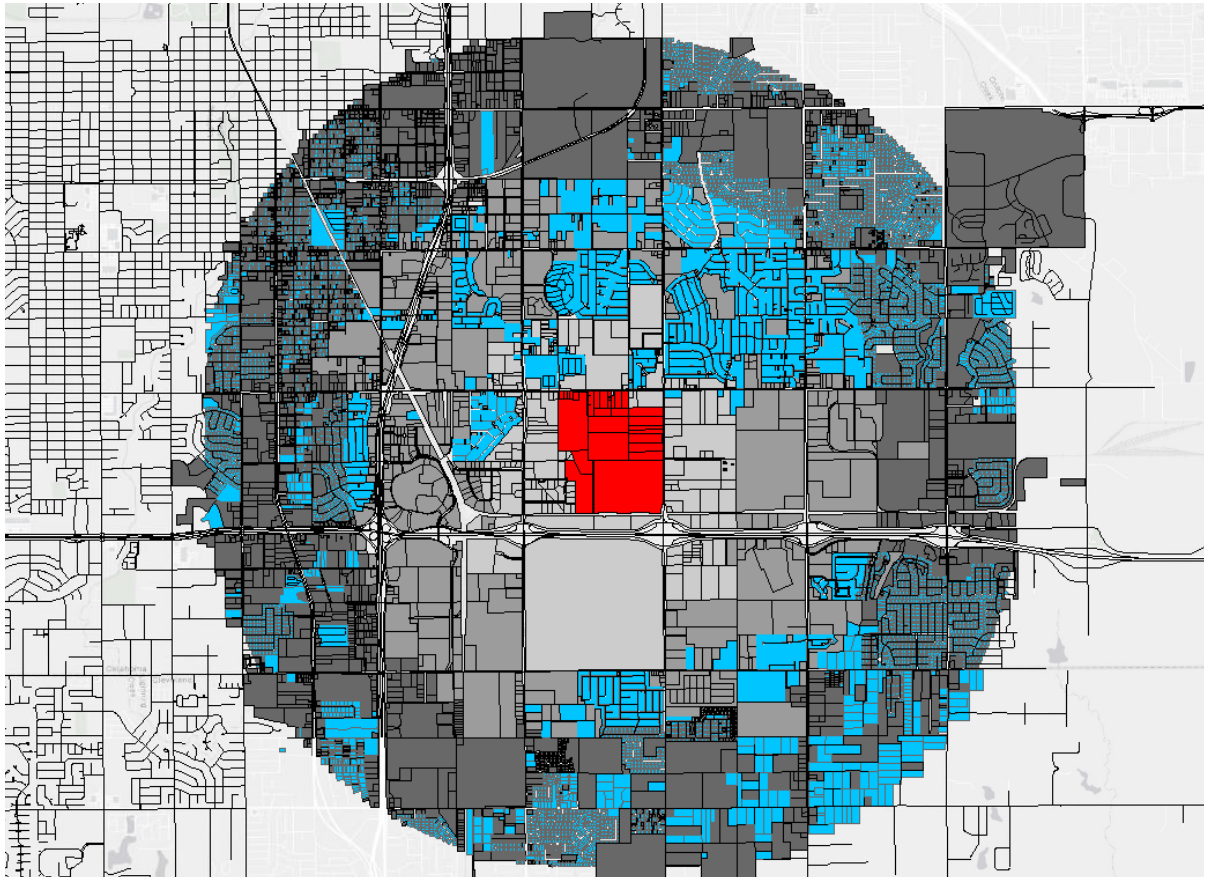
Opened:	1973
Estimated Closure:	2039
Surface Area of Waste:	167 acres
Waste Capacity:	19mm tons
Average Annual CO_2 Emissions:	165,748 tons

The 2.5 mile radius from the East Oak Landfill parcels includes portions of Oklahoma City as well as Midwest City, Spencer, Forest Park, Lake Aluma, and unincorporated portions of Oklahoma County. Within this total area, five-year estimates from 2012 to 2016 via the American Community Survey place population at 30,663 with 14,354 housing units.

About half of the parcels in Boundary One are residential yet make up just 10% of the land area closest to the landfill. Boundary Two is 90% residential and Boundary Three is 91% residential, primarily because neighboring municipalities have dense residential development nearby.

East Oak is sited within a 100-year floodplain but because it was permitted prior to the 1994 adoption of certain state laws, it is exempt from current floodplain siting restrictions but must nonetheless comply with state statutes to ensure the landfill does not restrict the floodplain's storage capacity, flow, or result in floodwaters carrying away solid waste.

Figure WR-5: Residential Development Near Southeast Landfill



Landfill Parcels

Boundary One: 0 to 0.5 Miles from Landfill Parcels

Boundary Two: 0.5 to 1.5 Miles from Landfill Parcels

Boundary Three: 1.5 to 2.5 Miles from Landfill Parcels

Residential Parcels

Southeast Landfill

7001 South Bryant Avenue

Opened:	1950
Estimated Closure:	2067
Surface Area of Waste:	150 acres
Waste Capacity:	38mm tons
Average Annual CO_2 Emissions:	121,495 tons

The 2.5 mile radius of the Southeast Landfill is occupied by a significant amount of residential parcels which is not surprising given its proximity to the crossroads of I-35 and I-240. In Boundary One, about 78% of parcels are residential but just 12% of land area. Parcels in both Boundary Two and Boundary Three are predominately residential at 85% and 88%, respectively. In Boundary Two, 28% of the total land area is residential while in Boundary Three the residential coverage is about 40%.

