North Central Texas Council of Governments

North Central Texas Organic Waste Gap Analysis Technical Study

Submitted by Risa Weinberger & Associates, Inc.

August 1, 2023

R. Alexander Associates, Inc. 4 DECADES OF SERVICE TO THE COMPOSTING AND ORGANICS RECYCLING INDUSTRY

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NewGen Strategies & Solutions

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This study was funded through a solid waste management grant provided by TCEQ through NCTCOG. This funding does not necessarily indicate endorsement of the study findings and recommendations.

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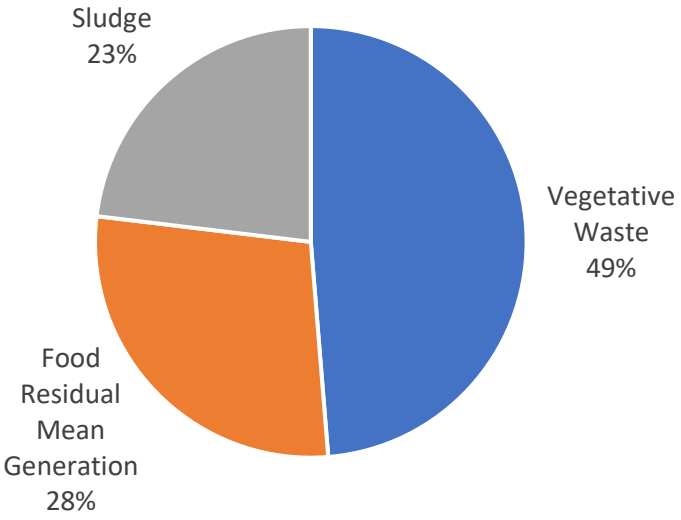
Executive Summary

Wasted organics account for 30% of the waste generated in the North Central Texas Council of Governments (NCTCOG) region (Region). To achieve the NCTCOG's regional goals, it is essential that local governments in the Region take action to increase the quantity of organics recovered. The NCTCOG Organic Waste Gap Analysis Technology Study aims to identify opportunities to reduce the disposal of vegetative wastes, non-residential food residuals, and municipal wastewater treatment plant sludge.

Wasted Organics

It is estimated that a total of 2.8 million tons per year of wasted organics is generated in the 16-county Region. Figure E-1 illustrates the distribution of "gross tons" of organic wastes generated in the Region. Gross tons are defined as wastes prior to recovery.

Figure E-1
Distribution of Gross Tons of Organics



Vegetative Waste

A total of 1.36 million tons of vegetative waste is generated in the Region. This includes brush, leaves, grass clippings, and tree-trimming wastes which are collected by municipalities and private landscaping and tree-trimming companies. A significant percentage of these materials are already being recovered and processed into mulch or compost. It is estimated that approximately 700,000 tons are recovered. An estimated 612,000 tons are still ending up in landfills. In the 40 cities with the largest population, about 50% of the Region's households receive separate collections of brush and yard waste. One of the more significant policy changes that could affect the recovery of organics is to have local governments currently collecting co-mingled brush and bulky waste shift to separate brush collection. Other factors that can impact the quantities of wasted organics recovered.

- Increased number of cities providing separate collection services of yard waste
- Frequency of storm events
- Continued growth in the area resulting in more land clearing
- More accessibility to processing facilities
- Higher landfill tipping fees

Food Residuals

The focus of the Study is on the generation of food residuals generated from industry, businesses, and institutions, and does not include an assessment of residential food waste. Based on a review of US EPA data, there is an estimated 788,000 gross tons of food residuals generated in the Region. For several

years, food processors have made efforts to reduce the amount of food residuals they generate as a matter of their sustainability policies and as a cost-saving measure. The US EPA estimates that this segment of the food industry landfills only 2% of the food residual they generate. Other sectors of the food industry reduce approximately 40% of their food residuals. These reductions are achieved by using food waste for animal feed, land application, food donations, and other measures. Taking these reductions into account, it is estimated that 405,000 tons of net tons of non-residential food residuals are landfilled annually. The following list includes factors that can impact the quantities of food residuals generated and recovered.

- Adoption of additional sustainability programs by food industries
- Increased landfill costs
- Mandatory recycling ordinances
- Continued population increases

Sludge

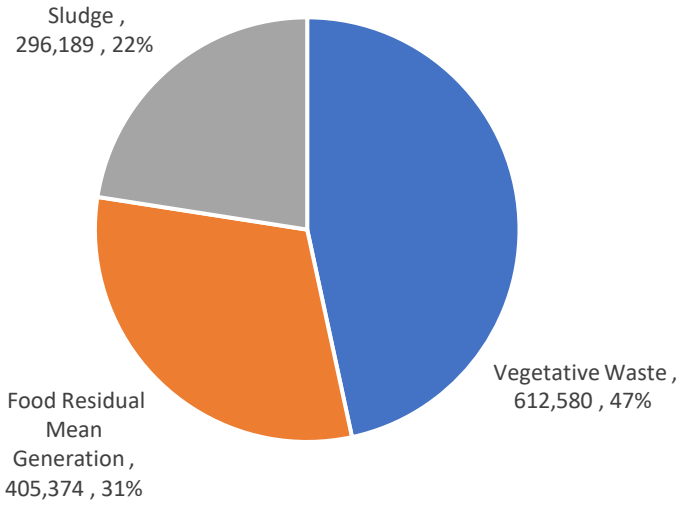
The 95 publicly owned and operated wastewater treatment facilities generate a total of 645,000 gross wet tons per year. The largest facilities, including the Fort Worth Village Creek plant and Trinity River Authority (TRA) Central Region Treatment Plant, land apply their sludge on croplands for beneficial use. The Dallas Water Utility (DWU) Southside plant disposes of its sludge on its own dedicated land disposal area or its monofil. Approximately 296,000 wet tons are landfilled each year. The North Texas Municipal Water District (NTMWD) and most other communities in the Region rely on either landfill disposal or surface disposal at dedicated land disposal sites. The City of Denton is the only community that is composting sludge. The following list includes some of the key issues confronting the municipal wastewater treatment industry.

- The potential impact of federal regulations related to PFAS
- Contractual arrangements between private haulers and communities for managing sludge
- Changes in wastewater treatment technologies
- Public opposition to, and Potential changes in regulations affecting land application of sludge

Net Tons Generated

Figure E-2 presents the distribution of the estimated 1.3 million "net tons" of organics that are still being landfilled in the Region. The quantities of material generated are expressed in tons, however, both the mulch and compost industries rely primarily on cubic yards. To produce compost from these materials, it is essential that there is a balance of bulking material (vegetative waste) and other materials including food and sludge. A preliminary

Figure E-2
Distribution of Net Tons of Organics



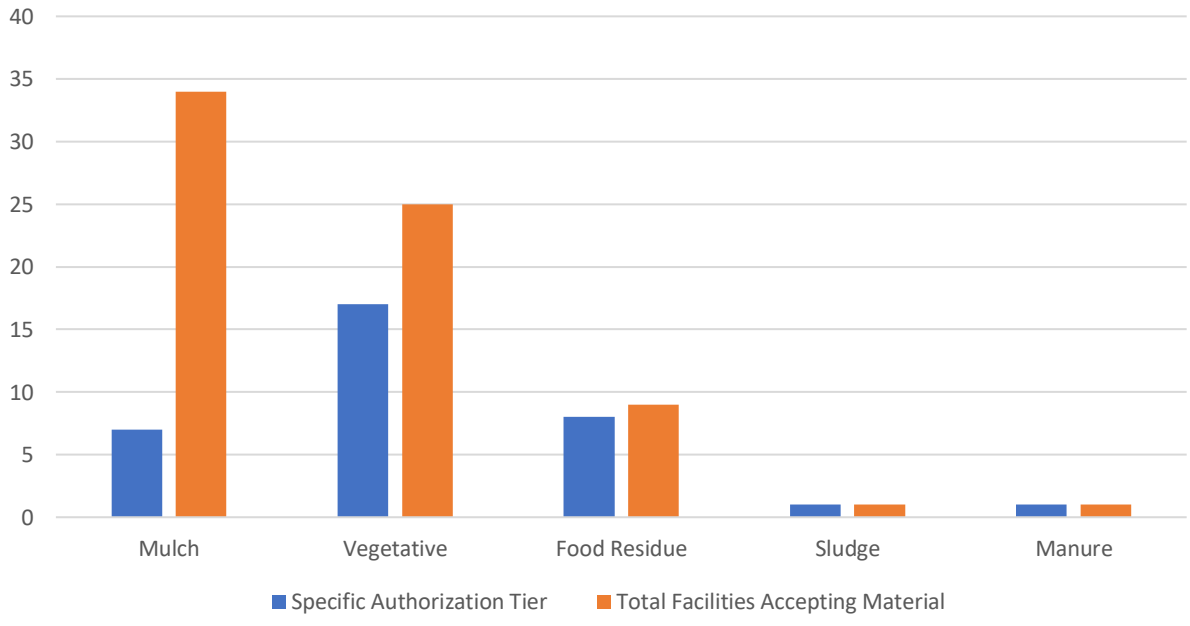
assessment of feedstock availability indicates that there is sufficient vegetative waste to blend with food and sludge***. It is estimated that the conversion of the available net tons of material would produce approximately 394,000 tons of compost, with an estimated value of $xxx to $yyy.***

The Compost and Mulch Industry

As stated, there are believed to be a total of 40 mulch/compost facilities that process vegetative waste, food residues, and sludge in the Region. These include TCEQ-authorized sites, landfills that have mulch or compost operations approved as part of their operating plan, and sites identified through this process. Of these 40 sites, only 34 were identified through a Google Earth search as having operational sites identified. ***Most of these facilities are owned and operated by the private sector. To protect their competitive position, these owners are reluctant to provide detailed information on facility capacity or throughput. As such, there were significant limitations on the accuracy of the data presented on the quantities of materials processed in the Region, but the data do present an order-of-magnitude assessment of the industry.*** The Project Team evaluated sites to try to estimate the projected annual throughput. Based on this evaluation, it is estimated that a range of between 568,000 tons to 947,000 tons are processed annually.

Most of the facilities in the region are vegetative compost operations. Figure E-3 presents a distribution of the types of facilities operating in the Region. It should be noted that mulch and vegetative material can also be processed at food, sludge or manure compost operations. There is only one sludge compost facility in the Region and one manure compost operation.

Figure E-3
Comparison of Number of Facilities Accepting Feedstocks



Material Markets

Based on the 1996 Statewide Iowa Compost Demand Study and the national "Battelle Study" on Compost Usage Potential, the estimated per capita use of compost ranges from 0.21 to 0.53 cubic yards per capita per year (excluding agricultural markets). Using an average of the two figures (0.37 cubic yards per year

per person) and the NCTCOG population base of 8.2 million people, that equates to a compost market of 3,034,000 cubic yards per year, without counting any usage in agriculture in the near term. This market estimate is for compost without accounting for material that may be blended with it prior to sale. Further, it does not account for composted yard trimmings or recycled wood that is processed into mulch.

Composters in the NCTCOG region are generally successful in marketing their compost, as an unblended soil amendment, in blended (enhanced) landscape soils and the coarser fraction as a mulch. Composters in the region are very active in the bulk landscape material resale network, many marketing to homeowners, and both small and larger professional end users. Large horticultural (lawn/garden) markets exist for compost and related products because of the large regional population and difficult soil and climatic (drought) conditions. Sales of compost into agricultural or environmental applications are not significant at this point in the region, because of economics and limits on environmental regulation. The largest markets for compost and related products appear to be with commercial landscapers, resellers of landscape products (e.g., home centers, garden centers, landscape material yards, topsoil dealers) and homeowners, in both bulk and packaged form. Compost is being used by government entities, but this could be significantly expanded by promoting its usage in soil improvement, carbon sequestration, erosion control and stormwater management.

Gaps

Geographically, the majority of the processing capacity is located in Collin, Denton, Dallas, and Tarrant Counties. There are significant gaps in the western region and southeastern regions. It should be noted that, while there are processing facilities in Collin, Denton, Dallas and Tarrant Counties, there are still gaps in these counties because they also represent the areas where most organic waste is generated. Table E-1 presents a summary of the estimated annual generation of wasted organics and estimated annual processing throughput of feedstocks to identify organic waste gaps, by county. Figure E-4 and Figure E-5 illustrate the major gaps for vegetative and food residuals. There is only one sludge composting facility, indicating a significant region-wide gap in sludge compost capacity.

Table E-1
Gap Summary by Feedstock

Feedstock Processing	Gap Observations
Vegetative	A total of 35 operating mulch and composting sites exist throughout the Region and each of these facilities can and does process vegetative waste which may include yard waste, brush and vegetative food residuals. Major gap areas were identified in the western and southeastern parts of the Region. Although there is significant processing capacity in Dallas, Denton, and Tarrant counties, processing gaps in those counties still remain due to the large amount of material generated in them .
Food	A total of 10 facilities exist that have food residual processing capacity, including meat, fish, dairy and fats. These are generally limited to Collin, Dallas, Denton, and Tarrant counties. Even with the 10 facilities, it is uncertain how much of the capacity of these facilities is used for food waste composting compared to just vegetative composting.

Sludge	The City of Denton's sludge composting facility is the only sludge composting facility in the Region. A majority of the sludge generated from TRA, the City of Dallas, and the City of Fort Worth is either land applied or managed through surface disposal. The City of Weatherford is currently evaluating the feasibility of a regional sludge composting facility in the western part of the Region.

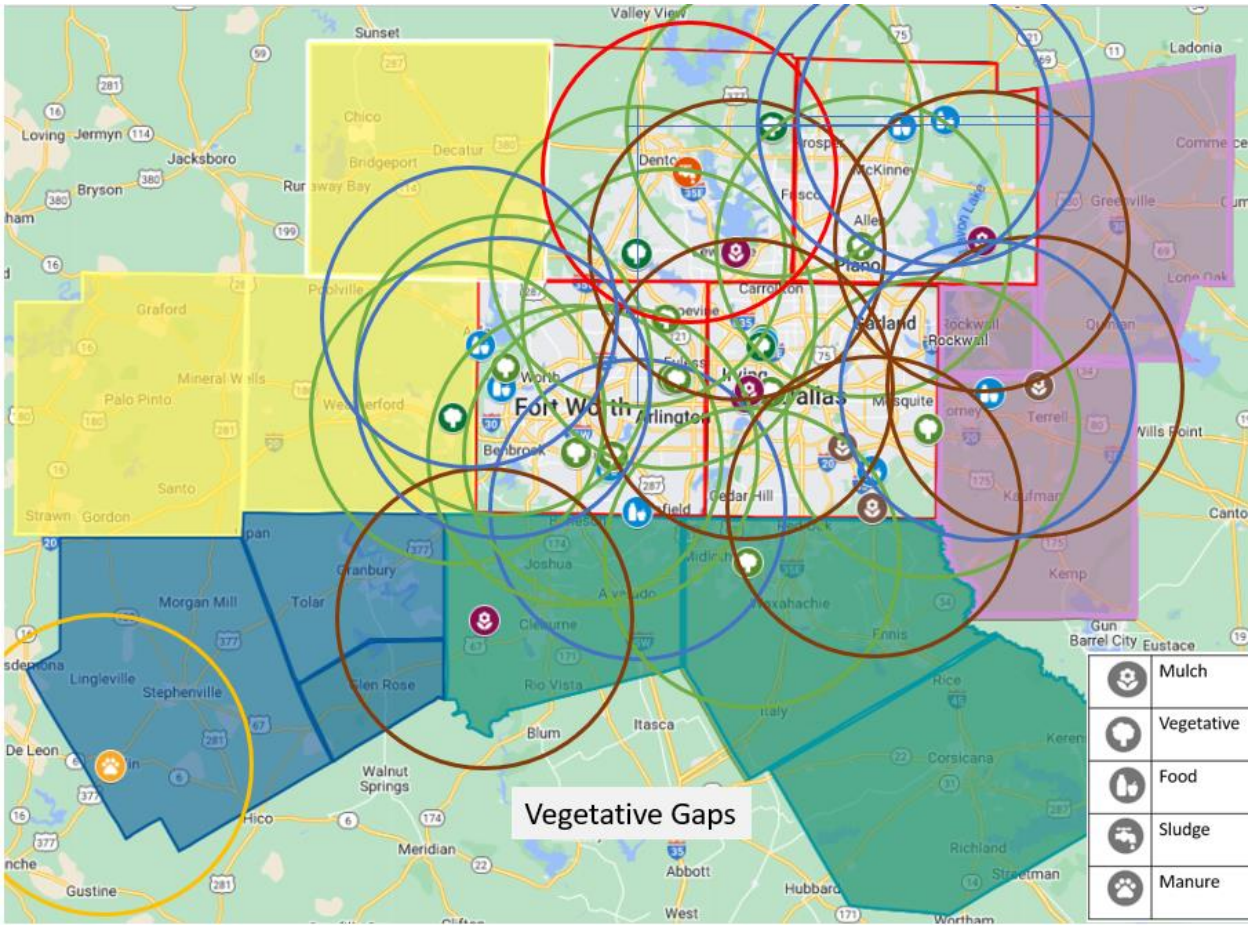


Figure E- 4 Vegetative Gap Map (assumes feedstocks hauled from within 30-mile radius from facilities

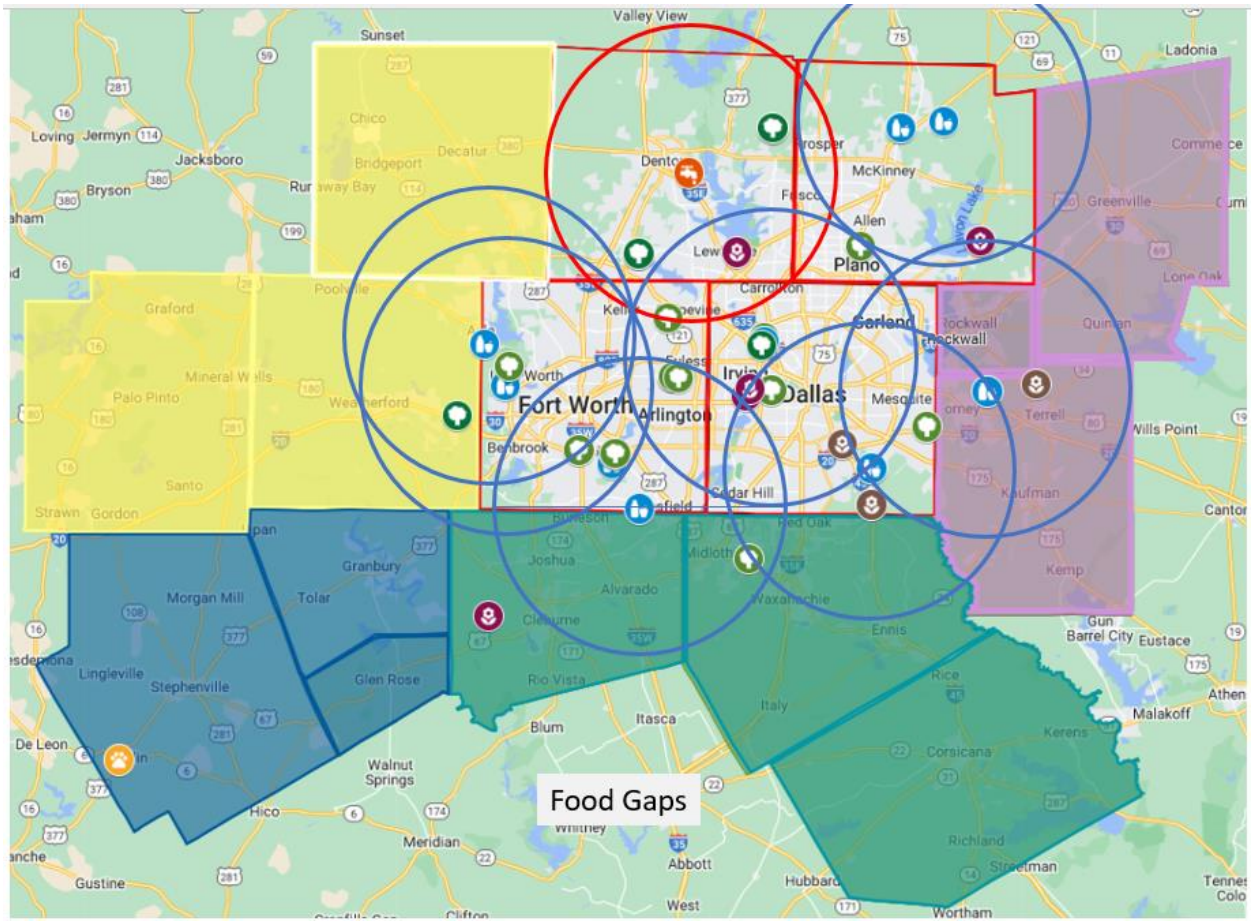


Figure E-5 Food Waste Gap Map - assumes 30-mile radius from facilities

Behavior and Technical Changes

Trends in technology and broad behavior change could affect the generation and management of sludge, food residuals and vegetative wastes in the future. Behavior changes may be voluntary, arising out of economic, social or sustainability motivations. Behavior changes may also be the result of changes in public policy or mandates. This Section addresses some of the more significant emerging technologies in the field of organics management, as well as behavior changes that may be adopted by residents of the region. Key findings of this assessment include the following.

- Public awareness of organic material management is increasing, but steps are still needed to increase widespread use and market demand. Technology has increased the options available to residents for in-home composting, but several are cost-prohibitive.
- Commercial pre-processing and processing technologies, including de-packaging, dewatering and biochar, may allow for better management of food waste and biosolids as technologies improve.
- The increasing attention paid to PFAS could complicate efforts to include biosolids in compost, as has been seen with recent legislation passed by the state of Maine.
- There are several options for drop-off or pickup of food waste in the region, but access is not universal and often requires a recurring cost.