Recycling

Recycling is comprised of a series of processes that involve several industries each with quality standards to ensure recovered materials can be used to make new products. First, recoverable materials – plastics, non-ferrous metals (aluminum, tin), fibers (paper and cardboard), and glass – whether collected commingled ("single stream") or pre-sorted are transported by a refuse hauling company to a Materials Recovery Facility (MRF).

MRFs are specialized facilities that accept discarded materials from residential and commercial sources then separate and prepare recyclables for end-user manufacturers. At the MRF, the materials are thoroughly sorted by type and compressed into bales. The bales of recyclables must be cleaned and prepared at processing centers before the materials are suitable for sale to manufacturers who can use the recovered raw materials to make new products. To reach manufacturers' cleanliness and granularity requirements, each material undergoes unique, thorough processing before they are sold and used for new products.

Aluminum is baled and sent to a processing plant where it is shredded, melted and formed into a raw material called ingot which is used to make aluminum sheets that are sold to manufacturers to make new products. In Oklahoma, there are numerous metal recycling facilities that help keep costs competitive.

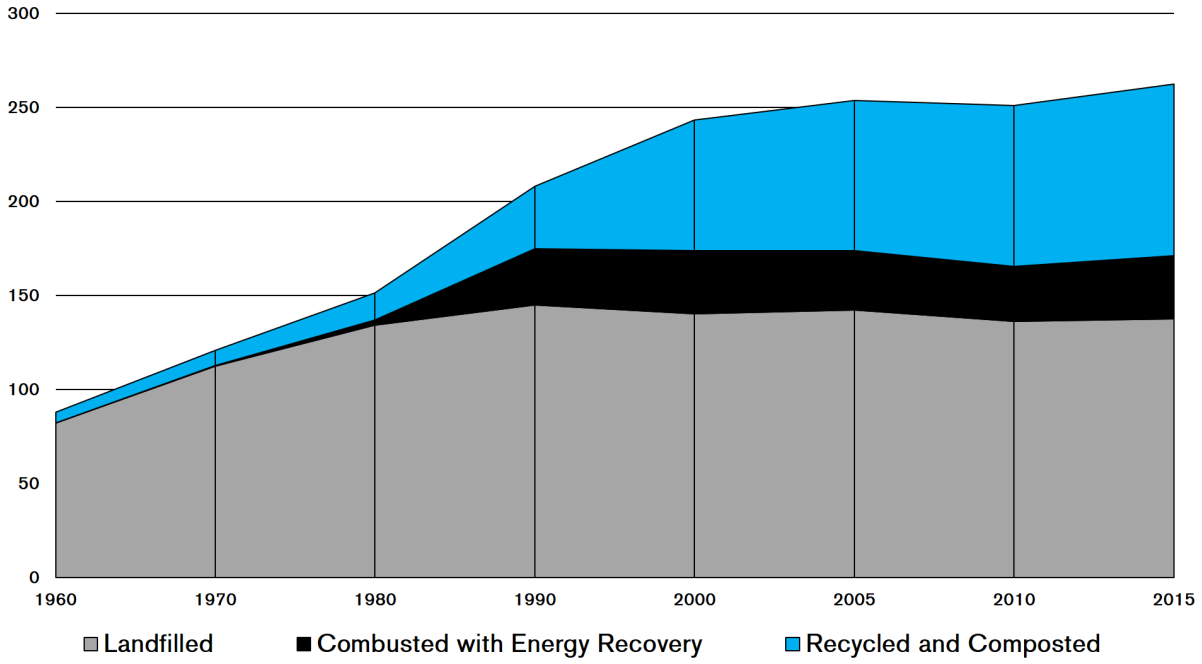
Paper is sorted, baled, and sold to a pulping facility where it is soaked and heated to separate fibers and ink. The pulp is screened to remove additional impurities like adhesive and then pressed into sheets for marketing to a variety of end uses. Like recycled metals, there are several paper mills that can process paper fibers for recycling in Oklahoma, which reduces shipping costs.

Plastic is sorted by type and baled at MRFs as most need to be processed separately from other plastic types. The bales of plastic are sold to processing plants that wash, chop into flakes, and separate using large floatation tanks. Once dried, the flakes are melted and any remaining liquid is screened to remove impurities which translate to potential weaknesses in new products. The screened plastic is chopped into clean, granular pellets that can be sold to manufacturers.

Glass in Oklahoma is typically collected with other waste streams and, as such, often contains significant contamination. At the MRFs, glass is usually broken and discarded to a collection bay early in the sorting process. Depending on the agreement between a buyer and seller, the pieces of broken glass, called glass cullet, may need to be a specific size and/or contain less than an established threshold for contaminants to be sold for a worthwhile price per ton. In fact, many manufacturers require recycled glass be "furnace-ready," which means the cullet must be sorted, cleaned, crushed, and sized – a process called beneficiation.

Glass from Oklahoma City's MRFs must be shipped to one of the two closest beneficiation plants located in Okmulgee – over 100 miles from Oklahoma City – or Midlothian, Texas – over 228 miles away from Oklahoma City. As such, transportation costs present a major challenge to the economics of recycling glass from Oklahoma City.

Figure WR-6: U.S. Municipal Solid Waste By Method of Disposal in Millions of Tons, 1960 - 2015



With renewed attention to the economic and environmental benefits of recycling and better public access to recycling programs, the share of Municipal Solid Waste (MSW) that was recycled and composted in the U.S. more than doubled each decade between 1980 and 2000, but this rate of growth has slowed in recent years.

International Commodity Markets. Modern recycling programs in the U.S. were built on the foundation of China's high demand for scrap materials and low-cost labor. Since the 1980s when Americans only recycled 9.6% of the municipal waste stream, the EPA reports recycling volumes in the U.S. have tripled, passing 89 million tons in 2014 with most of the materials exported to China. According to the Institute of Scrap Recycling Industries Inc., more than two-thirds of U.S. paper and over 40% of plastic collected for recycling in the U.S. were exported to China.

In early 2017, Chinese authorities initiated the 'National Sword' operation to crackdown on use of illegal permits for smuggling operations, but the inspections also targeted contaminated recyclable materials, such as paper with high moisture content and low-grade plastics. After confirming a ban on some materials – specifically recovered mixed paper; recycled PET, PE, PVC and PS; textiles; and vanadium slag – the Chinese government stopped issuing import permits, effectively halting recycling exports from the U.S. and tanking commodity prices.

In November 2017, China established a new contamination rate threshold of 0.5% - far lower than most domestic waste companies can achieve under current program structures and processing systems – and began enforcement in March 2018. As of August 2018, Malaysia, Thailand, and Vietnam followed-through with plans to enact restrictions on new import licenses and bans of some materials, further reducing export options.

Without the recycling import giant as a destination and with alternative scrap importers also diminishing markets in Asia creating a surplus of domestic scrap materials, U.S. processing plants continue to pay less for recovered materials further driving down commodity prices.

End-user convenience (single-stream recycling) has been relied upon to boost recycling participation but has also led to more unrecyclable recyclable materials due to contaminants in the recycling bin. The National Waste and Recycling association estimates an average 25% of the materials Americans attempt to recycle ends up landfilled due to contamination.

Source: China Photos/Getty Images

Used plastic bottles remain heaped up at a recycling mill in Wuhan of Hubei Province, China. In July of 2017, China, which is by far the world's largest importer and recycler of scrap metals, plastic, and paper, notified the World Trade Organization that it planned to effectively ban imports of 24 types of scrap, which its environment ministry called "foreign garbage."

"Everything we use comes in boxes, cartons, bins, the so-called packaging we love so much. The mountain of things we throw away are much greater than the things we use."