- Collection programs targeting uncontaminated food residuals and vegetative material is key to significantly increasing diversion of larger quantities of these materials in the future. Increased food residual and sludge composting requires either increased vegetative waste collection, or capturing material from the mulch market for compost bulking agent.
- The use of compost in stormwater management projects is common but not required. Policy decisions could encourage the use of compost to enhance the region's drought management and flood mitigation efforts, while improving markets for compost.
- Other policies that ban materials from landfilling (i.e., yard waste, sludge) could generate demand for processing capacity, though sufficient infrastructure and market development would need to occur before implementing a ban.

Recommendations

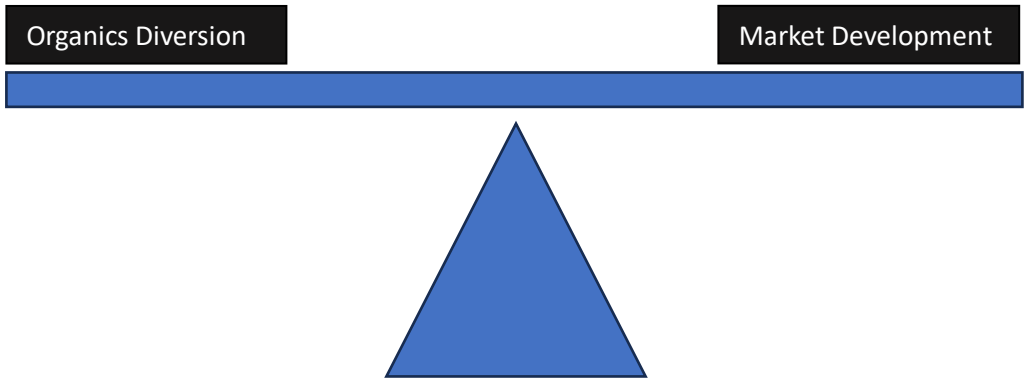
Compost and mulch facilities rely on these two revenue streams to remain profitable:

- Front-end tipping fees for materials managed at the site
- Back-end sale prices for mulch and compost produced

One of the goals of this analysis is to determine how to decrease the Region's reliance on landfill disposal of wasted organics. Increased quantities of material sent to existing processing facilities will increase front-end revenues. Increased demand for processing capacity will also likely lead to investments in existing facilities and the development of new capacity. Increased production of mulch or compost can also lead to lower final product prices if there is not a corresponding increase in the demand for final products. A review of potential policy and program options for both the NCTCOG and local governments in the Region is presented in Section 9 of this Study.

Increasing the quantities of materials produced without adequate product markets will lead to lower market prices and threaten producer profitability. Any policy or program changes requires a careful examination of the market and potential unintended consequences.

Recommendations are presented to address both sides of the balance.



The following are policy options for the NCTCOG and local governments in the Region that are designed to address both material diversion and market development issues.

Ongoing communication and information transfer

The NCTCOG established an Organics Advisory Group (OAG) to assist in the development of this Study. Given the fast-track nature of the Study, the OAG was only able to meet 2 times. These meetings provided a forum for public and private stakeholders to meet and share information to identify collaborative opportunities. They also provided an opportunity to discuss important issues facing the organics industry. It is recommended that the OAG, possibly with expanded membership, continue to meet to better understand the challenges facing the industry and to assist the NCTCOG in implementing some of the recommendations presented in the Study. The following list provides other issues that the OAG should consider:

- Status of PFAS regulation
- New organics projects
- Development of a regional mulch/compost market development program to increase demand for these products
- Outreach efforts to generators of wasted organics to encourage the use of mulch/compost facilities as opportunities for additional recovery of their organic resources.
- Presentation of findings of the study to Texas Restaurant and Food Processing Industry

The following are high-priority recommendations based on the above evaluation. It is important that any public sector actions be balanced to increase the amount of material diverted and market development. Without this balanced approach, there are going to be market distortions that will not benefit the existing mulch/compost industry.

Material Diversion High Priority Recommendations

NCTCOG

- Create organics exchange program letting major organic generators and processors understand where additional diversion opportunities exist.
- Encourage local government efforts to divert materials from disposal through grants for feasibility studies and pilot programs.
- Provide ongoing information on PFAS regulations and opportunities for advocacy.
- Prepare model ordinances for mandatory separate organics collection.

Local Governments

- Implement collection programs that divert uncontaminated yard waste and brush from the MSW stream.
- Identify opportunities for diverting wastewater treatment plant sludge from landfill disposal to composting once capacity becomes available. Prepare sludge hauling and disposal contracts that require a preference for composting over landfill disposal.

Market Development High Priority Recommendations

NCTCOG

- Use the NCTCOG's transportation program to encourage the use of compost for roadway projects, specifically for erosion control.
- Adopt stormwater management guidelines that recognize the value of compost in sustainable stormwater management.
- Meet with the Dallas and Fort Worth districts of TxDOT and encourage them to once again specify compost for erosion control and vegetation establishment in the NCTCOG region.
- Promote or require, compost-based stormwater management methods within the NCTCOG region to help to address the issue of drought, flooding and water quality while expanding markets for compost.
- Encourage the development of composting and brush processing facilities at geographically farther distances from Dallas and Fort Worth, the major population bases.
- Develop a model request for proposals for the marketing of existing ground mulch material.
- Encourage member cities to require increased organic matter in soil for developments.

Local Governments

- Adopt Green Building Ordinances which require a certain percentage of organic material to be incorporated into building design and landscaping.
- Evaluate Parks and Public Works operations to identify opportunities to utilize mulch and compost in their operations.
- Evaluate stormwater management ordinances to identify opportunities to utilize more mulch and compost. Adopt changes that encourage the use of these materials in public works projects.

1.0 Purpose & Approach

Purpose

Of the 11.3 million tons of municipal solid waste (MSW) disposed of in the North Central Texas Council of Government (NCTCOG) region ("Region"), approximately 30% is wasted organics. These wastes include vegetative waste, food residuals, and municipal wastewater treatment residuals (sludge). If the NCTCOG is to achieve its source reduction and recycling goals, it is essential to decrease the generation of these materials and increase the recovery of these valuable resources through technologies such as composting.

In 2022, wasted organics accounted for 3.3 million tons, or 30% of material going to landfills located in the NCTCOG Region. Identifying ways to reduce this waste is the primary goal of this Study.

Currently, a significant amount of organics are already being recovered through the processing of wood wastes, brush, and yard trimmings to produce either mulch or compost. A majority of sludge generated from wastewater treatment plants is being land applied on croplands. Some are composted. There are also efforts to reduce food residuals through food donations and use as animal feed. Some of the remaining food residuals are composted. It is estimated that a total of 1.9 million tons of organic are already being recovered. However, there is a significant "gap" between the amounts of wasted organics currently generated and the available processing capacity in the region.

To reduce the gap between the generation of wasted organics and available processing capacity, the NCTCOG has commissioned this Organic Waste Infrastructure Gap Analysis Study (Study). The Study identifies the quantities of wasted organics available, and the available processing capacity and makes policy and program recommendations designed to reduce these gaps. There are two potential gaps. The first gap is the difference between the amount of wasted organics generated and the current processing capacity in the region. The second gap relates to the availability of

The Organics Gap Analysis Study addresses:

- Wasted Organics Generation
- Compost and Mulch Processing Capabilities
- Regionalization
- Market Issues and Influences
- Policy Recommendations

markets for recovered organic products should processing capacity increase substantially in future years.

The Study was commissioned by the NCTCOG through a grant funded by the Texas Commission on Environmental Quality. The NCTCOG selected the Project Team of Risa Weinberger & Associates (RWA), NewGen Strategies and Solutions (NewGen), and Ron Alexander & Associates (RAA) to conduct the Study.

Approach

The Project Team worked with NCTCOG staff to assemble an Organics Advisory Group (OAG). The OAG included representatives of municipal utilities, composting industry, and interested professionals. The OAG met three times during the course of the project (two in-person meetings and one virtual meeting. Project Team staff also made presentations to NCTCOG Public Works Committee, Water Resource Council, and the Wastewater Treatment and Education Roundtable.

- North Texas Municipal Water District (NTMWD)
- Mesquite
- Trinity River Authority (TRA
- Dallas
- Plano
- Denton
- Moonshot
- Aptim
- Weatherford
- Plano
- Letco Group

The Project Team reviewed and evaluated the following documents and sources to identify wasted organics generation and processing capacity.

- Previous NCTCOG studies related to waste management and organics, including the NCTCOG's Regional Materials Management Plan (RMMP), the Organics to Fuel Study, the Weatherford Regional Compost Feasibility Study, and the Western Region Solid Waste Capacity Study.
- TCEQ records to identify compost and mulch facilities located in the NCTCOG Region.
- TCEQ landfill records identifying quantities of sludge and wood waste either landfilled or recovered at these facilities.
- EPA records related to food waste opportunities.
- EPA's Environmental Compliance and History Online website to identify quantities of biosolids generated by wastewater treatment facilities in the NCTCOG Region.
- Local government solid waste collection practices based on an internet search.
- Interviews with key stakeholders including compost facility owners and municipal officials.

The Project Team also wants to recognize the NCTCOG leadership team of Cassidy Campbell and Breanne Johnson for their assistance.

The Study evaluates the current state of wasted organics generation in the NCTCOG Region. Three categories describing materials of interest are described below.

- Generation and management of vegetative wastes including tree trimmings, brush, and yard waste generation. Municipal brush and yard waste collection practices are also evaluated.

- Generation of food residuals primarily from commercial, institutional, and industrial sources. The Study does not include an assessment of residential food residuals due to the difficulties associated with the collection of uncontaminated residential food waste.
- Generation of sludge from public wastewater treatment facilities in the Region.

The Study provides an analysis of current and planned management facilities and processes for waste organics. It also provides a market assessment of end uses of compost and mulch.

The Study addresses the following issues.

- Behavior changes or advancements in technology that may help reduce the amount of organic material going to the landfill
- Estimated costs of not taking action (i.e., the cost of not increasing processing infrastructure in the region)
- Location of generation centroids and processing capacity
- Transportation costs from points of generation to theoretical locations of potential new composting facilities
- Realistic market opportunities if new processing capacity were to be developed in the Region
- Identifies site selection criteria and permitting issues

It should be noted that due to the confidential nature of certain data, the Project Team was limited in identifying specific throughput or capacity information from private mulch and compost companies. While understandable, it did require the Project Team to make certain assumptions regarding existing facilities. Therefore, the data presented in this Study should be considered as order of magnitude estimates to be used in program and policy recommendations only.

Geographic Analysis

One of the Study's goals is to identify organic processing gaps by selected subregions. Data are first evaluated by individual counties. To expand the opportunities for cost-effectively developing facilities, it is appropriate to consider regional options. The Region is addressed in terms of four subregions plus each of the four more urbanized counties of Dallas, Tarrant, Denton, and Collin.

- Northwest: Wise, Palo Pinto, and Parker Counties
- Southwest: Erath, Hood, and Somervell Counties
- Northeast: Hunt, Rockwall, and Kaufman Counties

- Southeast: Johnson, Ellis, and Navarro Counties

Figure 1-1 illustrates the subregions.

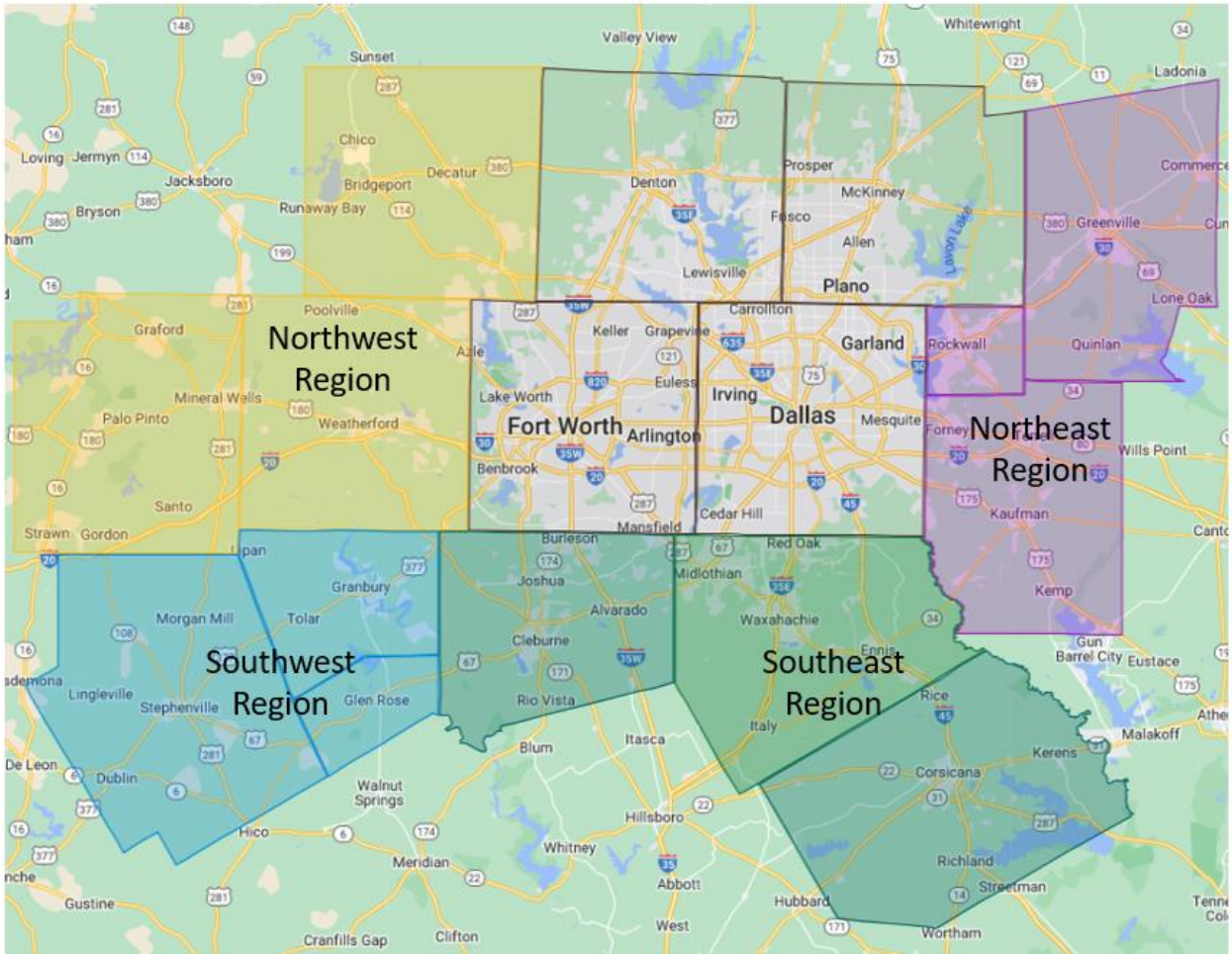


Figure 1-1 Gap Analysis Subregions

2.0 Background

Wasted organics are generated because of household activities such as landscape maintenance, wasteful food habits, and the generation of wastewater. Wasted organics are also generated by businesses and institutions. Tree trimming and land clearing activities generate tree waste and brush; sludge, which is generated from wastewater processing, is generated from almost all commercial activities; and businesses ranging from food processors to restaurants produce food residuals. Population, household, and employment data are important factors in understanding generation patterns for wasted organics.

Photo Source: Dallas Builders Association

Population

The Region is home to over 8.2 million people. Table 2-1 presents the population and housing data for each of the counties. There are over 1.9 million single-family households and 805,599 multi-family households in the Region. Single-family households are likely to generate more wasted organics than multi-family households generate due to their predominance and larger yards per residence.

Approximately 85% of the 16-county region's population is in Collin, Dallas, Denton, and Tarrant Counties. Subregional population and household data are also presented in Table 2-1.

Table 2-1 Population and Housing				
County	**Population**	**Single-Family Households**	**Multi-Family Households**	**% of the Total Population**
Collin	1,175,974	310,988	101,582	14%
Dallas	2,675,009	597,091	381,589	32%
Denton	1,006,492	268,200	84,602	12%
Ellis	218,125	45,978	5,372	3%
Erath	43,287	5,152	3,109	1%
Hood	62,511	9,010	1,307	1%
Hunt	109,127	15,045	4,589	1%
Johnson	201,427	32,977	6,569	2%
Kaufman	158,672	24,851	3,566	2%
Navarro	55,639	9,190	1,845	1%
Palo Pinto	29,277	5,250	847	0%
Parker	155,607	21,767	3,268	2%
Rockwall	124,734	33,821	3,754	2%
Somervell	9,899	738	65	0%
Tarrant	2,188,951	564,990	202,772	26%
Wise	70,159	8,272	763	1%
Total	**8,284,892**	**1,953,320**	**805,599**	**100%**
Northwest	128,713	18,772	2,457	1.6%
Southwest	115,698	14,900	4,481	1.4%
Northeast	392,534	73,717	11,909	4.7%
Southeast	475,191	88,145	13,786	5.7%
Source: https://data-nctcoggis.opendata.arcgis.com/datasets/NCTCOGGIS::2023-nctcog-population-estimates-county/explore Household data provided by NCTCOG staff.				

Economy and Employment

The Region supports the most diverse economy in Texas; it is the eighth-largest export market in the US and is home to 22 Fortune 500 companies. Between 2023 and 2045, the Region is expected to experience a 40 percent increase in population and a 42 percent increase in employment.[1]

[1] NCTCOG, Mobility 2045 Update, 2023

The RMMP estimated that 2022 employment was 4.0 million.[2] Table 2-2 presents a distribution of employment by County based on US Bureau of Labor Statistics data.[3] Ninety percent of the total employment is in either Collin, Dallas, Denton, and Tarrant Counties. Dallas County, alone, accounts for 43% of the region's total employment.

Employment data are used to distribute estimated quantities of commercial and industrial waste generation by County.

Table 2-2
Employment Distribution by County

County	% of Employment
Collin	13%
Dallas	43%
Denton	9%
Ellis	2%
Erath	0%
Hood	1%
Hunt	1%
Johnson	2%
Kaufman	1%
Navarro	0%
Palo Pinto	0%
Parker	1%
Rockwall	1%
Somervell	0%
Tarrant	25%
Wise	1%
	0%
Total	**100%**
Northwest	2%
Southwest	2%
Northeast	3%
Southeast	4%

Source: US Bureau of Labor Statistics, CAEMP25N Total full-time and part-time employment by NAICS industry 2023

[2] NCTCOG RMMP. The latest 2023 US Bureau of Labor Statistics estimates employment at 5.496 million. The percentages are used to distribute commercial and industrial waste generation by county.
[3] US Bureau of Labor Statistics (2023)

Population and Employment Growth

Table 2-3 presents the anticipated increases in both population and employment for the region. These increases will translate to increases in waste generation.

Table 2-3
Projected Population and Employment

Year	Population	Commercial Employment	Industrial Employment	Total Employment
2022	8,006,301	3,500,900	583,500	4,084,400
2027	8,696,657	3,802,771	633,813	4,436,584
2032	9,446,540	4,130,671	688,465	4,819,136
2042	10,261,083	4,486,844	747,829	5,234,673
2047	11,145,861	4,873,730	812,311	5,686,041

Source: RMMP

Land Use

The NCTCOG region includes 16 counties located in north central Texas. The region encompasses the Dallas / Fort Worth metroplex and surrounding counties that are rural in nature. It has a total area of 12,800 square miles.

Land use characteristics are relevant to the generation of wasted organics and facility site selection. More urban areas generate more waste, including wasted organics. As current rural areas become more developed, there will be a corresponding increase in land clearing and vegetative and yard waste generation.

In the future, it is anticipated that compost facilities will begin to process a more diverse blend of feedstocks, including more food waste and sludge. For facilities managing these diverse feedstocks, it will be necessary to include sufficient buffer zones around the site boundary. For example, there are no buffer requirements for wood and brush processing facilities; however, a compost facility that processes sludge must have a buffer zone equal to at least 50 feet. This will reduce the nuisances associated with handling potentially odorous feedstocks.

The region's land use is extremely diverse, including the major urban areas surrounding Dallas and Fort Worth, large suburban communities located in counties surrounding Dallas and Tarrant Counties, and rural areas located west, south, and east of the metroplex. To illustrate these differences, population density in the Region ranges from 30 persons per square mile to 3,000 persons per square mile. Figure 2-1 illustrates the NCTCOG's projected population density for the year 2030.

Agricultural land serves an important role in organics management in the Region. Over half of the Region's sludge is currently being land applied on agricultural lands. The availability of undeveloped land also can provide site opportunities for future compost or other types of facilities. Finally, agriculture represents a significant market for finished compost. Table 2-4 illustrates both farm data and population density for counties and subregions.

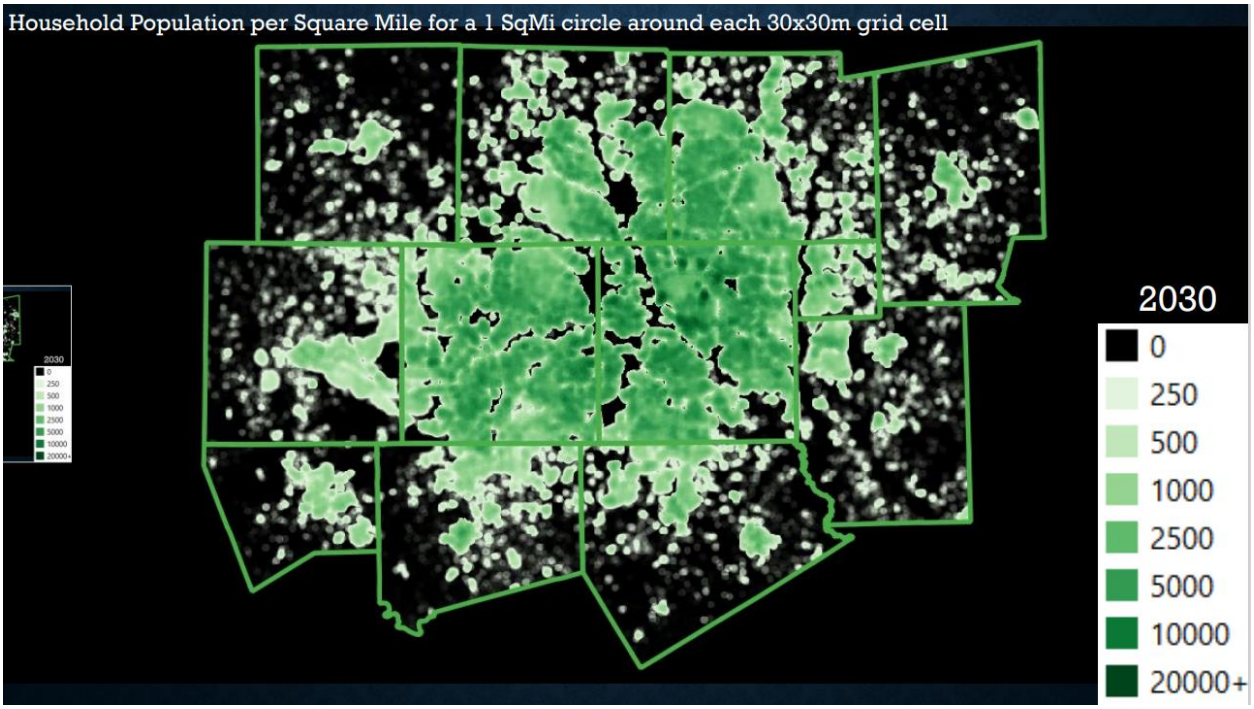


Figure 2-1 Population Density in the NCTCOG Region; Source NCTCOG

Table 2-4
Farms and Farm Acreage by County

County	Farm Count	Farm Acreage	% of Total Farms	% of Total Acreage	Population Density (persons/sq mile)
Collin	1,249	111,531	10%	6%	1,265
Dallas	208	23,962	2%	1%	3,000
Denton	1,023	161,862	8%	8%	1,031
Ellis	2,369	306,092	19%	16%	205
Erath	791	232,680	6%	12%	39
Hood	73	24,593	1%	1%	146
Hunt	1,748	182,348	14%	9%	118
Johnson	988	132,275	8%	7%	248
Kaufman	609	117,749	5%	6%	186
Navarro	1,593	281,620	13%	14%	52
Palo Pinto	106	98,497	1%	5%	30
Parker	157	50,216	1%	3%	164
Rockwall	92	9,304	1%	0%	848
Somervell	31	5,347	0%	0%	49
Tarrant	91	11,618	1%	1%	2,444
Wise	1,170	211,702	10%	11%	76
Total	**12,298**	**1,961,396**	**100%**	**100%**	**650**
Northwest	1,433	360,414	12%	18%	91
Southwest	895	262,620	7%	13%	68
Northeast	2,449	309,401	20%	16%	188
Southeast	4,950	719,987	40%	37%	171

Source: USDA, Crop Acreage Data, August 2022
Texas Counties: 2020 Population Density

3.0 Waste & Organics Generation

Municipal Solid Waste Generation by County

In 2022, the Region's residential sector generated a total of 4.28 million tons of MSW and the commercial, industrial, and institutional sectors generated 7.8 million tons[1]. MSW estimates for each county were calculated using county population and employment data. For example, Collin County represents 14% of the region's population and 13% of the region's employment. Collin County's residential waste quantities were calculated as 14% of 4.28 million tons, and commercial waste quantities were calculated as 13% of 7.0 million tons. Table 3-1 presents county and subregion MSW quantities for the base year of 2022.

The majority of the MSW generated in the Region is landfilled. A total of 18 MSW Type I (MSW) landfills, and 4 Type IV (Construction/Demolition) landfills are in the Region. In addition to disposing of MSW, several of these landfills operate material recovery operations, including the capture of vegetative waste for mulching or composting. Figure 3-1 shows the location of these facilities in relation to existing compost/mulch sites. Data on these landfills are presented in Appendix A.

In the 2021 TCEQ Annual Summary of MSW in Texas, it is reported that the Region has an average of 35 remaining years of landfill capacity. Five of these facilities have less than 15 years of capacity – the approximate time it takes to site, permit, and construct a new landfill. Of these five, the Weatherford Landfill closed in 2022 and the DFW Recycling and Disposal Facility has two years of remaining capacity. The closure of landfills will have various impacts on organics processing in the Region:

- It will increase the haul distance and costs associated with the disposal of organics.
- It will increase the cost of disposal as there is less competition for capacity.
- It will accelerate the closure period for remaining landfills.

[1] NCTCOG, RMMP

Table 3-1 County MSW Generation (tons/year)			
County	**Residential Waste**	**Commercial, Institutional & Industrial Waste**	**Total**
Collin	607,526	928,472	1,535,997
Dallas	1,381,950	3,065,562	4,447,511
Denton	519,969	601,421	1,121,390
Ellis	112,687	120,685	233,371
Erath	22,363	33,772	56,134
Hood	32,294	40,150	72,444
Hunt	56,377	61,541	117,918
Johnson	104,060	110,044	214,104
Kaufman	81,972	80,881	162,853
Navarro	28,744	34,412	63,156
Palo Pinto	15,125	17,919	33,043
Parker	80,389	93,447	173,836
Rockwall	64,440	77,340	141,780
Somervell	5,114	7,346	12,460
Tarrant	1,130,845	1,743,725	2,874,569
Wise	36,245	47,252	83,497
Total	**4,280,099**	**7,063,966**	**11,344,065**
Collin, Dallas, Denton & Tarrant	3,640,289	6,339,179	9,979,468
% of Total Waste	85%	90%	88%
Northwest	131,759	158,617	290,376
Southwest	59,771	81,268	141,039
Northeast	202,789	219,762	422,551
Southeast	245,491	265,141	510,632
Assumes Residential waste based on population; commercial is based on employment			
Source: NCTCOG Regional Materials Management Plan (RMMP)			

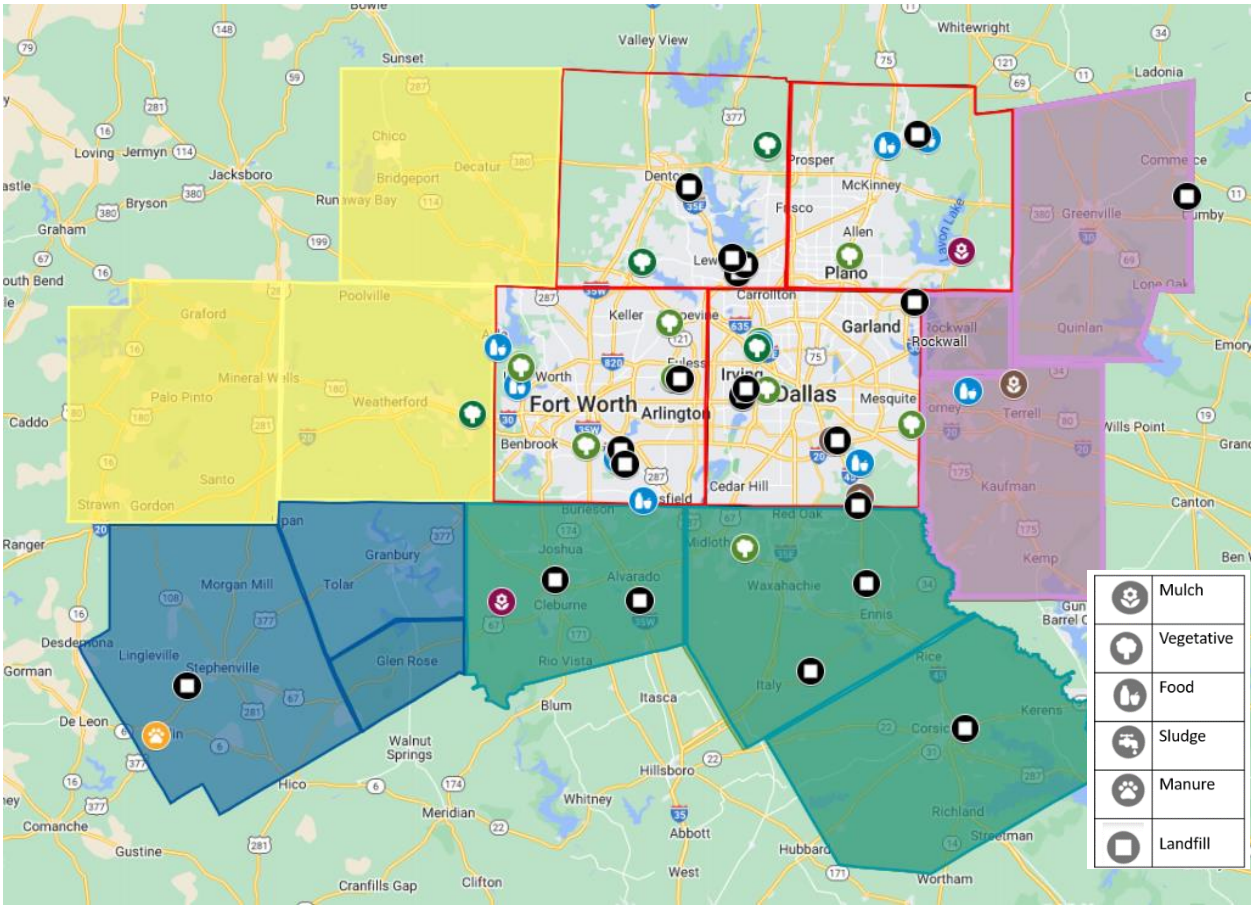


Figure 3-1 Location of MSW and C&D Landfills in NCTCOG Region - Source: TCEQ Annual Summary of MSW in Texas

The four counties of Collin, Dallas, Denton, and Tarrant represent 87% of the region's total MSW generation. Correspondingly, most wasted organics are also generated in these four counties (Table 3-2). The RMMP estimates that 46% of the residential waste stream (Figure 3-2) is wasted organics and 20% of the commercial, industrial, and institutional sectors is wasted organics (Figure 3-3). Table 3-2 applies these percentages for each of the individual counties and the four subregions. Based on this methodology, a total of 3.38 million tons of organics are generated in the Region, representing approximately 30% of the total MSW waste stream. Residential organics account for 1.9 million tons and commercial organics are 1.4 million tons. It should be noted that not all these organics are recoverable. Figure 3-4 illustrates how wasted organics generation is distributed throughout the Region by county.

The focus of this Study is to identify specific wasted organics streams that can be recovered. Section 4 focuses on specific components of the organic waste stream.

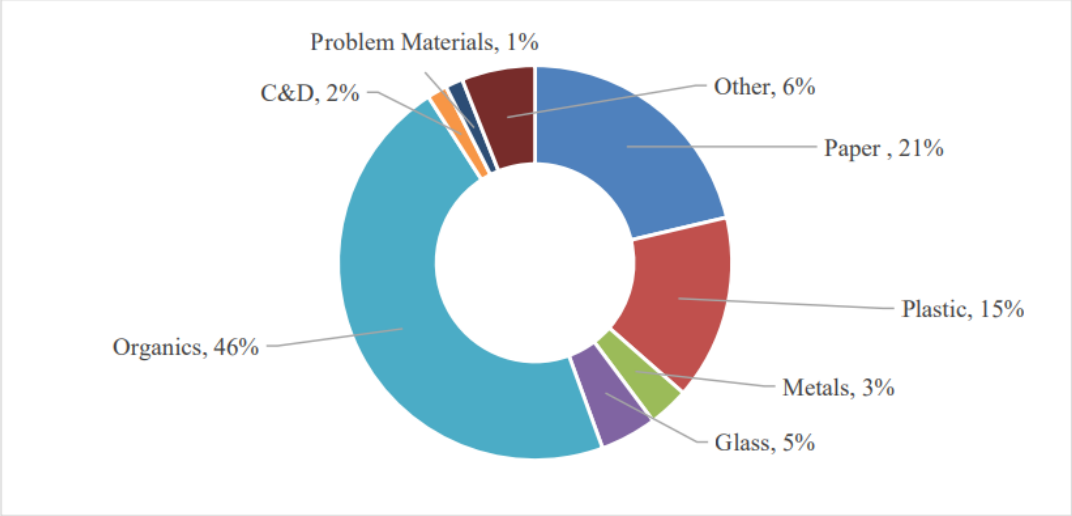


Figure 3-2
State-wide Composition of the Residential Waste Stream - Source NCTCOG RMMP

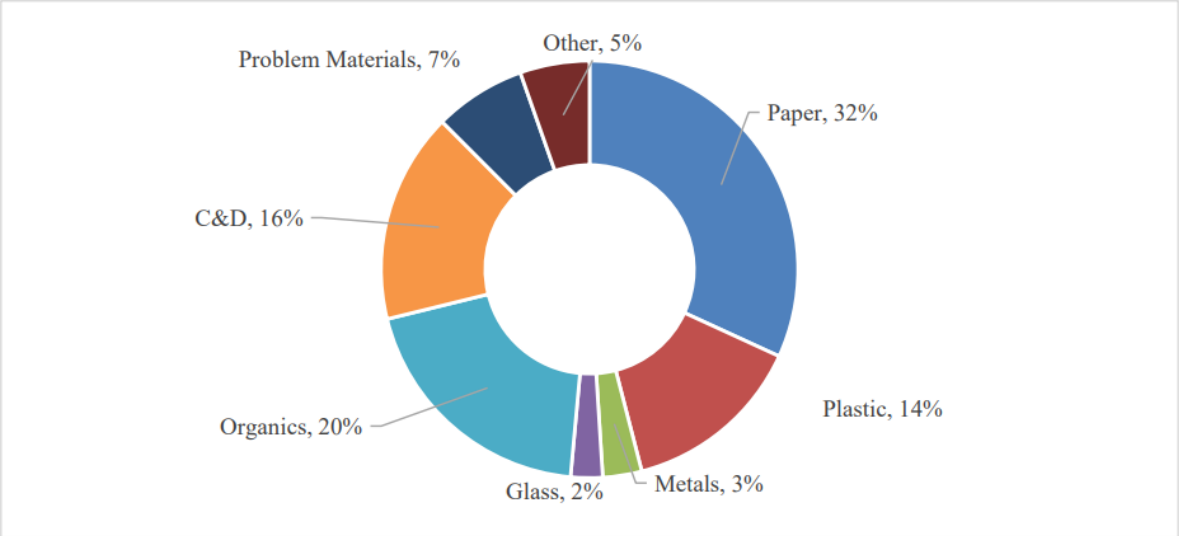


Figure 3-3
State-wide Composition of Commercial, Industrial, and Institutional Waste, Source NCTCOG RMMP

Table 3-2 County Wasted Organics Generation (tons/year)			
County	**Residential Wasted Organics**	**Commercial, Institutional & Industrial (CII) Wasted Organics**	**Total Wasted Organics**
Collin	279,462	185,694	465,156
Dallas	635,697	613,112	1,248,809
Denton	239,186	120,284	359,470
Ellis	51,836	24,137	75,973
Erath	10,287	6,754	17,041
Hood	14,855	8,030	22,885
Hunt	25,933	12,308	38,242
Johnson	47,868	22,009	69,877
Kaufman	37,707	16,176	53,883
Navarro	13,222	6,882	20,105
Palo Pinto	6,957	3,584	10,541
Parker	36,979	18,689	55,668
Rockwall	29,642	15,468	45,110
Somervell	2,352	1,469	3,822
Tarrant	520,188	348,745	868,933
Wise	16,673	9,450	26,123
	-	-	-
Total	**1,968,846**	**1,412,793**	**3,381,639**
Organics represent 30% of the Region's total waste stream			***30%***
Collin, Dallas, Denton & Tarrant	**1,674,533**	**1,267,836**	**2,942,369**
% of total	**85%**	**90%**	**87%**
Northwest	60,609	31,723	92,333
Southwest	27,495	16,254	43,748
Northeast	93,283	43,952	137,235
Southeast	112,926	53,028	165,954

Source: NCTCOG RMMP
Residential organics are 46% of total residential waste generation and CII organics are 20% of total CII waste generation.

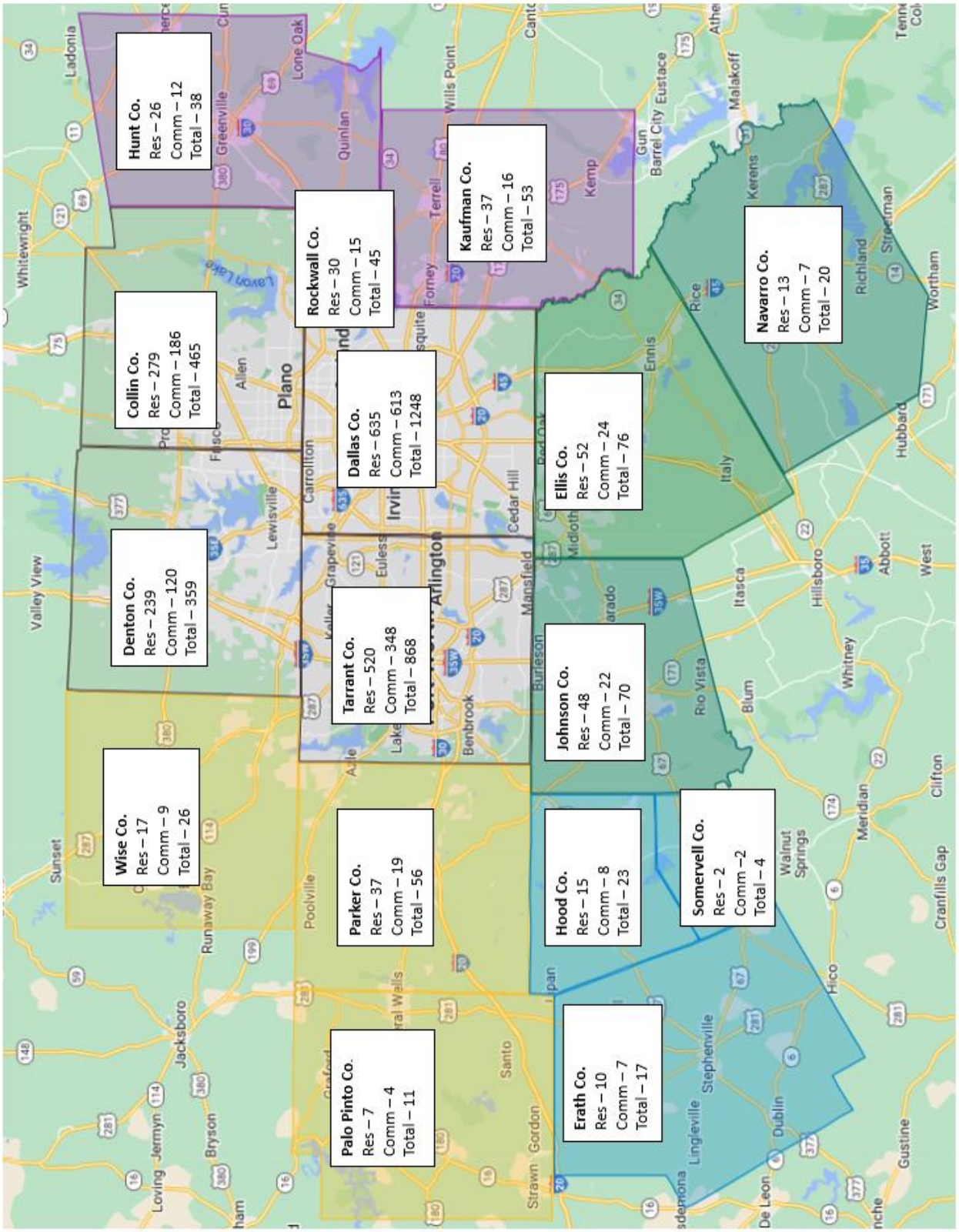


Figure 3-4 Residential, Commercial and Total Wasted Organics- 1000 tons per year

Table 3-3 and Figure 3-5 present a distribution of Regional waste and organics generation by residential, commercial, and industrial for the entire region. The majority of wasted organics generation is from the residential sector. The major components of the residential organic stream include vegetative wastes associated with tree trimming and landscaping, and food residuals. The commercial sector and industrial sector include vegetative wastes from land clearing, food processors, food distributors and restaurants.