- John Steinbeck
"Travels with Charley: In Search of America," 1962

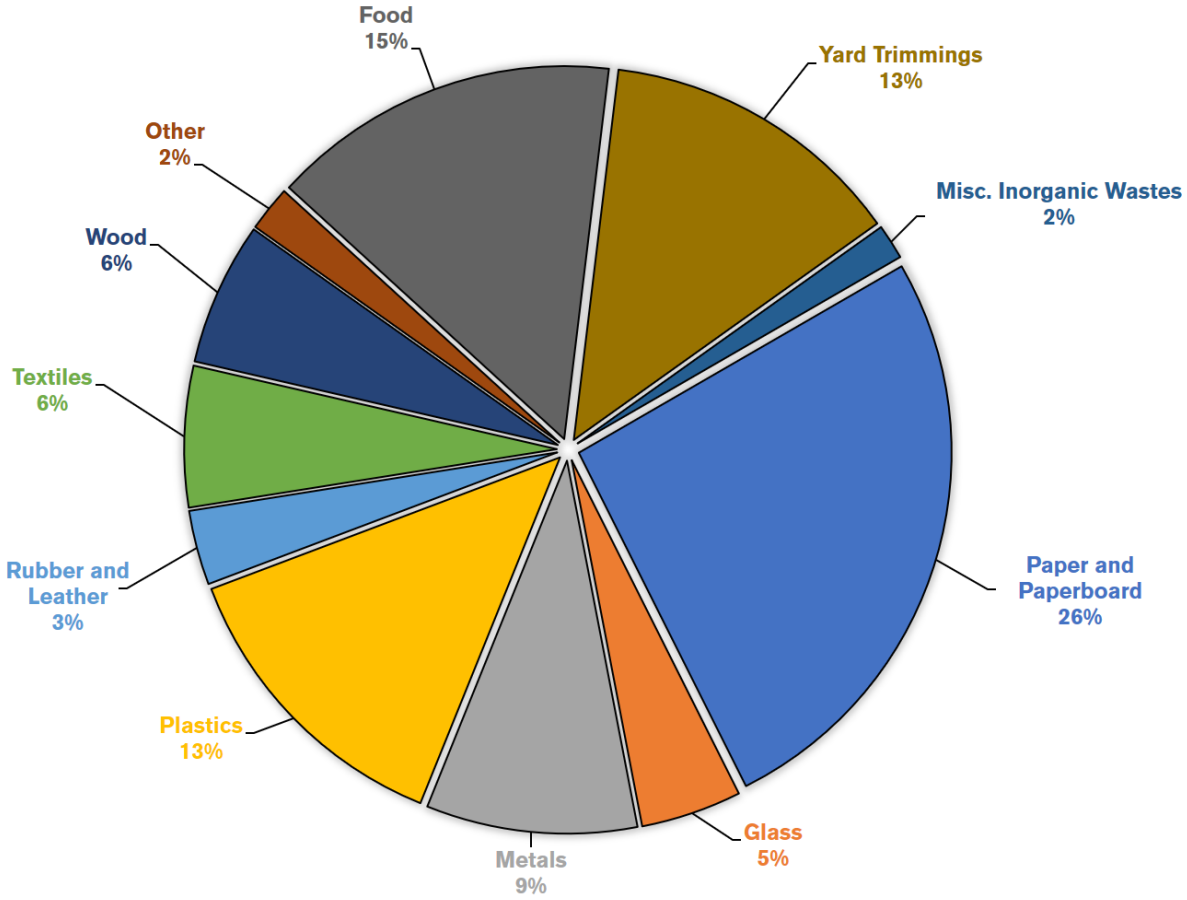
Waste Characterization

To significantly increase the amount of materials recovered through recycling, it's important to understand where the materials originate (sources that create and/or use the materials), but it's crucial to determine which material types are landfilled the most on an annual basis. Landfill owners/operators report total tonnage of waste accepted annually to both the EPA and Oklahoma Department of Environmental Quality (ODEQ), but the report does not include a breakdown of types of materials or source sectors (commercial, residential, industrial) from which the materials were collected. This knowledge gap presents a barrier to strategically prioritizing certain materials for source-reduction and monitoring progress.

In lieu of actual local data, U.S. municipal solid waste averages can provide insight into waste stream trends useful to estimate the gaps in available local data. Additionally, product generation statistics from the EPA help further refine how much of certain materials are generated and landfilled each year. The percentage breakdown of paper and paperboard products generated in the U.S. each year, for example, is likely to generally resemble the percentage make-up of paper products ending up in Oklahoma City landfills.

As paper and paperboard materials made up the largest share (26%) of total MSW and corrugated boxes were by far the leading paper and paperboard product generated in the U.S. in 2015, additional drop-off locations and other incentives to recycle corrugated boxes will help improve landfill diversion rates. Rather than seeking only to influence consumer behavior, policies and programs that work with manufacturers to reduce packaging waste from the point of production have the potential to make longer-lasting gains.

Figure WR-7: U.S. Municipal Solid Waste By Material, 2015



The breakdown by material of the total MSW generated nationally in 2015 depicts organic materials – paper, paperboard, yard trimmings, and food – as comprising more than 54% of the total waste stream. A renewed focus on diversion of these materials is needed to supplement the City's new curbside recycling capacity. It is important to note that over the last few decades, the generation, recycling, and disposal of MSW has changed substantially. Generation of MSW increased (except in recession years) from 88.1 million tons in 1960 to 262.4 million tons in 2015, an almost 200% increase. The generation rate in 1960 was just 2.68 pounds per person per day; it increased to 3.66 pounds per person per day in 1980 and in 2000 reached 4.74 pounds per person per day. The generation rate was 4.48 pounds per person per day in 2015, which was one of the lowest generation rates since 1980.

Hazardous Waste. One category of solid waste that carries additional regulation from both EPA and ODEQ is hazardous waste. Hazardous waste is any solid waste with dangerous properties or that is capable of being harmful to human health or the environment.

Examples of hazardous wastes include industrial wastes, batteries, dangerous gasses, paint, chemicals, cleaners, motor oil, mercury, and pharmaceuticals, among others. If improperly disposed, these materials contaminate soil and groundwater, contribute to harmful air quality, and depending on exposure, can be fatal for people and wildlife.

Mercury, for example, is commonly found in thermostats and fluorescent light bulbs but is a dangerous neurotoxin that can harm the human brain, heart, kidneys, lungs, and immune system and impair the nervous system of young children and unborn babies. Once introduced to the natural environment, microorganisms change mercury into methylmercury, a highly toxic chemical that can concentrate in fish and animals.

Even though mercury thermostats are no longer sold in the U.S., they can remain operable for several decades and are still in use in many buildings in Oklahoma City. While old thermostats containing mercury are often overlooked and landfilled due to the small quantities per device, those seemingly small quantities add up quickly with such a highly-potent substance.

In fact, due to the high potency of the substance, EPA restricts the amount of mercury in drinking water to a mere 0.002 parts per million. That's equivalent to one household thermostat contaminating more water than the average Oklahoma City single-family residential water customer uses over six years.

Pharmaceuticals, or prescription pills, are found in nearly every home and pose a significant risk to water quality if improperly disposed. Flushing old pills down the toilet can not only contaminate water reservoirs and harm wildlife, but will also increase treatment costs of drinking water. Twice per year, the City of Oklahoma City hosts special

collection events at State Fair Park for residents to dispose of pharmaceuticals, as well as other items difficult to safely dispose like tires, ammunition, and electronics/computers.

Additionally, the Oklahoma Bureau of Narcotics Safe Trips for Scripts program offers drop-off locations for safe disposal of pharmaceuticals. While the program's primary target is keeping secondhand narcotics off the street, the secure drop-off sites also prevent the chemical compounds from entering local waterways.

In Oklahoma City, residents can bring most household hazardous wastes, except for radioactive, biomedical, refrigerants, compressed gas containers, tires, or computer equipment, to the City's Household Hazardous Waste Facility, located at 1621 S Portland Ave., for safe recycling, treatment, or disposal.