Table 3-3 Wasted Organics Generated in NCTCOG Region in 2022[2]

Sector	Total MSW (tons/year)	% Organic$_1$	Total Organics (tons/year)	% of Total Organics Generated in Region$_2$
Residential	4,280,009	46%	1,968,804	58%
Commercial	6,271,540	20%	1,254,308	37%
Industrial	792,426	20%	158,485	5%
Total	11,343,975	30%	3,381,597	100%

(1) Percent of organics generated by each sector.
(2) Percent of total organics generated in the region.
Source: NCTCOG Regional Materials Management Plan

Figure 3-5
Sources of Wasted Organics in the NCTCOG Region
(Tons/Year, Percent of Total)
(Source NCTCOG Regional Materials Management Plan - 2022)

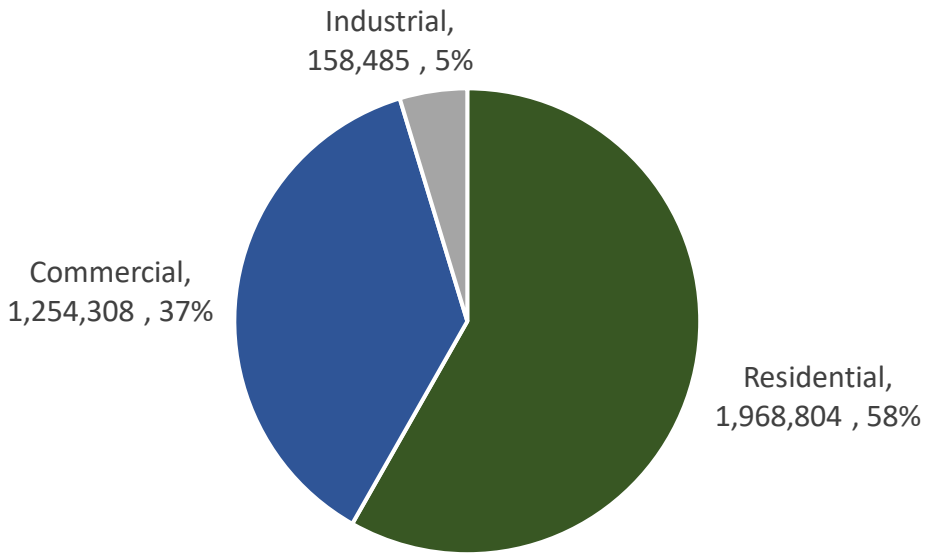
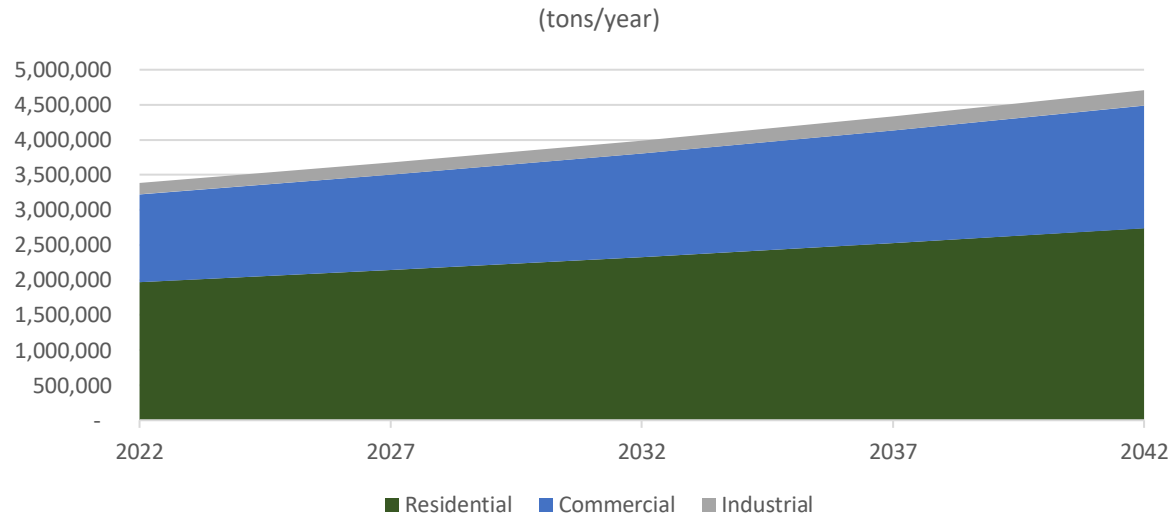


Table 3-4 and Figure 3-6 present the estimated quantities of materials that are projected to be generated in the coming years. Without major changes in waste characterization or management practices, wasted organics quantities are projected to increase from 3.4 million tons per year to 4.7 million tons per year in 2042.

[2] ibid

Table 3-4 Projected Wasted Organics Generation[3] (tons/year)				
Year	Residential	Commercial	Industrial	Total
2022	1,968,804	1,254,308	158,485	3,381,597
2027	2,138,612	1,362,463	172,151	3,673,226
2032	2,323,017	1,479,943	186,995	3,989,956
2037	2,523,324	1,607,554	203,119	4,333,996
2042	2,740,901	1,746,168	220,633	4,707,701

Figure 3-6
Projected Organic Waste Generation (Source: NCTCOG RRMP)



[3] NCTCOG RMMP

4.0 Specific Wasted Organics Streams

The purpose of this section is to identify specific wasted organics streams and identify potential barriers to the use of these materials for future processing. This section focuses on vegetative waste, food residuals, and sludge.

Vegetative Waste- wood waste, brush, and yard waste

Vegetative waste can be recovered and processed into either mulch or compost. Most of the material currently being processed into mulch or compost in the Region is from brush and yard wastes. These materials are typically source-separated prior to being delivered to the facility and should not require a significant amount of pre-processing to remove contaminants. Mulch produced from grinding brush and tree trimmings can either be sold directly or used as a bulking agent in the composting process.

Unlike vegetative wastes, wood wastes such as used furniture, construction lumber, and other wood wastes are difficult to recycle due to contamination or the fact that these materials have been treated with harmful chemicals. Treated and painted wood cannot be composted. One exception is pallets that are either reused or ground for recycling. It should be noted that there is a growing trend to use recycled plastic for pallets.

Definitions

For this Study, ***"vegetative waste"*** is defined as yard waste and brush. These materials can be processed and marketed as either mulch or compost. The TCEQ defines yard waste, brush, mulch, and compost in TAC 330.3 municipal solid waste rules and TAC 332.3 composting rules, as follows:

"Brush" is cuttings or trimmings from trees, shrubs, or lawns and similar materials.

"Yard waste" includes leaves, grass clippings, yard and garden debris, and brush, including clean woody vegetative material no greater than six inches in diameter, that results from landscaping maintenance and land-clearing operations. The term does not include stumps, roots, or shrubs with intact root balls.

"Mulch" is ground, course, woody yard trimmings, and untreated/unpainted wood material. Mulch is normally used around plants and trees to retain moisture and suppress weed growth and is intended for use on top of soil or other growing media rather than being incorporated into the soil or growing media. Mulch does not include wood from trees or other plants that have been systematically killed using herbicides.

"Compost" is the stabilized product of the decomposition process that is used or sold for use as a soil amendment, artificial soil, growing medium amendment, or other similar uses.

Major Generators

Landscaping and Residential Vegetative Wastes

Most of the organic material that is processed for mulch and composting in the Region is collected from city brush and yard waste collection programs or is supplied by landscapers and tree trimming companies. This material includes the following types:

- Brush collected as part of residential solid waste collection service. In some cases, cities provide drop-off locations for residents to dispose of brush or yard waste.
- Brush collected by landscaping companies.
- Leaves and grass clippings, which are typically collected either by city or private waste haulers, or landscaping companies.

Tree Trimming and Land Clearing

Commercial tree trimming operations represent a large source of vegetative material for mulch and compost operations. These sources include the following examples:

- Tree trimmings either set out for collection in city brush collection or by private tree trimming companies
- Utility line tree trimming operations
- Land-clearing operations

Other commercial sources

EPA estimates that 6.2% of the waste stream is waste wood. Waste wood represents only a small percentage of the overall resource for compost/mulch facilities. For this Study, waste wood is not considered a primary feedstock for mulch or compost operations for the following reasons.

Wood industries, such as sawmills, furniture manufacturers, and other businesses that utilize large amounts of untreated wood do generate some amount of wood waste; however, much of this material is often recovered and recycled.

- Treated or painted wood generally are not used in compost operation because of the chemical nature of the material.
- Waste wood that is used for furniture is often a composite of other materials that would result in contamination of the final product.
- Pre-processing is required to remove unacceptable materials.

Wood pallets can be recycled at a mulch operation. It is uncertain how many wood pallets are being processed for mulch. It should be noted that there is a growing trend toward plastic pallets made from recycled HDPE; however, wood pallets still represent the largest share of the pallet market. Pallet market research shows that demand for pallets doubled from 2010 to 2020 due to increased global trade and the growth in e-commerce[1]. Pallet reuse is also encouraged through waste-exchange programs, such as the State of Texas RENEW Program.

Construction materials and wood waste

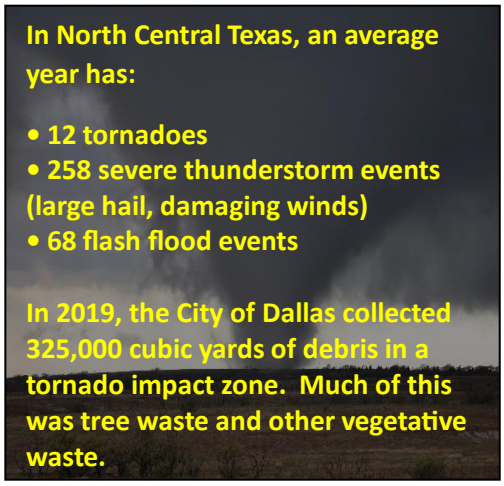
Another source of wood waste is source-separated construction debris. State-wide, C&D recycling accounts for 25% of recovered wood waste[2]. The majority of the C&D waste that is recycled is concrete, bricks, gypsum, and metals. The referenced report provides no estimate of the amounts of scrap lumber or wood from C&D.

Generation Quantities

The US EPA estimates that yard waste accounts for 12% of the entire waste stream.[3] EPA defines "yard waste" as grass, leaves, and tree and brush trimmings from residential, commercial, and institutional sources. Applying the same percentage to the Region's total waste stream indicates **an estimated 1.4 million tons per year is yard waste, brush, and residential wood waste in the Region.**

Table 4-1 presents a county and regional summary of yard waste and brush generation. The table includes materials generated by both residential and commercial sources. Specifically, this is material collected as part of residential collection programs, and by landscaping firms, tree trimming operations, land clearing operations, and utility tree trimming operations. The following factors affect the amounts of available brush and yard waste for either mulch operations or compost operations.

- Availability of a separate collection program for residential brush and yard waste
- Number of trees in a city
- Land clearing activity
- Occurrence of storm events.



[1] Allied Market Research, Pallets Market Size, Share, Growth, Trends and Forecast By 2032 (alliedmarketresearch.com)
[2] TCEQ, Recycling Market Development Plan, 2021
[3] US Environmental Protection Agency, National Overview, Facts and Figures on Materials, Waste and Recycling, 2022

Table 4-1 – Brush and Yard Waste Generation by County and Subregion	
County	**Brush, & Yard Waste (tons/year)**
Collin	184,320
Dallas	533,701
Denton	134,567
Ellis	28,005
Erath	6,736
Hood	8,693
Hunt	14,150
Johnson	25,693
Kaufman	19,542
Navarro	7,579
Palo Pinto	3,965
Parker	20,860
Rockwall	17,014
Somervell	1,495
Tarrant	344,948
Wise	10,020
	-
Total	1,361,288
Northwest	34,845
Southwest	16,925
Northeast	50,706
Southeast	61,276
Source: US Environmental Protection Agency, National Overview, Facts and Figures on Materials, Waste and Recycling, 2022	

As stated earlier, 46% of residential waste is organic material. The majority of this is yard waste and brush. Most cities in the region provide some form of a collection of brush material; however, it is often collected with bulky waste such as furniture and appliances, thereby making it unusable for compost/mulch operations unless some form of sorting is included. Table 4-2 presents data from communities that have, or are planning, separate collection of brush and yard waste. The average estimated recovery rate is approximately 0.22 tons per household. Applying this rate to the Region's 1.95 million single-family households is equivalent to 430,000 tons of brush and yard waste per year. This value accounts for only material collected as part of residential waste services, not from private landscaping operations or brush and yard waste collected from land clearing or utility tree trimmings.

The use of "Don't Bag It" and grass clipping collection bans are strategies that are cost-effective measures a city can employ to reduce residential waste generation. Yard waste can account for 12% of the waste stream and not collecting this material improves route efficiency.

Table 4-2
Brush and Yard Waste Collection Rates for Selected Cities

City	Households	Tons/Year Recovered	Tons/HH/YR
Stephenville [2]	5,600	285	0.05
Watauga [2]	8,100	592	0.07
Fort Worth [2]	235,000	26,960	0.11
Denton [2]	34,772	6,700	0.19
Dallas [3]	249,000	68,689	0.22
Weatherford [1]	12,000	2,926	0.24
Plano [6]	74,500	19,500	0.26
Irving [4]	41,772	12,743	0.31
Mesquite [5]	42,000	14,950	0.36
Cleburne [2]	11,717	4,300	0.37
Average (delete low and high values)	714,461	157,645	0.22
Sources:			
[1] Weatherford Regional Compost Study			
[2] Western Region Solid Waste Capacity Study			
[3] Dallas Long Range Solid Waste Management Plan (program has not been implemented at this time.)			
[4] City of Irving			
[5] City of Mesquite			
[6] City Budget			

Table 4-3 provides a summary of major city practices for brush waste and yard waste. A review of city websites identified cities that maintain separate brush and yard waste collection programs. The table presents the materials that local governments in the region have the greatest degree of control over for this feedstock. Appendix B presents the analysis of the 40 cities in the NCTCOG region with the greatest population.

The following specific policies and services are evaluated:

- The city bans the disposal of yard waste including grass clippings and/or leaves.
- The city provides cart collection services which significantly limit the amount of grass clippings and leaf disposal.
- Separate collection service for yard waste (grass and leaves). This service is either provided using compostable bags or other types of specialized bags.
- Separate brush collection. This material can be taken directly to a mulch or compost facility.
- Collection of co-mingled brush and bulky waste.

Table 4-3
Yard Waste and Brush Collection for Top 40 Cities

Program	Number of Cities	% of Regional Households
Reliance on cart collection with no or limited yard waste collection and yard waste disposal bans	13	57%
Separate brush collection	14	29%
Separate yard waste collection	21	58%
Combined brush and bulky waste	7	25%
Source: City solid waste websites		

Cities that require waste to be placed in carts generally do not allow for the disposal of a large amount of grass clippings and leaves. This reduces the quantities of grass clippings and leaves that are collected unless there is a separate collection for these materials. A separate collection of the brush allows cities to deliver the material directly to a grinding operation to produce mulch, which also may be composted.

In its Long-term Solid Waste Management Plan, the City of Dallas estimated that if it were to implement a source separated brush collection service, it would recover approximately 70,000 tons per year that now goes to the McCommas Bluff Landfill.

It is estimated that residential vegetative waste generation is in the range of 215,000 to 606,000 tons per year (Table 4-4). This is based on a high and low range based on the experience of other communities in the region. Using the average of 0.22 tons per household, a total of approximately 430,000 tons is generated. Factors that will affect an individual community's generation include 1) the type of collection service provided; 2) ordinances regarding grass or leaves collection 3) weather conditions and storm events; and 4) the extent of the tree canopy.

Table 4-4 Estimated Residential Yard Waste Generation (tons/year)				
County	Households (2022)	Yard Waste and Brush Low Range (tons/year)	Yard Waste and Brush High Range (tons/year)	% of Total
Collin	310,988	34,209	96,406	10.6%
Dallas	597,091	65,680	185,098	45.1%
Denton	268,200	29,502	83,142	9.0%
Ellis	45,978	5,058	14,253	1.7%
Erath	5,152	567	1,597	0.6%
Hood	9,010	991	2,793	0.7%
Hunt	15,045	1,655	4,664	1.0%
Johnson	32,977	3,627	10,223	1.6%
Kaufman	24,851	2,734	7,704	1.0%
Navarro	9,190	1,011	2,849	0.5%
Palo Pinto	5,250	578	1,628	0.2%
Parker	21,767	2,394	6,748	0.9%
Rockwall	33,821	3,720	10,485	1.0%
Somervell	738	81	229	0.1%
Tarrant	564,990	62,149	175,147	25.6%
Wise	8,272	910	2,564	0.5%
		-	-	
Total	**1,953,320**	**214,865**	**605,529**	**100%**
Northwest	35,289	3,882	10,940	1.4%
Southwest	14,900	1,639	4,619	0.6%
Northeast	73,717	8,109	22,852	2.9%
Southeast	88,145	9,696	27,325	3.5%
Low range assumes.11T/hh-yr High range assumes.31T/hh-yr The sample city average is .22 T/hh-yr				
Sources: Refer to Table 4-2				

Figure 4-1 illustrates the generation of total vegetative waste and vegetative waste generated by county and subregion. There is a high concentration of material in the four most populous counties, estimated at 91.3% of the total in the Region. It is anticipated that as counties surrounding Dallas and Tarrant begin to develop, quantities of vegetative wastes will increase at a faster rate due to large quantities of materials generated from land clearing activities.

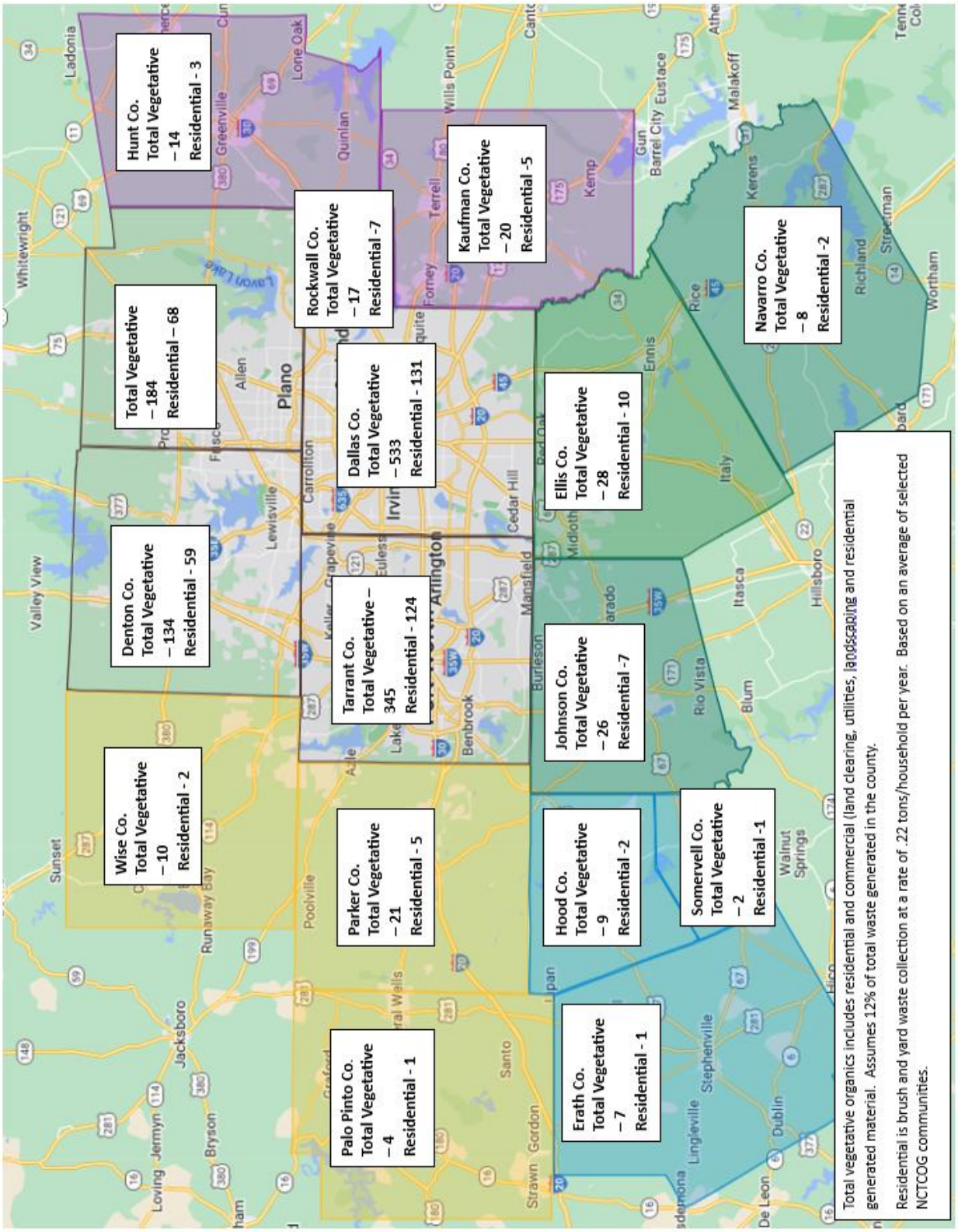


Figure 4-1 Vegetative Waste Generation by Count – 1000 Tons per Year

Management Practices

Landfill Disposal

There is only a small amount of brush that is currently reported as being disposed of in landfills in the Region. Table 4-5 provides a summary of brush waste being disposed of. This accounts for less than one percent of the overall quantities of waste disposed of. The state-wide average is 1.09%. This data do not reflect all the brush material that may be collected with bulky waste or brush that is not counted separately by landfill operators.

Table 4-5
Brush Disposal at Landfills[4]

Landfill	Tons / Year	% of Total Brush Reported Disposed
Garland	48,734	57%
Fort Worth	25,975	30%
121 Regional	8,989	10%
Weatherford[(1)]	1,080	1%
Irving	932	1%
Corsicana	8	0%
Total	85,718	100%

Source: TCEQ MSW Landfill Annual Reports
[(1)] Weatherford Landfill ceased operations in 2022

Landfill Recovery

Nine Regional landfills reported recovery of brush material at their facilities (Table 4-6). Data provided by these operators shows that a total of 172,369 tons of material were recovered at landfills in 2021 (an estimated 13% of the total 1.36 million tons of brush and yard waste generated in the Region). This also is equal to only 1.5% of the total amount of waste that was reported to be disposed of in the Region. (Source: TCEQ Annual MSW Report 2021). In the case of Plano, Fort Worth, and Arlington, the recovered material is ground to mulch and either sold as mulch material or converted into compost. Grand Prairie, Irving, Stephenville, and Garland recover brush, with the material either being provided to residents or used for on-site erosion control. Denton's mulch is also used for on-site erosion control and as a bulking agent or mulch product at the City's sludge compost operations. In addition to these quantities, other landfills in the region are likely using a clean brush and wood waste material for on-site erosion control; however, they are not reporting these as part of their annual report. For example, Waste Management reported in their 2011 permit amendment documentation to the NCTCOG that clean brush and wood waste would be used for on-site erosion control.

The amount of brush recovered at landfills has remained relatively constant over the past ten years. Figure 4-2 illustrates the quantities reported by landfills from 2010 through 2021. The amount of material recovered increased significantly from 2010 to 2015 – from less than 100,000 tons per year to almost 200,000 tons. Since 2015, the quantities recovered have remained relatively constant. In 2021, the amount of brush recovered at landfills represented 1.6% of the total amount of material landfilled.

[4] Landfill Annual Reports to TCEQ

Eight of the region's 18 landfills reported recovering brush. Based on conversations with landfill operators in the Region, segregated brush is used on-site for erosion control and other maintenance projects.

Table 4-6
Brush & Yard Waste Recovered at Landfills

Landfill	Brush Recovered [5]	% of Total
121 Regional Compost	50,233	29%
Arlington	49,183	29%
Fort Worth	32,950	19%
Grand Prairie	22,955	13%
Irving	10,151	6%
Denton	6,503	4%
Stephenville	334	0%
Garland	60	0%
380 C&D	11	0%
Total	**172,369**	**100%**

Source: TCEQ Landfill Annual Reports

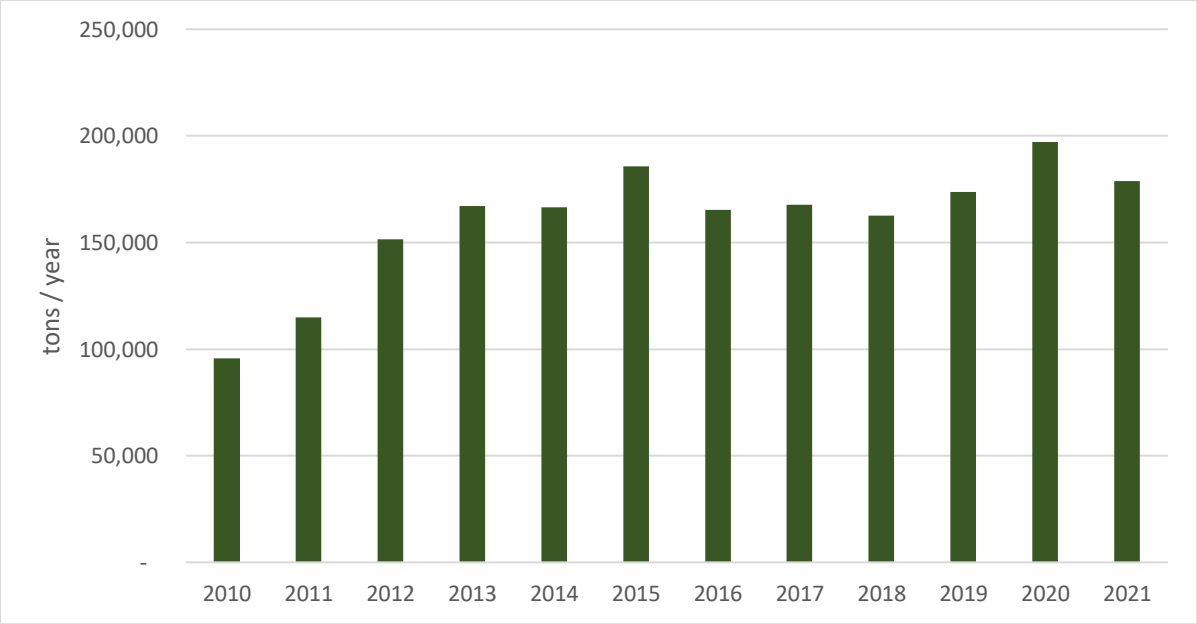


Figure 4-2 Reported Brush Recovery 2010-2021 at Regional landfills; Source landfill annual reports to TCEQ

Composting and Mulch Production

According to the TCEQ's Recycling Market Development Plan, it was estimated that a total of 5.8 million tons of green waste was recovered in Texas. This represented 45% of the total amount of materials

[5] ibid

recovered or recycled in Texas. The report notes that there were several facilities that did not respond to the survey; therefore, the 5.8 million tons is likely less than what is being recovered. In its 2021 Report, the US EPA estimates that 63% of the total amount of yard waste was recovered through composting or mulch operations.

Recovery Challenges and Opportunities

Challenges

1) Implementing programs to collect separated brush will be met with resistance from households, like any other change in collection practices.
2) There is a risk that there will be an insufficient market for the finished products.
3) Continued reliance on land application of sludge will reduce the demand for vegetative wastes going to produce compost. Land application for larger sludge facilities is less costly than composting that will rely on vegetative wastes for bulking purposes.
4) Regulatory uncertainty related to Federal PFAS regulations may delay or prevent new composting facilities.

Opportunities

1) Modify brush collection programs so that brush is collected separately from bulky waste.
2) Enhance efforts to promote "Don't Bag It" programs and adopt bans on the disposal of yard waste. Provide facilities for the disposal of yard waste for recovery and processing.
3) Develop or modify disaster debris management plans so that they provide for the separate collection of tree and other vegetative wastes.
4) Support information exchange efforts to encourage the reuse of pallets and other reusable wood products.
5) Consider Green Building Ordinances that require the separation of construction and demolition waste to reduce the disposal of wood waste and require minimum soil organic content for new developments.
6) Provide incentives for communities to implement material collection and processing programs.
7) Encourage greater composting of sludge and food residuals. This action will increase the demand for vegetative waste, especially brush.
8) Assist in the market development of mulch and compost through advocacy, education and public/private partnerships.

Food Residuals

According to the US EPA, over one-third of food produced in the US is never eaten and food residuals account for 22% of the waste that is landfilled. The generation of food residuals has environmental impacts beyond landfill disposal. Producing food uses valuable land and water resources and the harvesting, production, and delivery of food impacts air quality. The US EPA has established a hierarchy for managing food waste that is designed to focus on source reduction, donation of food to hungry people, use as animal feed, industrial purposes, composting, and finally, landfill disposal (Figure 4-3).

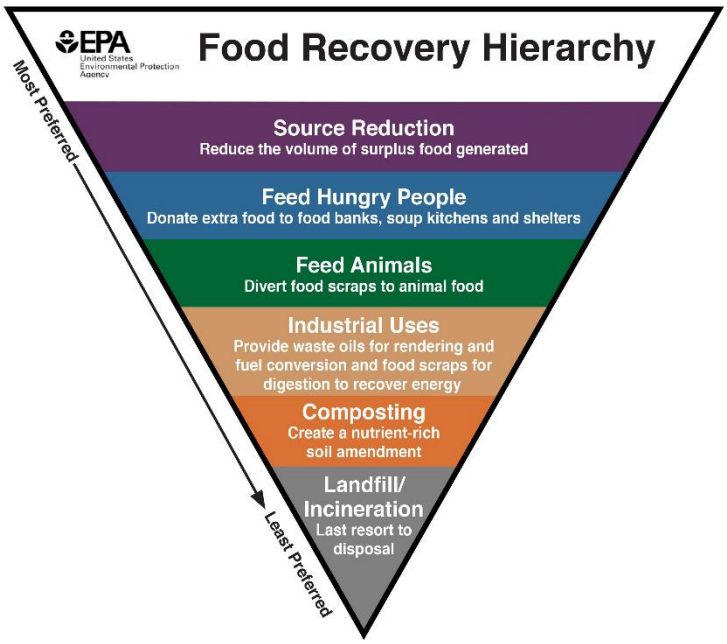


Figure 4-3
US EPA Food Recovery Hierarchy

Definition

For this Study, wasted food is referred to as **"food residuals."** This definition implies that material that is often referred to as "food waste" is often recovered through other means than composting. Much of what is often considered food waste is recovered to feed hungry people, used as animal feed, used in the production of other goods through bio-chemical processes or through codigestion at wastewater treatment plant anaerobic digesters, land applied for agricultural use, or disposed through municipal wastewater pretreatment programs. It is assumed that these materials will not be available for recovery through composting. On the other hand, food residuals are not recovered through any other means; they are typically landfilled and are available for recovery through composting.

Major Generators

The focus of the Study is food residuals generated from industrial through retail and food service industries. A few communities have adopted residential food residuals collection programs; however, the cost of implementing an additional collection service is often too prohibitive for most communities to afford. Food residual collection from residents also has a history of having significant contamination levels. Exceptions to this challenging condition are subscription programs and drop-off programs, which typically require that participants pay for collection directly, and typically have very low contamination rates due to the high level of motivation of voluntary participants.

The major source of information evaluated for this section is the US EPA Excess Food Opportunity Mapper (EFOM) and the 2021 EPA Report – From Farm to Kitchen: The Environmental Impacts of Food

Waste, EPA Facts and Figures about Materials, Waste and Recycling Food Waste Specific Materials[6] and the 2023 EPA Wasted Food Report for 2019. Appendix C includes EPA's methodology for collecting food waste and food residuals data.

The Excess Food Opportunity Mapper (EFOM)[7], developed by the US EPA, focuses on key commercial and institutional generators. These generators include:

- correctional facilities
- educational institutions
- food banks
- healthcare facilities
- hospitality industry
- food manufacturing and processing facilities
- food wholesale and retail
- restaurants and food services

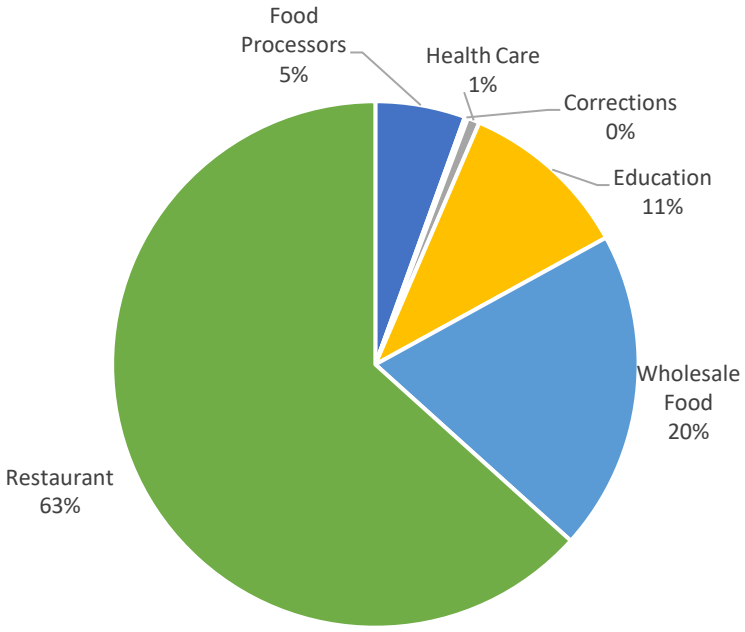


Figure 4-4
Food Waste Generator by Types in the Region (excluding residential)

Table 4-7 provides a summary of the number of generators by class in each of the Region's counties. EPA identified a total of 25,096 generators in the Region. Figure 4-4 illustrates the distribution of these types of generators. As can be seen, most food waste generators identified by the EPA are restaurants. Restaurants represent 63% of the total number of generators in the Region. Appendix D lists some of the major food residue generators based on the EPA data.

[6] Food: Material-Specific Data | US EPA
[7] Excess Food Opportunities Map | US EPA

Table 4-7 Number of Food Residuals Generators Identified by US EPA							
County	**Food Processors**	**Corrections**	**Health Care**	**Education**	**Wholesale Food**	**Restaurant**	**Total**
	Number of Facilities						
Collin	165	2	29	306	631	1,963	3,096
Dallas	620	22	60	908	1,996	6,353	9,959
Denton	137	4	19	251	451	1,802	2,664
Ellis	21	-	3	67	110	323	524
Erath	10	1	1	19	30	101	162
Hood	8	-	1	19	41	120	189
Hunt	15	-	3	47	46	120	231
Johnson	16	-	2	116	99	313	546
Kaufman	16	1	3	50	65	198	333
Navarro	-	1	1	77	31	75	185
Palo Pinto	1	1	1	15	20	59	97
Parker	18	1	2	47	61	193	323
Rockwall	15	2	3	29	57	210	316
Somervell	1	-	1	6	6	22	36
Tarrant	329	14	54	658	1,253	3,945	6,253
Wise	13	2	3	29	42	94	183
Total	**1,385**	**51**	**186**	**2,644**	**4,939**	**15,891**	**25,096**
Northwest	32	4	6	91	123	346	602
Southwest	19	1	3	44	77	243	387
Northeast	46	3	9	126	168	528	880
Southeast	37	1	6	260	240	711	1,255

Generation Quantities

Commercial and institutional sources evaluated in this report generated a total of between 228,000 and 1.3 million tons of food residuals per year (Table 4-8). The reason for the widespread values is that there are significant limitations in the data available to the EPA (refer to Appendix C). These totals represent the total amount generated, not necessarily landfilled. It should also be noted that EPA did not have data for every source, therefore quantities may be more than presented in the Study.

Because of a high concentration of wholesale food generators and restaurants, Collin, Dallas, Denton, and Tarrant Counties combined represent 89% of the total food residuals generated in the Region.

Table 4-8 presents the tonnages of food waste generated by sectors. While there are significant variances in the data from low to high, the data do illustrate potential sources of materials and where to potentially focus efforts to divert food waste. Depending on the scenario, either wholesale food or restaurants represent approximately 60% of the total amount generated. These are also the sectors with the greatest number of generators. The EPA data identified a total of more than 15,000

restaurants and 5,000 wholesale food generators in the Region. The large number of generators will complicate the local government's efforts to implement either public information or collection programs. Counties and subregions with fewer generators represent lower collection route density and higher collection costs.

Table 4-8
Food Residuals Generation by County and Subregion (tons/year)

County	Low Total	High Total	% of Low Total	% of High Total
Collin County	22,203	144,504	9.7%	10.7%
Dallas County	101,141	609,106	44.3%	45.2%
Denton County	21,295	120,710	9.3%	9.0%
Ellis County	3,220	23,267	1.4%	1.7%
Erath County	1,467	8,262	0.6%	0.6%
Hood County	1,387	8,904	0.6%	0.7%
Hunt County	2,572	13,176	1.1%	1.0%
Johnson County	3,477	21,280	1.5%	1.6%
Kaufman County	1,782	13,328	0.8%	1.0%
Navarro County	961	6,583	0.4%	0.5%
Palo Pinto County	429	3,407	0.2%	0.3%
Parker County	1,816	12,573	0.8%	0.9%
Rockwall County	2,457	13,463	1.1%	1.0%
Somervell County	166	1,005	0.1%	0.1%
Tarrant County	63,050	341,033	27.6%	25.3%
Wise County	767	6,994	0.3%	0.5%
Total	**228,160**	**1,347,596**	**100.0%**	**100.0%**
Northwest	3,012	22,973	1.3%	1.7%
Southwest	3,020	18,171	1.3%	1.3%
Northeast	6,810	39,967	3.0%	3.0%
Southeast	7,658	51,130	3.4%	3.8%

Table 4-9 Food Residuals Generation by Sector							
	Food Processors	**Corrections**	**Health Care**	**Education**	**Wholesale Food**	**Restaurant**	**Total**
Number of Generators	1,385	51	186	2,644	4,939	15,891	25,096
Low TPY	55,210	2,843	2,520	17,344	12,467	137,776	228,160
High TPY	177,071	7,882	13,674	87,663	735,353	325,953	1,347,596
% of Generators	6%	0%	1%	11%	20%	63%	100%
% of Low Tons	24%	1%	1%	8%	5%	60%	100%
% of High Tons	13%	1%	1%	7%	55%	24%	100%
TPY – tons / year							

Management Practices

Several large food processors have established environmental goals for their organizations. Some of the goals established by the Region's food processors are presented below. While these goals have yet to be achieved, they do represent an acknowledgment by major food processors that food residuals are an issue that must be addressed as part of their environmental program.

Table 4-10 Private Sector Food and Environmental Goals	
Company	Environmental Goals
Sysco	Sysco has committed to diverting 90% of operations and food waste from landfills as part of the company's 2025 Corporate Social Responsibility (CSR) goals. This will be achieved through meal donations and contributing food waste to animal feed and composting efforts. Sysco 2022 Sustainability Report
Mrs. Baird's Bakery	Mrs. Baird's bakeries are involved in food donations. Fighting Texas Hunger | Mrs. Bairds (mrsbairds.com)
Tyson Foods	Diverting Product Processing and Food Waste Throughout our operations and supply chain, we actively seek opportunities to eliminate or minimize waste from food and products. For example, in our animal processing operations, we avoid waste from byproducts by instead producing products such as animal feed, biofuels, and fertilizer. 2021 Tyson Foods Sustainability Report (tysonsustainability.com)
Rudy's Food Products, Inc.	Our solid food waste is distributed to local farmers for use as livestock feeds and our ongoing recycling programs minimize our use of landfill space. Teasdale Latin Foods

Coca Cola Company	We're committed to supporting The Coca-Cola Company's "World Without Waste" initiative, a beverage industry goal to collect and recycle the equivalent of every bottle or can it sells globally by 2030. And we're making significant progress, with 30 percent of our packages currently collected and recycled and 100 percent made from recycled materials. Sustainable Packaging (coca-colacompany.com)
Dr. Pepper Snapple Group	Achieving zero waste to landfill from our manufacturing facilities is an important part of our circular economic ambitions. This commitment involves reducing, reusing, and recycling our waste in creative ways. In our hot beverage manufacturing network, more than 99% of our waste was kept from landfills by composting coffee grounds, recycling filter paper scrap and burlap coffee bean bags and converting waste to energy. environment (keurigdrpepper.com)
Buzzballz, LLC	We recently partnered with TerraCycle so now, any consumer can sign up, download a shipping label, and send in their BuzzBallz empties for recycling. Once received, the waste collected is then typically shredded, washed, melted, and transformed into plastic flakes or pellets which are then turned into recycled products such as outdoor furniture. Our Story - Buzzballz
Dannon Company, Inc.	Dannon commits to offering products coming from more sustainable agriculture by working with its dairy farmer partners and their suppliers to progressively implement the use of sustainable agriculture practices and technology that leads to better soil health, better water management, an increase in biodiversity, and a decrease in carbon emissions. Dannon Announces Breakthrough Sweeping Commitment for Sustainable Agriculture, More Natural Ingredients and Greater Transparency | Business Wire

Residential Food Waste

As shown in Figure 4-5, residents account for approximately 44% of the total amount of food waste going to landfills (excluding food processors). The EPA estimates that each household generates 337.9 pounds of food waste per year.[8] Based on this estimate, the Region's 1.9 million single-family households generate approximately 330,000 tons of food waste per year; the Region's 805,000 multi-family residents generate approximately 136,100 tons of food waste per year.

[8] 2019 Wasted Food Report (epa.gov)

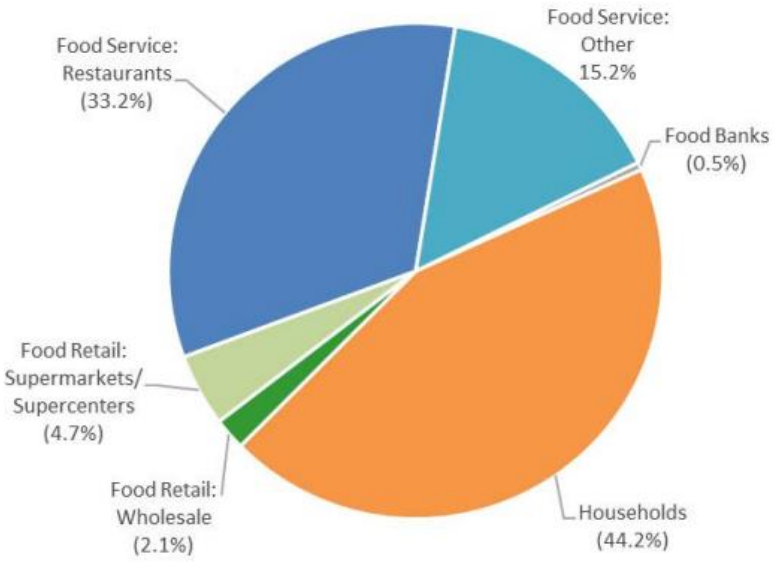


Figure 4-5 - Landfilling Sources (food retail, food service, residential and food bank sectors 2019)
Source: US EPA Food Waste Report 2019

Nationally, approximately 60% of food waste is landfilled (excluding food residuals from food processors who have a high reduction/recovery rate). The remaining 40% is managed in several different ways as shown in Figure 4- 6 and Table 4-11. It is beyond the scope of this Study to determine the exact food waste flows in the Region. It should be noted that while there is some management of food through anaerobic digestion, these quantities are considerably limited based on the findings of the Food to Fuel Study performed for the Region. Also, very few composting facilities in the Region rely on large quantities of food waste for processing. There are also no controlled combustion facilities for municipal solid waste in the Region. It is estimated that the majority of food waste generated in the Region is managed through donations, animal feed, and bio-based materials (i.e., converting material into industrial products). Most of this wasted food managed by bio-based materials/biochemical processing was from restaurants, other food service providers, and supermarket and supercenter retailers.