Residents of the Village, Yukon, Tinker Air Force Base, Shawnee, El Reno, Edmond, Bethany, Warr Acres, and Moore can also recycle their hazardous waste at the facility, but may be charged for the service through their municipality.

ABOVE: HOUSEHOLD HAZARDOUS WASTE

Paints, polishes, and CFL or fluorescent light bulbs are a small sample of materials accepted by the City's Household Hazardous Waste Facility. In the past three fiscal years alone, the Household Hazardous Waste Facility has collected about 975 tons of materials; for scale, that's about 12 times the weight of the Space Shuttle Endeavor.

Organic Waste. Organic waste in the MSW stream includes any biodegradable material including green waste (grass clippings, tree branches, leaves, etc.), paper, and wasted food. On a national scale, EPA estimates paper products have the majority share of the organic waste stream, representing nearly 26% of MSW, with wasted food and yard trimmings comprising 15% and 13%, respectively.

Composting, a natural process through which organic matter decomposes and creates a nutrient-rich soil conditioner, is a more-beneficial alternative to both applying excessive fertilizer and landfilling green waste. Adding compost to soil can assist in erosion control, soil fertility, stimulating healthy root development in plants, and water conservation.

Top-dressing, or adding compost in a thin layer above bare soil, creates a barrier to evaporation reducing need for more frequent irrigation by retaining moisture in the soil. In fact, increasing organic material in soil by as little as 5% quadruples the soil's water holding capacity. On the other hand, adding fertilizer to soil provides food to plants – not the soil.

As plants can consume a finite amount of food, much fertilizer applied to lawns and gardens is washed into storm drains and eventually enters local lakes and streams incrementally altering water quality and damaging aquatic habitats.

Making compost is relatively easy with heat, moisture, and the proper ratio (2:1) of carbon (e.g. leaves, wood chips, shredded newsprint) and nitrogen (e.g. food scraps, coffee grounds, animal manure, grass clippings). Compost production is highly scalable; homeowners can divert as much or as little as needed for lawn amendment or garden supplement, but commercial operations can produce more by increasing the speed of decomposition with higher heat levels and more effective mixing equipment.

The City of Norman recycles an average of 14,000 tons of yard waste at its green waste facility and makes compost and mulch available to residents for free. In FY18, Norman residents diverted 15,856 tons of green waste material from landfills – more than twice the tonnage of recyclables collected in Oklahoma City's curbside recycling program during that time.

There are many sources of routine green waste, like commercial yard maintenance crews, residential bulky waste collections, and vegetative management by utility companies, but large volumes of green waste can accumulate quickly after severe weather. Ice storms, tornadoes, and straight-line winds can generate spikes in green waste arriving in Oklahoma City landfills.

The total amount of debris from green waste will vary wildly depending on a weather event's severity, duration, and proximity to highly-populated areas. Two tornadoes occurring in May of 2010 and 2015, for example, combined to produce just over 3,000 tons of debris that needed to be managed. However, in May of 2013, the tornado event that ravaged densely-populated areas of Moore and south Oklahoma City generated more than 795,000 tons of debris which is more than 2.5 times Oklahoma City's average annual amount of residential curbside solid waste collections.

Another subcategory of the organic waste stream that has gained increasing attention in recent years is wasted food. With less than six percent of the 39 million tons of wasted food produced in the U.S. in 2015 diverted from landfills and incinerators, food represents a major opportunity to reduce both the volume and associated emissions of MSW reaching landfills.

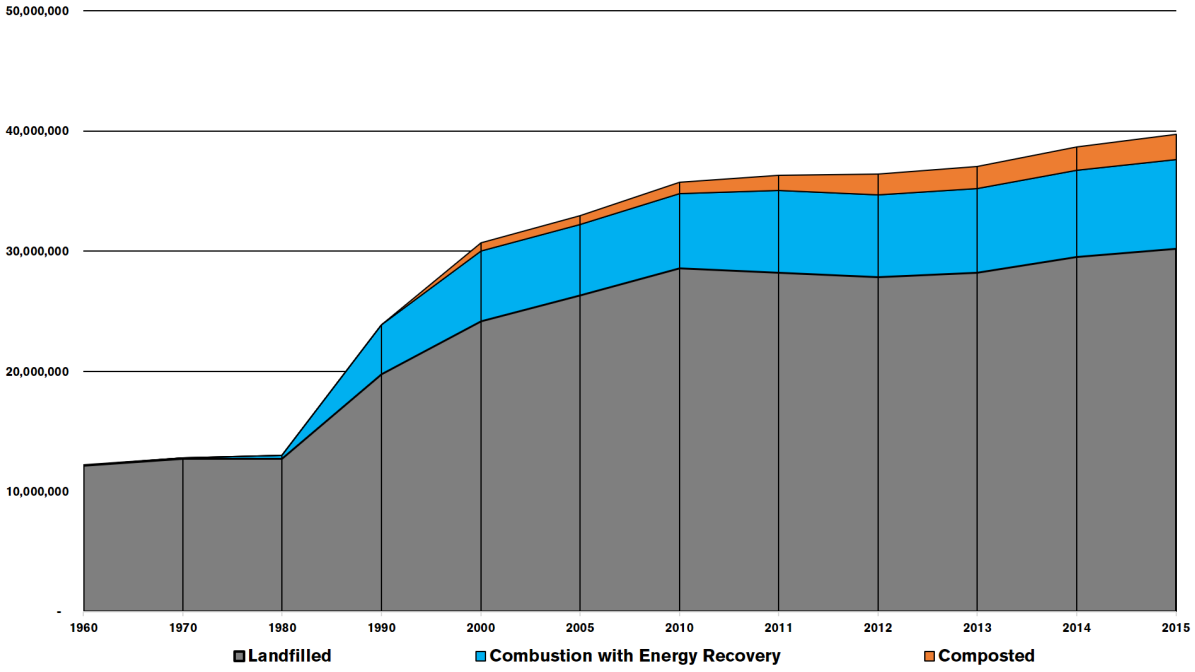
Wasted food breaks down faster than most other materials in landfills and produces the highest percentage of the most potent greenhouse gas – methane.

Photo by Jim Beckel, the Oklahoman, 2015

LEFT: STORM DEBRIS GREEN WASTE

The November ice storm of 2015 devastated Oklahoma, resulting in a state of emergency declaration for all 77 counties. Ice-laden trees fell and took overhead power lines with them, knocking out electricity to roughly 60,000 households statewide. In Oklahoma City, clean-up efforts took months including pick-up of curbside green waste and tree debris. The quantity removed by City personnel and contractors was estimated to exceed 71,000 tons with an estimated cost per ton range of $67 to $71, putting the total debris price tag in a range of $4.8 million to $5.1 million.

Figure WR-8: Food Waste Disposal by Method in Tons, 1960 - 2015



Source: U.S. EPA

Since 1980, an increasing amount of food waste has been diverted from landfills either via composting or combustion with energy recovery. Despite this trend, the total amount of food waste has continued to climb to nearly 40 million tons in 2015.

While the greatest amount of highly-potent greenhouse gas emissions is likely generated during decomposition, emissions are associated with every step of food production and distribution: industry (producing fertilizer), transportation (moving food around), buildings (storing food), energy (refrigerating and cooking food), and agriculture (digesting).

From source reduction to feeding people and animals to industrial uses to composting, a successful food recovery strategy is a product of identifying opportunities, forging connections across industries, and working with a wide variety of partners to maximize effectiveness. There are numerous sources of wasted food, such as: unsold food from retail stores; uneaten prepared food; kitchen trimmings from restaurants, cafeterias, and households; and by-products from food and beverage processing facilities. These streams of wasted food generally fall into one of three broad categories: excess food, food waste, and food loss. Excess food can be recovered and donated to feed people, food loss is unused product that never made it to processing, like unharvested crops, but food waste refers to inedible scraps like spoiled food or plate waste.

Opportunities to divert excess food starts with excess food generators like correctional facilities, schools, food banks, healthcare facilities, hospitality industry, event planners, and food manufacturing, processing, wholesalers, and distributors. In Oklahoma City, the Regional Food Bank of Oklahoma, whose services spread across the western half of the state, is a leader in re-routing excess food from landfills to feed people. In 2017, the organization rescued more than 12.3 million pounds of food through their Retail Food Recovery Program, the equivalent of more than 6.2 million meals.

To defer landfilling food waste not suitable for human consumption, food waste can be used as feedstock for animals, composted, anaerobically digested (AD), or combusted with energy recovery. Interest in the AD process has increased in recent years due, in part, to a renewed focus on eliminating wasted food. AD is a natural process in which microorganisms break down organic wastes and can decompose fats, oils, and greases, solids and liquids used in food processing, and biosolids produced during water treatment. In the Oklahoma City metro, there are four AD facilities, all related to water: Yukon, Del City, and Midwest City use AD processing, but do not use outside waste for AD, while Norman's Water Reclamation Facility does use AD to convert organic material in biosolids to methane and CO_2. None of the facilities are used for food waste.

"There is no such thing as garbage, just useful stuff in the wrong place."

- Alex Steffen

Our Plan

The economic, environmental, and social costs of traditional waste disposal will continue to grow without a combination of practical and innovative solutions including greater recycling, composting, materials reuse, anaerobic digestion, and source reduction. The success of the expanded curbside recycling program illustrates that residents place a high priority on public investments that reap both near- and long-term benefits.

Our plan will implement the vision of plan**okc** by supporting the growth of materials-recovery industries, protecting valuable land for future growth, and integrating life-cycle considerations to purchasing decisions. It acknowledges Oklahoma City's status as a primary stakeholder in the disposal practices of the metro and proposes purchase power aggregation to increase waste diversion from commercial properties and construction/demolition activities. With control of a portion of the MSW stream (residential curbside, hazardous waste) and influence over others (commercial/office/retail, industrial), Oklahoma City is positioned to affect how and where the metro manages waste materials for the next century.