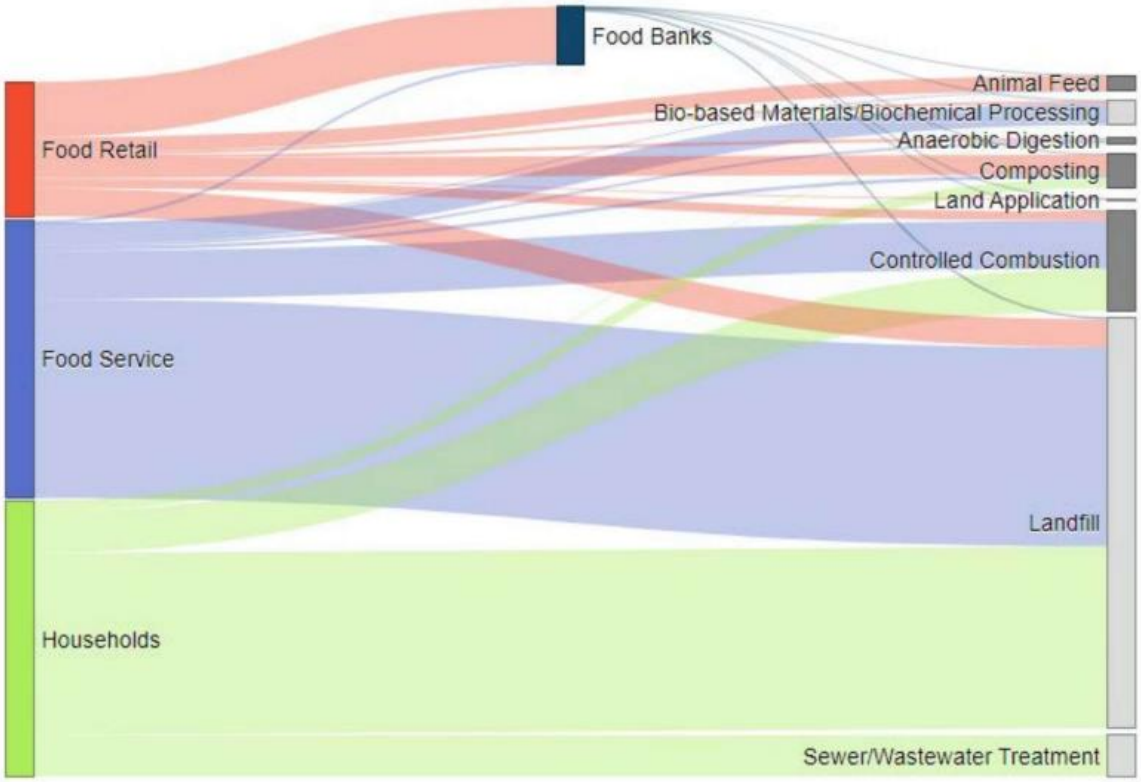


Figure 4-6
National food waste flows from retail, food service and residents
Source: USEPA 2019 Wasted Food Report, Estimates of Generational Management of Wasted Food in the United States in 2019; April 2023

Table 4-11
National Food Residuals Management Pathways

Management Pathway	Quantity Managed (tons/year)	Percentage Managed
Donation[1]	5,135,293	7.76%
Animal Feed	1,516,771	2.29%
Bio-based Materials/Biochemical Processing	2,335,988	3.53%
Anaerobic Digestion	538,539	0.81%
Composting	3,304,764	4.99%
Land Application	141,371	0.21%
Controlled Combustion	9,646,263	14.57%
Landfill	39,621,902	59.84%
Sewer/Wastewater Treatment	3,975,352	6.00%
TOTAL	66,216,242	100.00%
Source: US EPA Food: Material-Specific Data | US EPA		

1 These estimates exclude the small share of excess food (473,027 tons) that food banks cannot distribute and is routed to other management pathways.

DFW International Airport

Photo Source DFW International Airport

In March 2021, DFW implemented a composting program to collect food waste and transport it to local farms and compost facilities, diverting it from landfills. Since the program's inception, more than 9 tons of food waste have been collected, translating to an average of over 100 pounds per day. DFW's internal goal for the year was to complete two food residuals projects. In 2021, DFW exceeded this goal by onboarding 15 concessions.

Source: DFW Annual ESG Report

University of Texas - Arlington

UTA's award-winning composting program composts food waste from on-campus and off-campus dining services, coffee shops and hospitals, as well as yard waste from campus grounds. The University uses this compost as mulch and soil amendment on campus grounds and in a community garden. It also hosts master composter training in partnership with the city of Arlington. In 2018-19, the program composted 92,177 pounds of materials.

Source: [UTA Recognized For Composting, Reducing Food Waste - City of Arlington (arlingtontx.gov)]

Collection of Food Residuals

One of the ways that food waste is getting to compost facilities is through subscription services. These services are provided by private firms that specialize in food waste and recycling collection. Companies, including Turn, Recycling Revolution, Cowboy Compost, and Moonshot Compost provide these services. These companies provide collection services to both businesses and residents for a monthly fee. Materials collected by these firms are then delivered to a compost facility.

Some cities have implemented drop-off collection centers for food waste; however, no cities in the Region provide curbside collection of food waste.

Landfill Disposal

One of the primary goals of the Study is to identify key sources of organics for diversion from the landfill. As stated earlier, the EPA estimates that only 2% of the food waste currently generated by major food processors is landfilled, and 60% of the food waste currently generated by wholesale, institutions, and restaurants is landfilled. For food processors and manufacturers, most food waste generated is recovered for agricultural purposes. ***However, because of the lack of current infrastructure for managing this waste through composting or anaerobic digestion in the Region, the actual landfilled quantities for food processors and manufacturers may be likely higher.***

Food Donations are a high priority.

Second to reducing the amount of food waste generated, donating unused food is a national and regional priority. There are several groups in the DFW area that focus on getting unused food from generators to people in need. Any future program that focuses on reducing landfilling of food waste should include an element to encourage food donations.

The large discrepancy between the low and high estimates by US EPA for food generation is significant. Considering all non-residential food waste generation, the low estimate implies that of the 228,000 tons per year of food waste generated, 105,000 tons per year is likely landfilled. Whereas the high estimate implies that of the 1,347,000 tons per year of food waste generated, 706,000 is likely to be landfilled. These estimates provide a range of estimated food residuals currently landfilled (available for composting or another recovery) of 105,000 tons per year to 706,000 tons per year.

The largest reduction of unrecovered food residuals currently occurs in the food processing sector. This sector has demonstrated an ability to find alternatives to landfilling for food waste. In addition to diversion to various beneficial uses, this sector attempts to reduce food residuals through the production process as a means of saving costs. In contrast, the two sectors that have the highest quantities of landfilled food residuals are the wholesale sector and restaurants.

Tables 4-12 and 4-13 present food residual disposal by county and food residual generation ranges by sector. Figure 4-7 illustrates non-residential generation and disposal by county.

Table 4-12
Food Residuals Landfilled by County

County	Low Net Tons/year	High Net Tons/year	% of Low Net	% of High Net
Collin County	11,578	81,111	11.0%	11.5%
Dallas County	42,254	306,351	40.3%	43.4%
Denton County	10,680	65,700	10.2%	9.3%
Ellis County	1,815	13,584	1.7%	1.9%
Erath County	639	4,184	0.6%	0.6%
Hood County	824	5,315	0.8%	0.8%
Hunt County	1,491	7,740	1.4%	1.1%
Johnson County	1,965	12,377	1.9%	1.8%
Kaufman County	987	7,734	0.9%	1.1%
Navarro County	576	3,950	0.5%	0.6%
Palo Pinto County	256	2,042	0.2%	0.3%
Parker County	1,047	7,408	1.0%	1.0%
Rockwall County	1,301	7,523	1.2%	1.1%
Somervell County	98	599	0.1%	0.1%
Tarrant County	28,936	176,094	27.6%	24.9%
Wise County	444	4,143	0.4%	0.6%
	-	-		
Total	**104,891**	**705,856**	**100.0%**	**100.0%**
Northwest	1,748	13,593	0.0%	0.0%
Southwest	1,561	10,098	1.7%	1.9%
Northeast	3,779	22,997	1.5%	1.4%
Southeast	4,356	29,911	3.6%	3.3%

Source: US EPA Excess Food Waste Mapper
US EPA Food Waste Report 2019

Table 4-13
Net Tons Food Residuals Disposed (tons/year) (1)

	Food Processors	Corrections	Health Care	Education	Wholesale Food	Restaurant	Total
Net Low Tons	1,104	1,706	1,512	10,407	7,480	82,666	104,874
Net High tons	3,541	4,729	8,205	52,598	441,212	195,572	705,856
% of Low Tons	1%	2%	1%	10%	7%	79%	100%
% of High Tons	1%	1%	1%	7%	63%	28%	100%

(1) Net food residuals are tons estimated to be landfilled after source reduction and recovery.

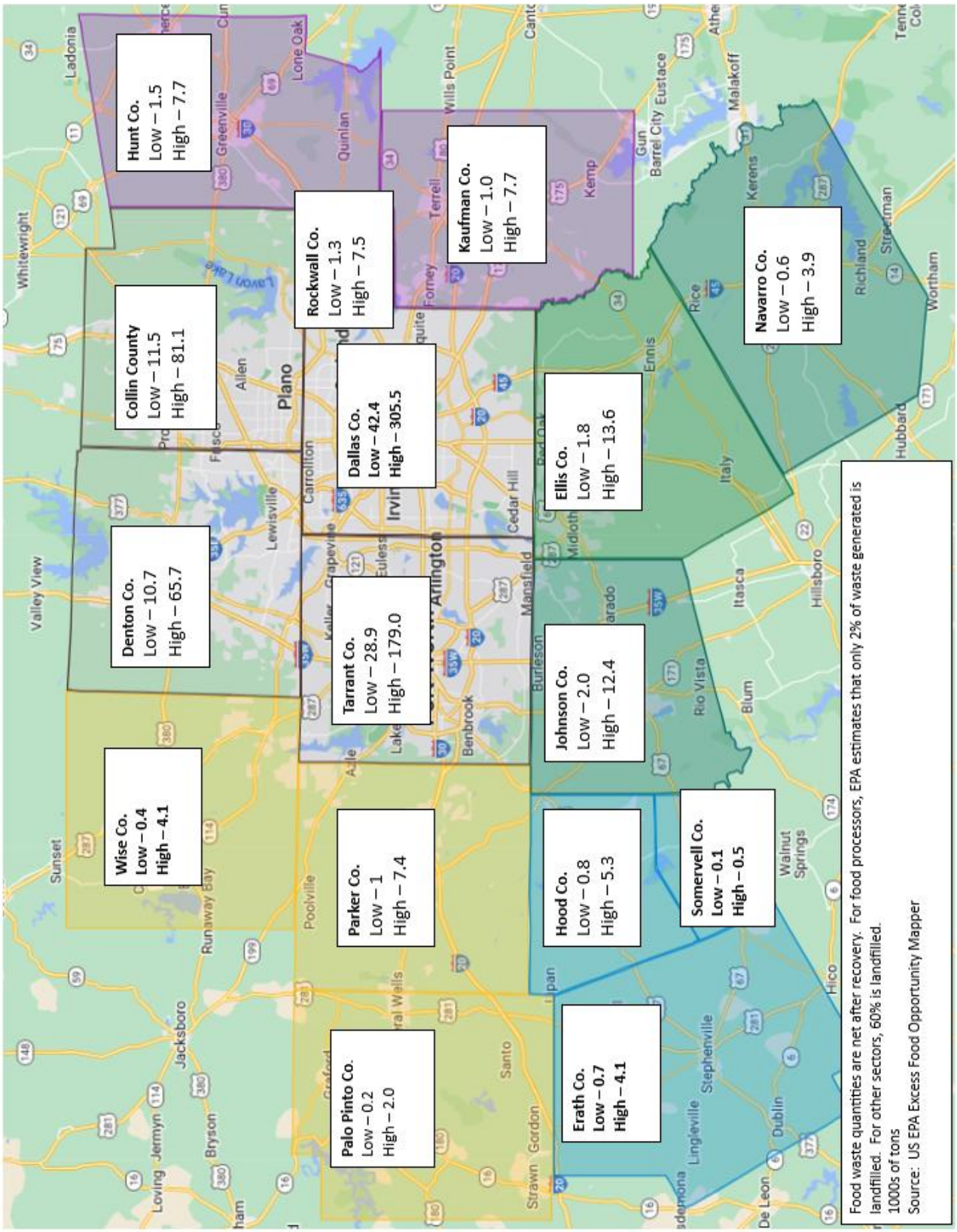


Figure 4-7 Non-residential Food Residual Generation by County (Source US EPA Excess Food Opportunity Mapper)

Challenges and Opportunities

Challenges

While several Regional compost facilities are authorized to accept food residuals, conversations with compost processors indicate that only a minimal amount of food is processed in comparison to non-food vegetative wastes. The lack of processors accepting more food residuals will be a deterrent to more businesses being involved in either separating materials or providing collection services. Facilities that are currently authorized to accept food residuals may choose not to. Some facilities are authorized to take vegetative food residuals but not animal byproducts such as meat, dairy, and fats or grease.

According to US EPA data, most food residuals are generated by either restaurants or wholesale operations. Because of a lack of collection route density, collecting from several generators is going to be the least cost-effective means of collecting materials. Generators with large quantities may find direct haul to composters as a feasible option.

While there are firms that provide subscription collection services to residences and businesses, the food residuals collection service business is still in its infancy and represents a small percentage of waste collected in the Region. For businesses to realize cost savings associated with using these companies, they will likely have to be able to reduce the size of their current collection container or reduce the frequency of collection. When processing facilities are closer to generators than landfills, the decreased transportation cost can make food residual recovery more attractive than landfill disposal.

Much of the food currently landfilled could have been composted or otherwise recovered for beneficial use if it were not packaged.

Based on interviews with major food waste generators outside the Region, some food processors indicated a desire to reduce food waste but are generally not aware of opportunities to do so. Many corporations have sustainability goals. In addition, the US EPA has made the reduction of food residuals a priority and has devoted program dollars to encouraging generators to reduce their food residuals.

Opportunities

Utilize NCTCOG's resources to encourage greater food donations.

Provide the food industry with information on opportunities to have food residuals collected and composted. Identify specific composters that are interested in securing additional feedstocks or customers.

Evaluate policies designed to discourage the disposal of food residuals from commercial and industrial sources.

Encourage information exchanges between the food industry and the composting industry to identify specific barriers and opportunities.

Programs to facilitate depackaging equipment at composters and other recovery facilities will increase the ability of processors such as composters to accept wasted packaged food.

In 2021, the NCTCOG sponsored the North Central Texas Food Waste Collection Networks Roundtable (presentations: PowerPoint Presentation (nctcog.org). Collaboration with industry partners and government can identify opportunities to expand efforts to reduce food residuals generation and disposal. There are several local food donation programs in the DFW area. Increased awareness of food residual management options can reduce the amount of food residuals generated. Key trade groups include the Texas Restaurant Association, Texas Food Processors Association, and others. These industries recognize that sustainability is an issue they will probably not be able to ignore in the future.

A recent presentation to the Texas Food Processor Association identified the following trends in the industry.

Sustainability

1. ***Circular economy approach:***
    - ***Designing packaging for recyclability, reusability, and reduced waste***
    - ***Supporting collection and recycling infrastructure to close the loop***
2. ***Carbon footprint reduction:***
    - ***Optimizing packaging design for material and energy efficiency***
3. ***Waste reduction and upcycling:***
    - ***Implementing zero-waste initiatives in manufacturing processes***
    - ***Developing new products from packaging waste, like food-grade PET or bio-based materials***

Source: TFPA 2023.pptx - Google Slides, presentation by **Gary Burdow - Supply One**
Senior Vice President, Sales

Sludge

Maintaining high water quality standards requires a complex system to collect and treat wastewater generated from residents, businesses, and institutions. There are 91 operating public wastewater treatment facilities in the Region.[9] Wastewater treatment facilities use a variety of technologies to process wastewater to standards that allow for the water to be sent back into the water cycle. Each of these technologies does result in the generation of residuals, or sludge. Sludge is an organic resource that, when properly disinfected, can be applied to cropland through land application techniques. It can also be used as a feedstock in composting, increasing the value of the product as a soil amendment. It may also be disposed of at a landfill.

TRA Central Region Wastewater Plant

Definitions

The TCEQ defines biosolids and sludge as the following: "**Biosolids**--Sewage sludge that has been treated or processed to meet Class A, Class AB, or Class B pathogen standards under this chapter for beneficial use." In other words, biosolids have been disinfected. **Sewage sludge** is defined as solid, semi-solid or liquid residue generated during the treatment of domestic sewage in treatment works. Sewage sludge includes but is not limited to domestic septage, scum, or solids removed in primary, secondary, or advanced wastewater treatment processes, and material derived from sewage sludge. Sewage sludge does not include ash or grit and screenings that are generated during the preliminary treatment of domestic sewage treatment works. (Source: TAC 312.8)

Dry solids refer to only the solid component of sludge or biosolids, without the weight or any water that may be associated.

When sludge is properly composted the product is typically disinfected to meet standards enabling it to be approved for unrestricted use. Compost made from sludge meeting disinfection standards may be referred to as biosolids.

Data Collection

Sources of data for this section include the following:

[9] This figure does not include small municipal utility facilities less than 1000 gallon per minute design capacity

- RWA Team interviews with wastewater officials
- Survey results from the Weatherford Regional Composting Study
- Data provided by individual wastewater facility owners, including the North Texas Municipal Water District (NTMWD), Trinity River Authority (TRA), Dallas Water Utilities, and the City of Fort Worth
- EPA Enforcement and Compliance Online (ECHO) data
- TCEQ wastewater data

Major Generators

There are a total of 91 wastewater treatment facilities located in the region that were evaluated for this Study. These facilities range from small facilities generating less than one ton per year, to the TRA Central Treatment Plant which generates approximately 68,140 dry tons of sludge per year.

Most of the wastewater treatment facilities are owned and operated by public entities including TRA, NTMWD, the City of Fort Worth, and the City of Dallas. TRA has five wastewater treatment facilities located in Dallas and Tarrant counties and provides services to over 40 local governments in those Counties. The NTMWD operates 13 wastewater treatment plants with over 163 million gallons of daily (MGD) treatment capacity. The City of Fort Worth's wastewater treatment facility provides service to a portion of Fort Worth. The City of Dallas has two primarily wastewater treatment facilities that serve primarily Dallas customers.

Generation Quantities

Table 4-14 provides a summary of publicly operated wastewater treatment facilities located in the region. These facilities have an average design flow rate of over 945 million gallons per minute. A total of 238,000 tons of dry solids are generated by these facilities according to US EPA ECHO records.

Almost half of the sludge generated in the region is produced in Dallas County, primarily from the Dallas Southside Wastewater Treatment Facility and the TRA Central Region Wastewater Treatment Plant. Appendix E lists the wastewater treatment facilities in the Region and their design capacities and sludge generation. Figure 4-14 provides the average design capacity and dry solids generation by County and subregion.

Table 4-14
Sludge Generation at Public Wastewater Facilities

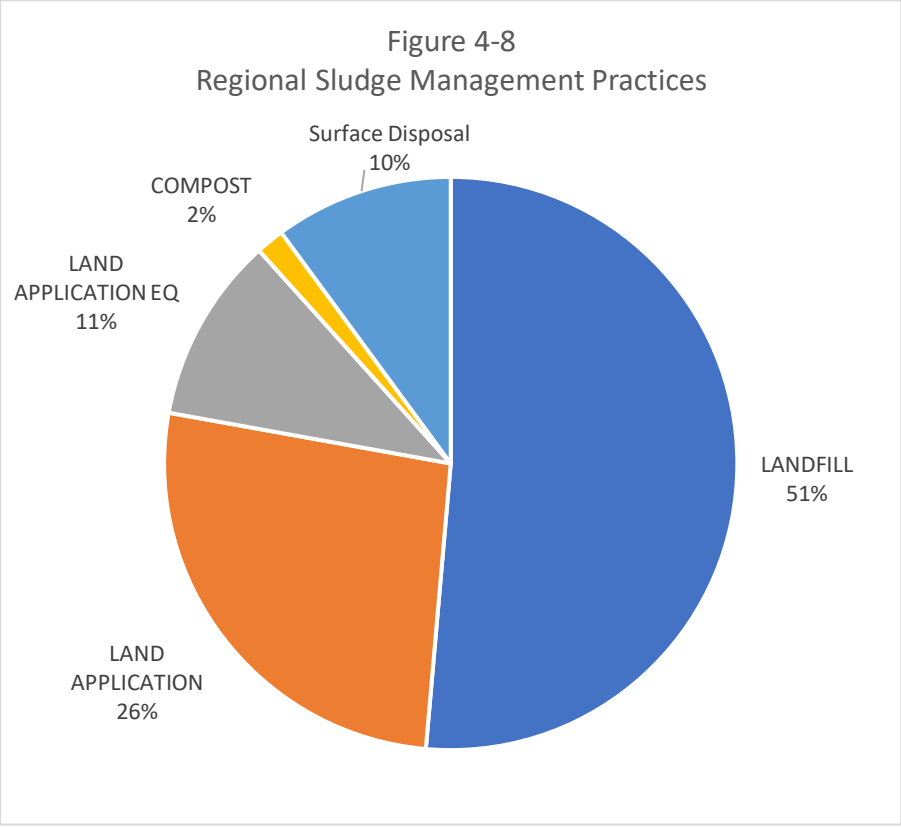
Generation	Facility Avg Design Flow (million gallons/day)	Annual Dry Tons	% of Total Dry Tons	# of Facilities
Collin County	82	23,520	9.8%	10
Dallas County	455	109,842	46.0%	7
Denton County	105	42,499	17.8%	21
Ellis County	30	16,407	6.9%	8
Erath County	3	299	0.1%	1
Hood County	3	409	0.2%	4
Hunt County	9	1,740	0.7%	5
Johnson County	12	1,382	0.6%	7
Kaufman County	46	7,704	3.2%	5
Navarro County	6	289	0.1%	2

Palo Pinto County	2	572	0.2%	2
Parker County	6	1,185	0.5%	5
Rockwall County	8	2,159	0.9%	3
Somervell County	1	48	0.0%	1
Tarrant County	174	30,345	12.7%	3
Wise County	3	417	0.2%	7
				10
Total	**945**	**238,818**	**100.0%**	7
Northwest	11	2,175	1%	17
Southwest	7	756	0%	8
Northeast	63	11,604	5%	13
Southeast	48	18,078	8%	17

Management Practices

There are four primary methods of managing sludge in the NCTCOG Region (Figure 4-8).