Our Goals

RESOURCE RECOVERY

1. **Recycle or reuse recoverable material.**

SOURCE REDUCTION

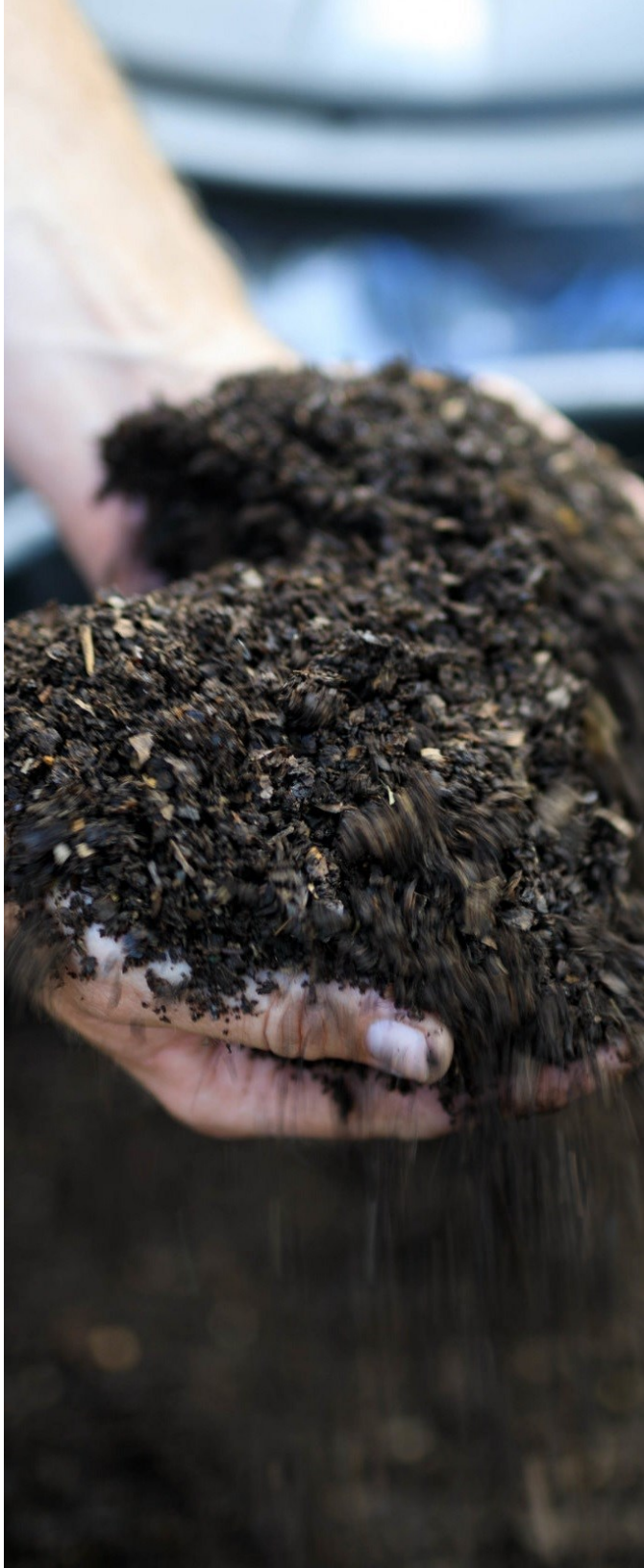
2. **Increase demand for products made with recycled content.**

ENVIRONMENTAL HEALTH

3. **Prevent exposure to hazardous waste.**

Our Initiatives

Waste Reduction Initiatives	Goals 1	2	3
1. Reduce amount of recoverable waste sent to landfills.	■	■	■
2. Purchase products made with recycled content.		■	
3. Increase options for proper hazardous waste disposal.	■	■	■



INITIATIVE 1

REDUCE AMOUNT OF RECOVERABLE WASTE SENT TO LANDFILLS

Identify recycling options for residents and businesses not included in the curbside recycling program. To delay the increased costs associated with landfill expansion or relocation, intervention is needed in the waste streams of commercial, multifamily, and construction sectors. To compliment the recent investment that increased curbside recycling capacity, we will identify recycling options available for the one in four residents living in multifamily properties. Consulting property owners, waste haulers, and residents to determine the right mix of programs, incentives, and policies will be critical to achieving our goals.

Collect recyclable materials in City facilities. Routine collection and hauling of waste materials to landfills from ninety-nine City of Oklahoma City facilities costs about $465,000 on average each year. Recycling is presently available in fewer than 13% of the City's more than 100 staffed locations. Many smaller City facilities, like Police and Fire stations, may already be located on existing collection routes and could potentially provide cost-savings by recycling materials through the curbside program.

Reduce green waste sent to landfills. Routine vegetative maintenance in public spaces and along utility easements combined with unpredictable spikes in green waste volume caused by severe weather events offers ample feedstock to create soil-enriching, water-conserving compost. FEMA standards exist to allow keeping tree limbs and other organics in disaster debris out of landfills without compromising reimbursement eligibility, but these standards are strict and will require formal planning and partnerships. We will develop alternatives to landfilling green waste and offer mulch and compost for residents, businesses, and City operations.

Coordinate and implement a food waste strategy. Creating lasting change in food waste behaviors is more than just interrupting the farm to table to landfill pipeline of our food system. Producers, processors, distributors, and consumers all have stake in shrinking the amount of wasted food sent to landfills and should all be engaged in developing a strategy that achieves results for our community. A proper mix of encouragement, incentives, and regulation will foster healthier, more efficient food production, delivery, and disposal.

POLICIES

WR-1: Provide recycling service in City and Trust facilities.

WR-2: Conduct study of paper-intensive municipal processes and implement strategy to reduce paper consumption.

WR-3: Use paper that contains a minimum of 30% recycled content in City processes.

WR-4: Transition board, council, and commission meetings to paperless agendas and packets.