1) Land Application
2) Landfill Disposal
3) Surface Disposal (monofil)
4) Composting



Land Application

Wastewater treatment facilities can land-apply sludge to agricultural fields under certain regulated conditions. The benefits of land application include adding nutrients to soils that promote greater crop production and the material that is land applied is not using landfill space. Agricultural uses of biosolids must meet strict quality criteria and application rates. When properly managed, land application of biosolids serves as an environmentally responsible alternative or substitute for more expensive chemical fertilizers.

The benefits and disadvantages associated with land application include the following:

Benefits

- Keeps material out of landfills and preserves landfill capacity

- Provides nutrients to soil for crop production
- Producers are able to generate revenues.

Disadvantages

- Requires large tracts of land that are located away from residential areas due to odors associated with land application.
- Regulatory status for land application is uncertain as TCEQ evaluates rules for sludge land application.
- Haul distances required to transport sludge to land application sites.

Prior to issuing a permit for land application, the TCEQ considers the following issues:

- Water and nutrient needs of the plants,
- How the soils hold water and nutrients, and
- Nearby wells and groundwater sources.

A beneficial land-use permit does the following.

- Before the sludge is brought to the application site, it is analyzed to ensure that it meets safe levels of bacteria based on state and federal guidelines and regulations. Nutrients in the sludge must also not exceed the land's capacity to absorb them.
- After the sludge is applied and spread, best management practices must be used to ensure the site does not harm human health or the environment.

There are also several site constraints associated with land application which are defined in TAC 312. These site rules are relevant to biosolids that do not meet Class A pathogen reduction requirements.

The Fort Worth Village Creek Wastewater Treatment Plant is an example of a facility that produces Class A – Exceptional Quality biosolids. The TRA is in the process of converting the Central Region Wastewater Facility to be able to generate a Class A biosolid through a Thermal Hydrolysis Process.

Site criteria for non-Class A material include:

(1) Surface water:

(A) A 200-foot buffer zone, if the biosolids and/or domestic septage are not incorporated; for land application units located in a major sole-source impairment zone this buffer zone must maintain a vegetative cover; or

(B) 33-foot vegetative buffer zone, if the biosolids and/or domestic septage are incorporated.

(2) Other buffer zones:

(A) 150 feet, private water supply well;

(B) 500 feet, public water supply well, intake, spring or similar source, public water supply treatment plant, or public water supply elevated or ground storage tank;

(C) 200 feet, solution channel, sinkhole, or other conduit to groundwater;

(D) 750 feet, established school, institution, business, or occupied residential structure;

(E) 50 feet, public right-of-way and property boundaries; and

(F) 10 feet, irrigation conveyance canal.

TCEQ also requires that applicants for land application permits demonstrate that they have sought public input as part of the permit application process.

Major Wastewater Treatment Facilities and Sludge Management

Four agencies manage the majority of wastewater processed in the Region and each manages sludge in different ways.

- Trinity River Authority (TRA)
- City of Fort Worth
- City of Dallas
- North Texas Municipal Water District (NTMWD)

TRA manages five facilities in the Region and generates sludge with a total of 75,959 tons of dry solids per year. The Central Region Wastewater Treatment Plant (CRWT) generates 68,769 tons per year of dry solids, which are land applied for beneficial use. The remaining 7,190 dry tons are landfilled. TRA is in the process of converting the CRWT to the Thermal Hydrolysis Process (THP), as the City of Fort Worth has done.

The City of Fort Worth utilizes THP to produce an "exceptional quality" biosolid. This classification allows the materials to be used in a similar fashion as Class A Compost for Unrestricted Use. EPA defines exceptional quality sludge as "biosolids (disinfected sludge) that meets low-pollutant and Class A pathogen reduction (virtual absence of pathogens) limits and that have a reduced level of degradable compounds that attract vectors... considered a product that is virtually unregulated for use, whether used in bulk or sold or given away in bags or other containers." The City generated a total of 27,500 tons of dry solids in 2022.

The City of Dallas disposes of its sludge from both the Central and Southside wastewater treatment plants by surface disposal at the Southside facility. Once Southside receives sludge from Central it is blended with sludge from Southside in the City's Gravity Belt Thickener building. All sludge is thickened and fed to anaerobic digesters. After a minimum of 15 days of digestion, the sludge is then dewatered through belt presses to a minimum of 15% solids before surfaced disposal. The City also has a monofil disposal facility, separate from the surface disposal operation described above, which accepts sludge that does not meet the minimum requirements for surface disposal. In the City's monofil, the City is permitted to dispose of undigested sludge with proper burial. Since all of the City's sludge is digested, they operate most of the monofil as land application fields. In FY 21/22 the City generated 24,516 tons of dry solids. The average percentage of solids in this material is 16.8%.

NTMWD disposed of sludge generated from its facilities in landfills. NTMWD owns and operates the 121 Regional Landfill located in Melissa. Annually, that landfill disposes of 131,282 tons per year of wet sludge.

Surface Disposal

Surface disposal of sludge occurs in areas approved by the TCEQ for disposal of sludge in a monofil application. This is how the City of Dallas manages sludge generated from both the Central Wastewater Treatment Plant and the Southside Wastewater Treatment Plant.

Table 4-15 presents the estimated quantities of biosolids that are being land applied in the Region. The majority of land-applied sludge is generated from the City of Dallas, TRA, and the City of Fort Worth. The City of Fort Worth produces Class A -Exceptional Quality biosolids using the Thermal Hydrolysis Process (THP), which not only produces a disinfected product but also reduces the organic fraction of the solids generated by approximately 50%. Exceptional Quality biosolids products are as safe as other agricultural and horticultural products and may be used without site restrictions. It should be noted that TRA is in the process of converting its Central Region facility to produce Class A-EQ sludge through a THP process as does Fort Worth's plant.

Table 4-15
Land Application and Surface Disposal of Biosolids

Facility	Class A – Exceptional Quality Land Application Tons Dry Solids/Year	Class A or B Land Application Tons Dry Solids/Year	Surface Disposal Tons Dry Solids/Year
City of Dallas Southside			26,320
TRA Central Region*		68,140	
Fort Worth Village Creek	27,500		
City of Greenville		1,106	
City of Bridgeport			6
City of Glen Rose			48
Total	**27,500**	**69,246**	**26,375**
Note: TRA is in the process of converting to thermal hydrolysis and will be regulated as Class A – Exceptional Quality			

Landfill Disposal and Surface Disposal

Sludge generated from wastewater treatment facilities can be landfilled. Most wastewater treatment facilities in the Region send their sludge to Type I MSW landfills. The City of Dallas and two other cities rely on surface disposal (monofil).

Table 4-16 presents the amounts of sludge that are currently generated by wastewater treatment facilities in the Region's counties. In 2022, a total of 111,071 dry tons of sludge were sent to landfills in the Region. The table shows that Denton and Collin Counties landfill the most sludge generated from wastewater treatment facilities located in their region. The reason that they are higher than Dallas and Tarrant counties is because the major wastewater treatment facilities in those counties rely on land application of sludge.

Table 4-16 Sludge Generation That is Landfilled by County	
Management Practice	Landfill (tons dry solids)
Collin County	23,520
Dallas County	14,859
Denton County	38,340
Ellis County	16,407
Erath County	299
Hood County	409
Hunt County	635
Johnson County	1,382
Kaufman County	7,704
Navarro County	289
Palo Pinto County	572
Parker County	1,185
Rockwall County	2,159
Somervell County	48
Tarrant County	2,845
Wise County	417
Total	**111,071**

Table 4-17 lists the amounts of sludge that are generated in each of the counties that are disposed of in a landfill. The data are derived from TCEQ's Annual Landfill Reports submitted by landfill owners to the TCEQ. Region-wide, sludge, expressed as wet weight, represents approximately 2.70% of the material being disposed in landfills, by weight. This compares to the state-wide average of 2.45%.

Table 4-17 Landfills Accepting Sludge by County		
Landfill	**Landfill Tons (wet tons)**	**County Tons (wet tons)**
121 Regional	131,282	
Collin Total		131,282
Dallas McCommas	434	
Dallas Total		434
City of Denton Landfill	9,766	
Camelot	9,753	
DFW	36,971	

Denton Total		56,490
Skyline	70,193	
Ellis County Disposal	4,903	
Ellis County Total		75,096
Maloy Landfill	2,053	
Hunt County Total		2053
Turkey Creek Landfill	3,279	
Johnson County Total		3279
Corsicana Landfill	352	
Navarro County Total		352
Weatherford Landfill	2379	
Parker County Total		2379
Arlington Landfill	18104	
Fort Worth Landfill	6691	
Tarrant County Total		24795
Total (wet tons)	**296,160**	**296,160**
Note, the Weatherford Landfill ceased accepting waste in 2021 and sludge sent to this facility is directed to other landfills – predominantly the Turkey Creek Landfill.		

Figure 4-9 illustrates the sludge generation and disposal by county. The generation values are the tons of dry solids that are generated at wastewater treatment facilities located in a specific county. The disposal quantities are the amounts of sludge that are disposed at landfills located in a specific county.

- Together, Denton and Collin Counties represent the largest amount of sludge being disposed at landfills. This is in part because the NTMWD relies on landfill disposal for sludge generated from its facilities, in spite of the fact that it owns a compost facility at its landfill.
- The DFW Recycling and Disposal Facility located in Denton County accepted 16,795 dry tons of sludge in 2021. The DFW RDF facility will reach capacity in a short period of time. Sludge that was historically disposed at this facility, will now have to be landfilled at another site or otherwise managed. This may also provide an opportunity for the City of Denton to expand the quantities of sludge managed at its compost facility (see below). Denton currently operates the only sludge composting facility in the Region.
- Dallas County generates the most sludge because of the location of both the DWU Southside Wastewater Treatment Plant (which accepts sludge from the DWU Central Wastewater Treatment Plant) and the TRA Central Region Wastewater Treatment Plant. However, the McCommas Bluff Landfill only accepts a small quantity of sludge. Sludge generated from these two large wastewater treatment plants is either land applied to cropland (TRA) or disposed of in a monofil (DWU).
- Prior to 2022, the Weatherford Landfill accepted sludge from the Northwest and Southwest subregions. With its closure, sludge is now transported out of the region to either the Turkey Creek Landfill, the Arlington Landfill, the Fort Worth Landfill, and some small amounts to the Iowa Park Landfill near Wichita Falls. (Source: Weatherford Regional Compost Facility Feasibility Study).

- The Fort Worth Landfill reported disposing of 3,040 dry tons of sludge in 2021. The Fort Worth Landfill has approximately 10-12 years of remaining capacity. One of the policy options under consideration is reducing the amount of waste accepted from sources outside the City of Fort Worth.
- Sludge generated in seven of the Region's counties has no disposal site located within the county boundary. Sludge must be hauled long distances for disposal at a landfill located in a surrounding county. Longer haul distances may make alternatives such as composting more economically feasible for smaller communities.
- One of the issues identified in the Weatherford Regional Compost Feasibility Study was that private contractors are responsible for collecting, transporting, and disposing of sludge for several cities. Often these same haulers own and operate landfills. Diverting the material from landfills results in a loss of revenues which is a consideration in their interest in sending sludge to compost facilities.

It should be noted that while a majority of sludge is generated in Dallas and Tarrant Counties, the land application sites are generally located outside these counties.

Composting

The City of Denton's compost facility is the only facility that composts sludge in the NCTCOG Region. This facility primarily composts material from the City of Denton's wastewater treatment operation. In the fiscal year 2022/23, a total of 32,000 wet tons of sludge per year are processed at the facility. The City markets a number of products from both sludge and mulch. These products include:

- Dyno Dirt (bulk compost)
- Dyno Dirt (bagged compost)
- Dyno Soil (compost/soil blend)
- Dyno Lite (compost/soil blend)
- Mulch and colored mulch
- Double Grind Fines
- Mulch Culls for erosion control

The City has indicated that in future years it intends to increase the amount of sludge it will accept at the facility (primarily from surrounding local governments).

While Denton is the only entity now composting sludge, there are projects on the horizon that could increase the amount of sludge composting. These projects include a potential project in Weatherford that would provide access for counties in both the Northwest and Southwest regions. The City of Dallas is also considering developing a compost facility to potentially manage some of the sludge generated from its two wastewater treatment facilities, along with other organic materials.

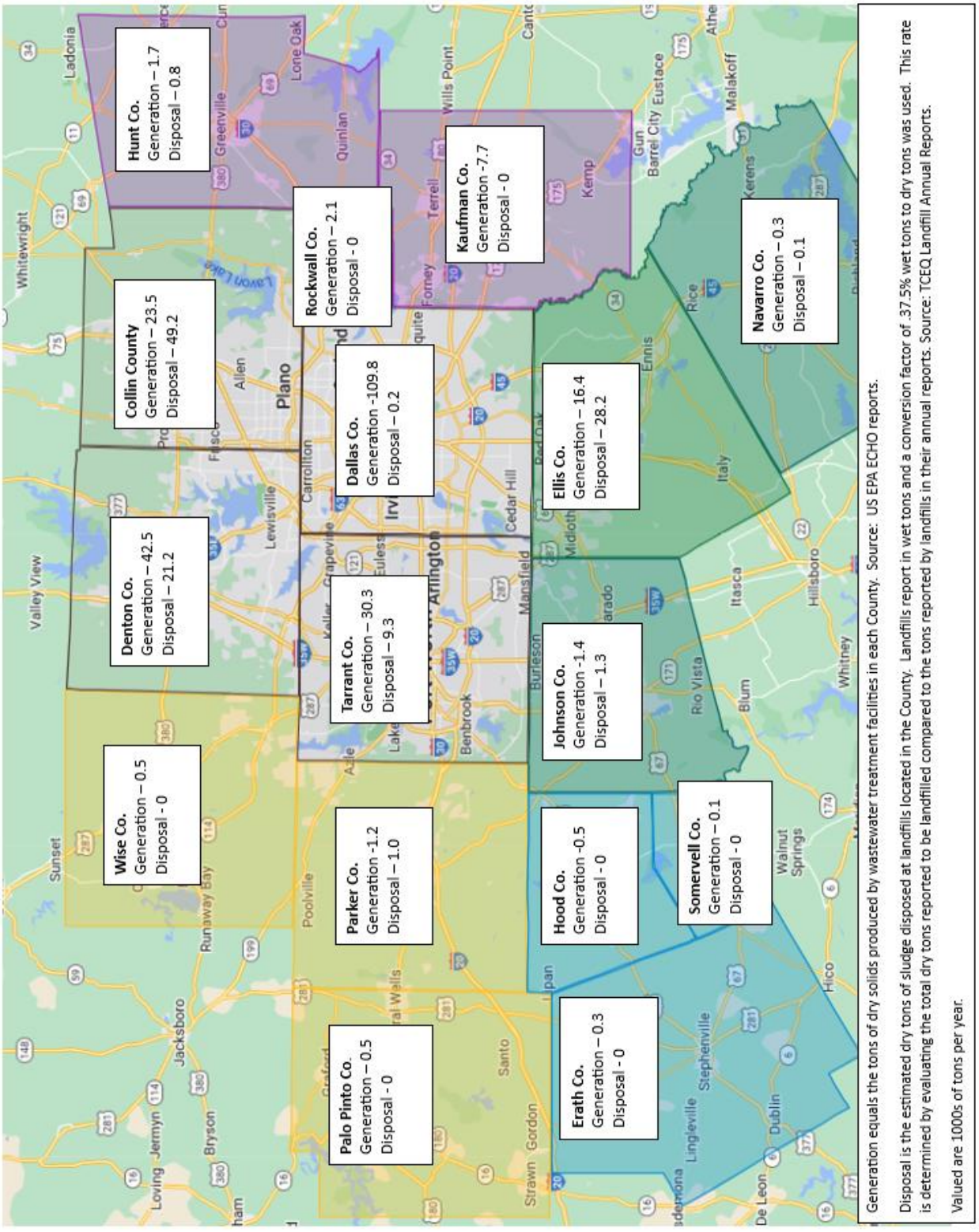


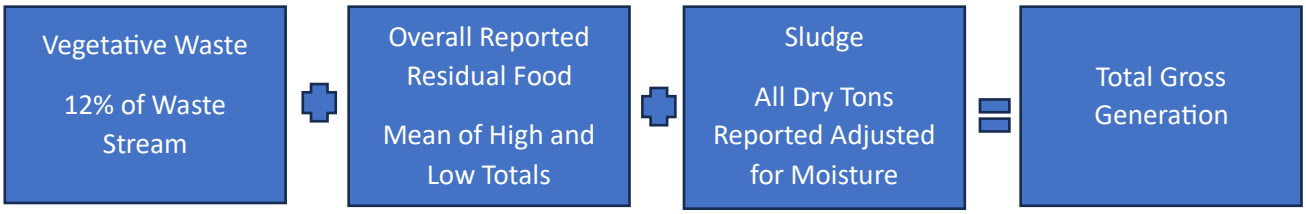
Figure 4-9 Sludge Generation and Disposal By County – Tons Dry Solids/Yr

Resource Summary

Based on the data presented in Section 3.0, there are an estimated 3.3 million tons of wasted organics generated in the Region. This section evaluates specific elements of this wasted organic stream, specifically, vegetative waste, food residuals, and sludge. Table 4-18 summarizes the "gross amount" of wasted organics generated in the Region. The gross amount is calculated as the total amount of these organics that are generated. The net amount is calculated as the total amount of these organics that are landfilled, plus sludge which is not land applied for beneficial use or composted. In other words, this is the amount of wasted organics that are available for diversion from disposal to recovery. The vegetative waste amount assumes that vegetative waste accounts for approximately 12% of the waste stream. Food residuals include those from the commercial and institutional sectors evaluated by the EPA and does not include food residuals from residences. Sludge is the number of wet tons of sludge generated by the Region's wastewater treatment facilities prior to land application or disposal in a monofil.

Figure 4-10 illustrates the information that is used in calculating gross tons for each of the counties and subregions. Figure 4-11 illustrates that the distribution by weight of vegetative waste is 51% of the gross generation, followed by food residuals (30%) and sludge (19%).

Figure 4-10
Gross Generation Equation



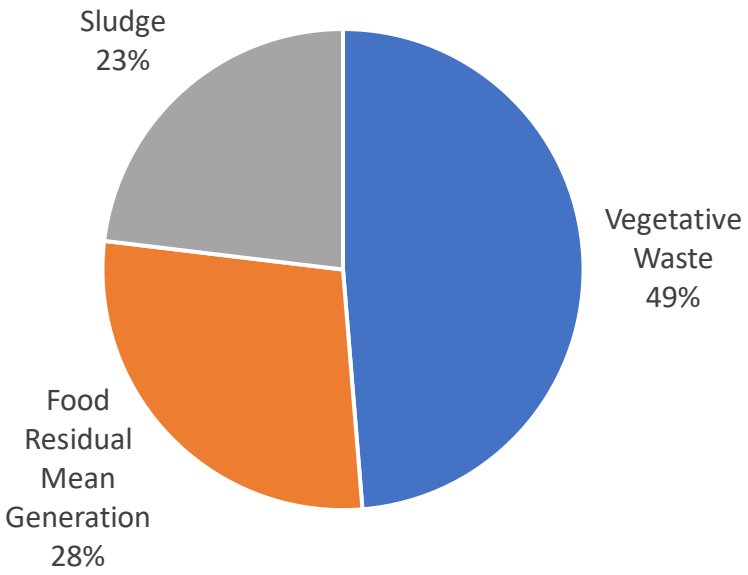
The estimated total amount of gross wet tons is 2.67 million tons. This amount accounts for 80% of the total estimated 3.3 million tons generated (see Section 3.0).

Sources of wasted organics not accounted for include:

- Food residuals generated by residences.
- Other commercial and industrial food or wasted organics are not identified in the US EPA report.
- Sludge generation from small municipal utility districts.