WR-5: Recycle plastic and metals collected routinely by code enforcement staff and during sign sweeps.

WR-6: Recycle and compost waste from City events.

WR-7: Develop and promote toolkit for community event organizers to pursue zero landfill events.

WR-8: Prioritize green waste diversion from landfills in Debris Management Plan.

WR-9: Study start-up and operational feasibility of municipal green waste/mulch/compost facility.

WR-10: Promote strategies and resources to reduce wasted food.

WR-11: Adopt building codes to reduce debris and total losses during extreme weather and tornado events.

WR-12: Increase recycling access for residents in multifamily properties and commercial businesses through tools such as franchise zones and drop-off locations.

Mixed paper shredded and baled in preparation for shipment to a paper mill.

INITIATIVE 2

PURCHASE PRODUCTS MADE WITH RECYCLED CONTENT

Update and implement the City's Sustainable Purchasing Policy. As commodities are inextricably tied to market values, recycling is only as cost-effective as the markets that exist to process, sell, and recreate new products. To fully support a closed-loop approach to waste management, the City and residents should prioritize buying products that contain recycled content as highly as we do the act of recycling. Likewise, the City should also reduce purchases of products with excessive packaging and/or are packaged in materials not accepted by recycling providers.

Recognizing the pressing need for domestic facilities that can process and manufacture recycled materials, the City's Sustainable Purchasing policy should be implemented and used in new contract language.

POLICY

WR-13: Update the City's Sustainable Purchasing Policy and develop implementation strategy.

INITIATIVE 3

INCREASE OPTIONS FOR PROPER HAZARDOUS WASTE DISPOSAL

Expand options and encourage producer responsibility to safely dispose of hazardous waste. While the dangers and extreme potency of substances like mercury have long been understood and well-documented, there are still unprotected paths for these materials to reach soil, water, and residents. Many thermostats in buildings still contain mercury and, even in small doses, can pose fatal risks when introduced to the natural environment after demolition or remodeling. Pharmaceuticals are often disposed with the best of intentions (to prevent abuse of the substances) in the worst of places: toilets. The unused medications can increase water treatment costs and cause irreparable harm to fish and wildlife.

Transportation can be a barrier to maximizing safe disposal options, either via the Household Hazardous Waste Collection Facility or during bi-annual special drop-off events. Engaging neighborhoods and other stakeholders to explore additional collection locations and events will ensure we can capture more.

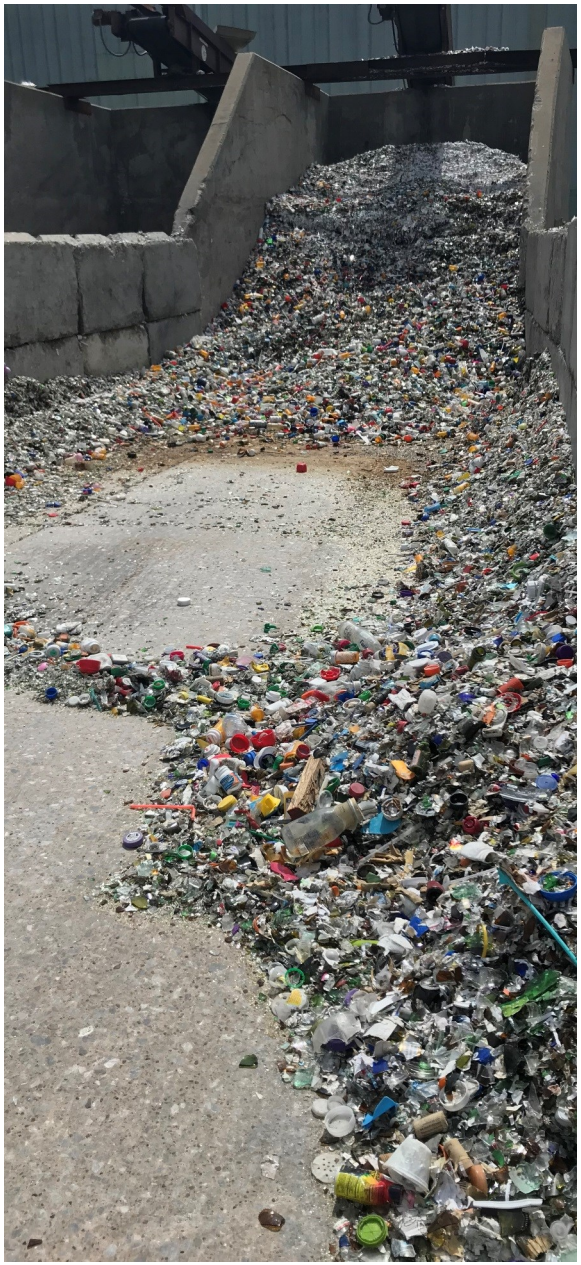
POLICIES

WR-14: Explore additional hazardous waste collection events each year to target specific geographic areas of the city.

WR-15: Increase the number of prescription and sharps drop-off locations.

WR-16: Advocate for requiring battery producers to offer recycling of nickel-cadmium, lithium-ion, and small sealed lead batteries.

WR-17: Require recycling of mercury thermostats when issuing demolition permits.



Remnants of broken glass containers and small plastic detritus at one of Waste Management's multi-reuse facilities in Oklahoma City.