Table 4- 18 Gross Generation Summary					
County	**Vegetative Waste**	**Food Residual Mean Generation**	**Sludge**	**Total**	**% of Total**
Collin	184,320	83,354	63,568	331,241	11.9%
Dallas	533,701	355,124	296,870	1,185,695	42.4%
Denton	134,567	71,003	114,862	320,432	11.5%
Ellis	28,005	13,244	44,343	85,592	3.1%
Erath	6,736	4,865	808	12,409	0.4%
Hood	8,693	5,146	1,105	14,944	0.5%
Hunt	14,150	7,874	4,703	26,727	1.0%
Johnson	25,693	12,379	3,735	41,807	1.5%
Kaufman	19,542	7,555	20,822	47,919	1.7%
Navarro	7,579	3,772	781	12,132	0.4%
Palo Pinto	3,965	1,918	1,546	7,429	0.3%
Parker	20,860	7,195	3,203	31,257	1.1%
Rockwall	17,014	7,960	5,835	30,809	1.1%
Somervell	1,495	586	130	2,210	0.1%
Tarrant	344,948	202,042	82,014	629,003	22.5%
Wise	10,020	3,881	1,127	15,028	0.5%
Total	**1,361,288**	**787,878**	**645,454**	**2,794,620**	**100.0%**
Northwest	34,845	12,992	5,878	53,716	1.9%
Southwest	16,925	10,595	2,043	29,564	1.1%
Northeast	50,706	23,388	31,362	105,457	3.8%
Southeast	61,276	29,394	48,859	139,529	5.0%

Figure 4-11
Distribution of Gross Tons of Organics



A review of industry practices and current recovery programs for each of the wasted organics was evaluated in this section. "Net Wasted Organics" are presented in Table 4-19. The Net Wasted Organics totals take into consideration the following adjustments to Gross Wasted Organics. **A total of 1.31 million net tons were calculated. This represents the net amount of organics available for future processing using today's technology.**

The estimated recovery rate of vegetative waste

For the NCTCOG Region, the gross vegetative waste is adjusted for the projected amount currently being recovered through compost or mulch programs. The US EPA CEQ Market Study was used as the source to determine the amount currently being recovered (63%).[10] Using these assumptions, there is an estimated 748,000 tons of vegetative waste currently being recovered in the NCTCOG Region.

1. US EPA data were used to determine food residual quantities. For this Study, an average of low and high estimates was calculated to determine a mean generation value. EPA also estimated the percentage of materials generated in these sectors that is being landfilled. For food processors, only 2% is landfilled compared to 60% for other non-residential generators of food residuals. These percentages were applied to gross generation rates to calculate net tons. The total net generation of food residuals is 104,000 to 705,000 tons.
2. There are an estimated 96,476 dry tons of sludge being land applied. The City of Dallas and some other small communities are disposing of 26,375 dry tons of sludge in monofils. Only the City of Denton is recovering sludge through composting. The net quantities of sludge focus on the material that is being landfilled, surface disposed or monofilled.

[10] Yard Trimmings: Material-Specific Data | US EPA

Figure 4-12 illustrates the equation for net wasted organics.

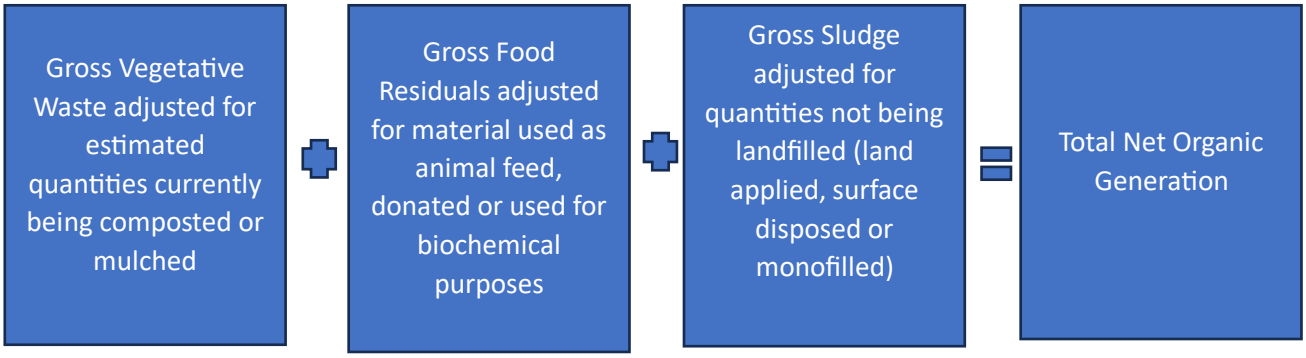


Figure 4-12 Net Organics Equation

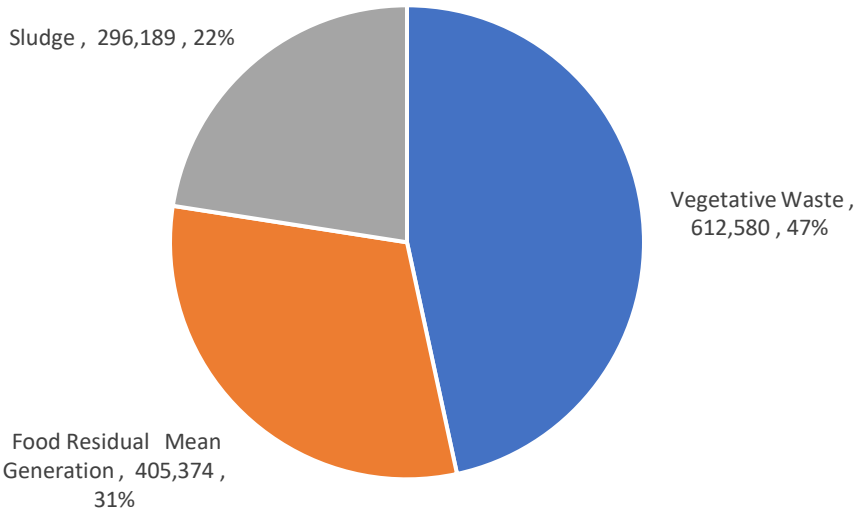
Table 4-19 includes sludge quantities expressed as dry solids.

Table 4-19
Net Tons of Wasted Organics by County of Origin

County	Vegetative Waste	Food Residual	Sludge	Total	% of Total
Collin	82,944	46,345	62,720	192,009	15%
Dallas	240,165	174,303	39,624	454,092	35%
Denton	60,555	38,190	102,240	200,985	15%
Ellis	12,602	7,700	43,752	64,054	5%
Erath	3,031	2,412	797	6,240	0%
Hood	3,912	3,070	1,091	8,072	1%
Hunt	6,368	4,616	1,693	12,676	1%
Johnson	11,562	7,171	3,685	22,418	2%
Kaufman	8,794	4,361	20,544	33,698	3%
Navarro	3,411	2,263	771	6,444	0%
Palo Pinto	1,784	1,149	1,525	4,459	0%
Parker	9,387	4,228	3,160	16,775	1%
Rockwall	7,656	4,412	5,757	17,826	1%
Somervell	673	349	128	1,149	0%
Tarrant	155,227	102,515	7,587	265,328	20%
Wise	4,509	2,294	1,112	7,915	1%
Total	**612,580**	**405,374**	**296,189**	**1,314,142**	**100%**
	-	-	-	-	0%
Northwest	15,680	7,671	5,800	29,151	2%
Southwest	7,616	5,830	2,016	15,462	1%
Northeast	22,818	13,388	30,944	67,150	5%
Southeast	27,574	17,134	48,208	92,916	7%

Does not include the City of Dallas 156,667 wet tons of sludge which is not landfilled, but also is not recovered for beneficial use.

Figure 4-13
Distribution of Net Tons of Organics



Balancing the feedstocks

To produce compost from sludge or food residuals, a bulking agent such as mulch is needed. A typical balance of materials is 3 parts **by volume** mulch to 1 part **by volume** sludge or food residuals. According to Figure 4-13, there is an approximate 1 to 1 ratio **by weight** of mulch to food and sludge. Assuming an average of 37% dry solids in sludge, this yields an estimated volumetric ratio of vegetative waste to food residuals plus sludge of 4.9 to one. This indicates that there is enough bulking material in the form of vegetative material, such as yard waste and wood, to be able to compost the net food and sludge on a regional basis. The geographic distribution of these materials is a critical aspect of determining whether feedstocks that are currently disposed of (net) are in general balance. This is because transportation cost is often a determining factor of the feasibility of capturing a given feedstock.

The above analysis does not take into account the amount of mulch that is currently being sold as mulch in today's market, which could be utilized for a bulking agent.

5.0 Facilities

In Section 4.0, it was determined that there is an estimated 2.8 million tons of wasted organics generated in the Region. However, approximately 1.5 million tons of this material is recovered through reuse and recycling.

The net tons calculated after these recovery efforts is 1.3 million tons. This is equivalent to a recycling rate of 54%. The 54% is achieved using food residuals for animal feed, food donations, mulching, land application of sludge, plus composting vegetative waste, food residuals and sludge. The focus of this section is to evaluate the processing capacity for wasted organics in the Region, specifically compost and mulch facilities.

The TCEQ Recycling Market Development Plan reported that an estimated 6.2 million tons of organic material (food, vegetative, and sludge) were recovered in 2019. Table 5-1 provides a breakdown of the materials recovered state-wide.

Table 5-1
Organic Materials Recovered in Texas, 2019

Material	State Tons/Year	% of Total (State)
Biosolids	296,114	5%
Food	81,611	1%
Vegetative Green Waste	5,824,824	94%
Total	6,202,549	100%

Source: TCEQ, Texas Recycling Market Development Plan

According to TCEQ records, there are over 156 organics processing facilities in Texas, not including those operating under landfill permits or wastewater facility permits. These include facilities that produce both mulch and compost. These facilities are authorized based on a tiered system based on feedstocks. To illustrate the industry's growth in recent years, in 2019, there were 109 organic processing facilities. Additional mulch operations are likely to operate without authorizations. Some of the factors that influence the need for organic processing facilities include the following:

- Local government programs that encourage composting (for example the City of Austin's mandatory food residual recycling program).
- Climate and its impact on vegetative growth. Areas along the Texas coast generate significantly more vegetative material than the NCTCOG Region.
- High concentration of food processing, restaurants, and food distribution try wastes in an area.
- Lack of nearby disposal and recovery alternatives, such as landfills or land application sites
- Markets demand for materials produced.

Background

According to TCEQ records, in 2023 there are over 156 facilities that operate under TCEQ Permits, Registrations or Notices of Intent. To illustrate the industry's growth in recent years, in 2019, there were 109 such facilities.

Organic wastes and residuals can be processed or recovered through many different techniques. These include mulching, composting, anaerobic digestion, pyrolysis, incineration, and energy recovery, among others. In the Region, organic waste is recovered at several mulching and composting facilities – large and small. These facilities produce end products – mulch, compost, and blends – which are valued for their ability to increase the water-holding capacity of soils, reduce the use of synthetic agricultural and horticultural chemicals, improve water quality, improve plant growth and hardiness, and decrease soil erosion.

Compost is defined by the US Compost Council as follows:

> *Compost – is the product manufactured through the controlled aerobic, biological decomposition of biodegradable materials. The product has undergone mesophilic and thermophilic temperatures, which significantly reduces the viability of pathogens and weed seeds and stabilizes the carbon such that it is beneficial to plant growth. Compost is typically used as a soil amendment but may also contribute plant nutrients. (Source: USCC 2018)*

The following are the four tiers under which TCEQ authorizes processors of organic residuals. Each tier is defined by the listed feedstocks accepted.

<u>Exempt (NOI for Recycling)</u>

- Clean wood material
- Vegetative material (This could be from food.)
- Paper
- Manure and paunch manure
- Yard trimmings

<u>Notification (NOI for Composting)</u>

- Everything in Exempt
- Source separated meat, fish, dead animal carcasses, oils, grease, dairy materials (This would include pre- and post-consumer food that is not necessarily all vegetative.)

Registration

- Everything in Notification
- Municipal wastewater sewage sludge/biosolids
- Positively sorted organic material from municipal solid waste stream (such as from a material recovery facility/recycling facility)
- Source separated organic materials from the MSW stream
- Disposable diapers
- Paper mill sludge

Permit

- Everything in Registration
- Mixed municipal solid waste
- Grease trap waste defined as "material collected in and from an interceptor in the sanitary sewer service line of a commercial, institutional or industrial food service establishment, including the solids resulting from dewatering processes."

All composting facilities, regardless of tier, must prevent nuisance conditions such as odor, noise, and dust. Each successive tier requires more detailed information to be submitted to TCEQ and more rigorous operational and design controls than the previous tier. Only facilities at the Permit tier may be required to hold public hearings prior to authorization. All facilities must be designed and operated to protect groundwater and surface water and comply with all other, applicable State and Federal environmental regulations.

Regional Facilities

To identify existing Regional compost and mulch processing capacity, the project team evaluated a number of sources. Specifically, the project team conducted the following activities:

- Contacted TCEQ and reviewed available public information regarding authorization submittals.
- Evaluated TCEQ municipal solid waste facility databases.
- Contacted industry groups and specific compost facility owners and operators.
- Evaluated EPA databases.
- Reviewed previous NCTCOG reports and plans.
- Reviewed individual landfill annual reports to TCEQ.
- Participated in several meetings with either the OAG or other NCTCOG committees dealing with water quality and the environment.
- Evaluated Google Earth aerial photos of sites identified as having TCEQ authorization to confirm an operational compost or mulch facility.

Most of the mulch and compost facilities are privately owned and operated. The owners of these facilities operate in a competitive marketplace and often view any information disclosures as potentially negatively impacting their competitive position. Therefore, owners were reluctant in many

cases to provide specific data regarding material inputs and outputs. To address concerns by facility owners, only county-wide production data are reported.

Table 5-2 presents a summary of the types of organic facilities located in the Region, based on the regulatory tier of each facility and the types of feedstocks allowed to be processed under that tier. Table 5-3 presents a detailed listing of these facilities. A review of data from sources described earlier identifies a total of 40 facilities, including mulch and compost facilities, as well as landfills that have either mulching or compost operations at their sites. Each of these sites was evaluated using Google Earth to determine if there was an operational site at the location and to determine the number of acres used for operations. Six of the 40 sites did not show any operations per the Google Earth evaluation. Table 5-3 presents numbers of different types of facilities by county. The estimated feedstocks processed are not presented for counties with only one facility, to maintain data confidentiality for privately owned facilities.

A review of Google Earth aerials did show that some of the sites authorized by TCEQ are not operating or some authorizations are duplicates for the same site. Also, not all sites were listed in the database either because they are: a) located on a landfill that is authorized as part of its landfill permit to operate mulch or compost operations; b) is not within the purview of the TCEQ's MSW Section; or c) because they have not submitted their notice to the TCEQ at this time.

To calculate the annual quantities of materials processed, the project team evaluated two variables, described below.

1) The number of acres that appear to be used in the operation of the facility, excluding buildings and other infrastructure.
2) The estimated quantity of material throughput per acre is based on available data from facility operators, TCEQ and other sources. This evaluation yielded an average range of between 1500 to 2500 tons per acre. It is noted that each site's actual throughput capacity will vary depending on the following factors.
    - The method of composting (windrows or static piles)
    - The mix of mulch to compost products sold.
    - Site configuration.
    - Operational efficiencies.

The throughput capacities determined using this method will result in order-of-magnitude values and should be used for planning and policy analysis purposes only.

Table 5-2 lists compost facilities reflected in TCEQ databases. Descriptions are taken from information from processors and authorization tiers reflected in TCEQ records. Descriptions of facilities are reflected as follows. Each facility can operate at the levels listed above the reflected description if desired.

- "Mulch" indicates production of only mulch.
- "Manure Compost" indicates composting only manure.
- "Vegetative Compost" indicates composting vegetative material which might include vegetative food residuals.
- "Food" indicates composting all food, which may include animal byproducts.
- "Sludge" indicates municipal wastewater sludge.

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Table 5-2 Compost Facilities		
Name of Facility	**Description**	**County**
City of Plano Compost Division-Plano Pure Products	Food Composting	Collin
PJS BBQ*	Food Composting	Collin
Living Earth Technology Co.	Vegetative Composting	Collin
Sustainable Soil Solutions	Mulch	Collin
The Organics Recycler Melissa	Vegetative Composting	Collin
Dallas Recycling	Vegetative Composting	Dallas
Living Earth Technology Co.	Vegetative Composting	Dallas
Soil Building Systems	Vegetative Composting	Dallas
GWG Wood Group, Inc.	Mulch	Dallas
City of Mesquite	Vegetative Composting	Dallas
City of Irving Landfill	Mulch	Dallas
City of Grand Prairie Landfill	Mulch	Dallas
The Organics Recycler Dallas	Food Composting	Dallas
The Organics Recycler Hutchins	Food Composting	Dallas
Living Earth	Vegetative Composting	Denton
MD Golden Tree Maintenance	Mulch	Denton
City of Denton Wastewater	Sludge	Denton
Living Earth	Vegetative Composting	Denton
Travis Equipment Company	Vegetative Composting	Ellis
Green Cow Compost	manure comp	Erath
Harrington Organic Produce*	Food Composting	Johnson
Harrington Environmental*	Food Composting	Johnson
DC Organics, Inc.	Mulch	Johnson
TOR Forney	Food Composting	Kaufman
AAA Nursery Sand & Stone, Inc.	Mulch	Kaufman
Dwayne E Woody DBA W W Cattle*	Food Composting	Parker
Living Earth	Vegetative Composting	Parker
Green Ground Compost	Food Composting	Tarrant
D&D Construction Materials Company	Food Composting	Tarrant
Green Ground Compost	Food Composting	Tarrant
Silver Creek Materials	Food Composting	Tarrant
Thelin Recycling	Vegetative Composting	Tarrant
Earth Materials Recycled	Vegetative Composting	Tarrant
Alpine Materials, Inc.	Vegetative Composting	Tarrant
The Organic Recycler of Texas	Vegetative Composting	Tarrant
Living Earth (Lakeside)	Vegetative Composting	Tarrant

Living Earth (Fort Worth)	Vegetative Composting	Tarrant
Living Earth (Arlington)	Vegetative Composting	Tarrant
Wistron Greentech Texas Corporation*	Mulch	Tarrant
One Oak SUS*	Mulch	Tarrant

*Unable to confirm the operation of these sites on Goole Earth.

Table 5-3
Number of Compost and Mulch Facilities in the Region

County	Number of Facilities by Feedstocks					Estimated Feedstocks Processed (1000 tons/year)
	Mulch Only	Vegetative	Food	Sludge or Manure	Total	
Collin County	1	2	1		4	69-115
Dallas County	3	4	2		9	210-350
Denton County	1	2		1	4	46-77
Ellis County		1			1	NA
Erath County				1	1	NA
Hood County					0	
Hunt County					0	
Johnson County	1				1	NA
Kaufman County	1		1		2	54-89
Navarro County					0	
Palo Pinto County					0	
Parker County		1			1	NA
Rockwall County						0
Somervell County						0
Tarrant County		7	4		11	131-218
Wise County						
Total	**7**	**17**	**8**	**2**	**34**	**568-947**
Northwest		1				NA
Southwest				1	1	NA
Northeast	1		1		2	54-89
Southeast	1	1			2	19-33

Data only includes observable sites
NA – data not provided when only one site is identified per County
Total includes NA facilities so totals do not foot

The estimated feedstocks processed are based on a combination of the following techniques:

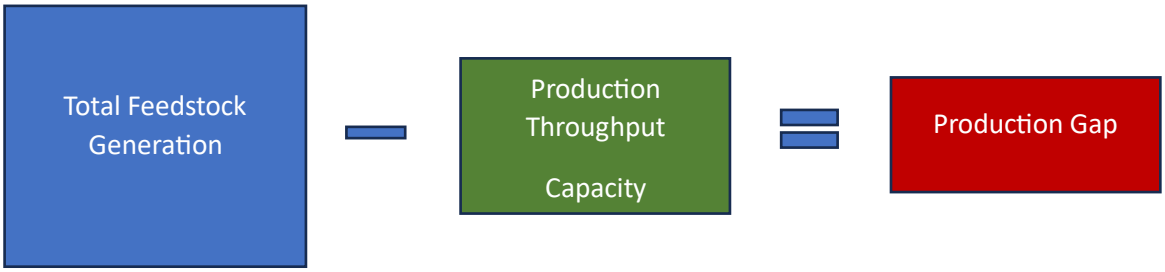
- Communications with the processors
- Hypothetical calculation based on the acreage of processing area identified from aerial photography, combined with average feedstock processed per acre from data provided by select processors.

Industry Analysis

Feedstocks

All the facilities in the region process vegetative waste. Composters may process vegetative food residuals under the TCEQ regulations, but not all have specifically asked for authorization to do so. Thirteen of the sites are authorized to accept food waste that can include meat, dairy, and fats/oils as feedstocks. However, based on input from representatives in the industry, only a relatively small amount of food waste is being processed into compost compared to yard waste, brush, and wood. The City of Denton is the only facility in the Region processing sludge. Denton's facility accepts a total of 32,000 wet tons of sludge per year, which is blended with vegetative waste prior to composting. Denton produces compost under the DynoDirt brand as well as compost blends and various mulch products. Green Cow composting facility in Stephenville processes dairy cattle manure and marketing that material as composted manure. Green Cow also sells various compost, mulch, and soil blends.

It is estimated that in 2022, a total of 568,000 to 947,000 tons of material were processed in the Region. ***One of the key unknowns is how much additional capacity existing sites could process should local market conditions change – specifically if more material were to become available in their market shed or if the demand for materials increased significantly.***



Based on known and estimated data and numbers of facilities, most of this material was processed in Collin, Denton, Dallas, and Tarrant Counties. Counties that were identified with no compost capacity are shown in Table 5-4. Figure 5-1 illustrates the location of the facilities. It should be noted that gaps in processing capacity can exist even with the availability of facilities, depending on the amount of material that is generated and the capacity of the processing facilities, as well as the size of the nearby market for the product. For example, it is estimated that Dallas County processed the most material, but Dallas County is still identified as having a processing gap because there is such a large quantity of wasted organics in this densely populated county, and there is such a large population base supporting market demand.

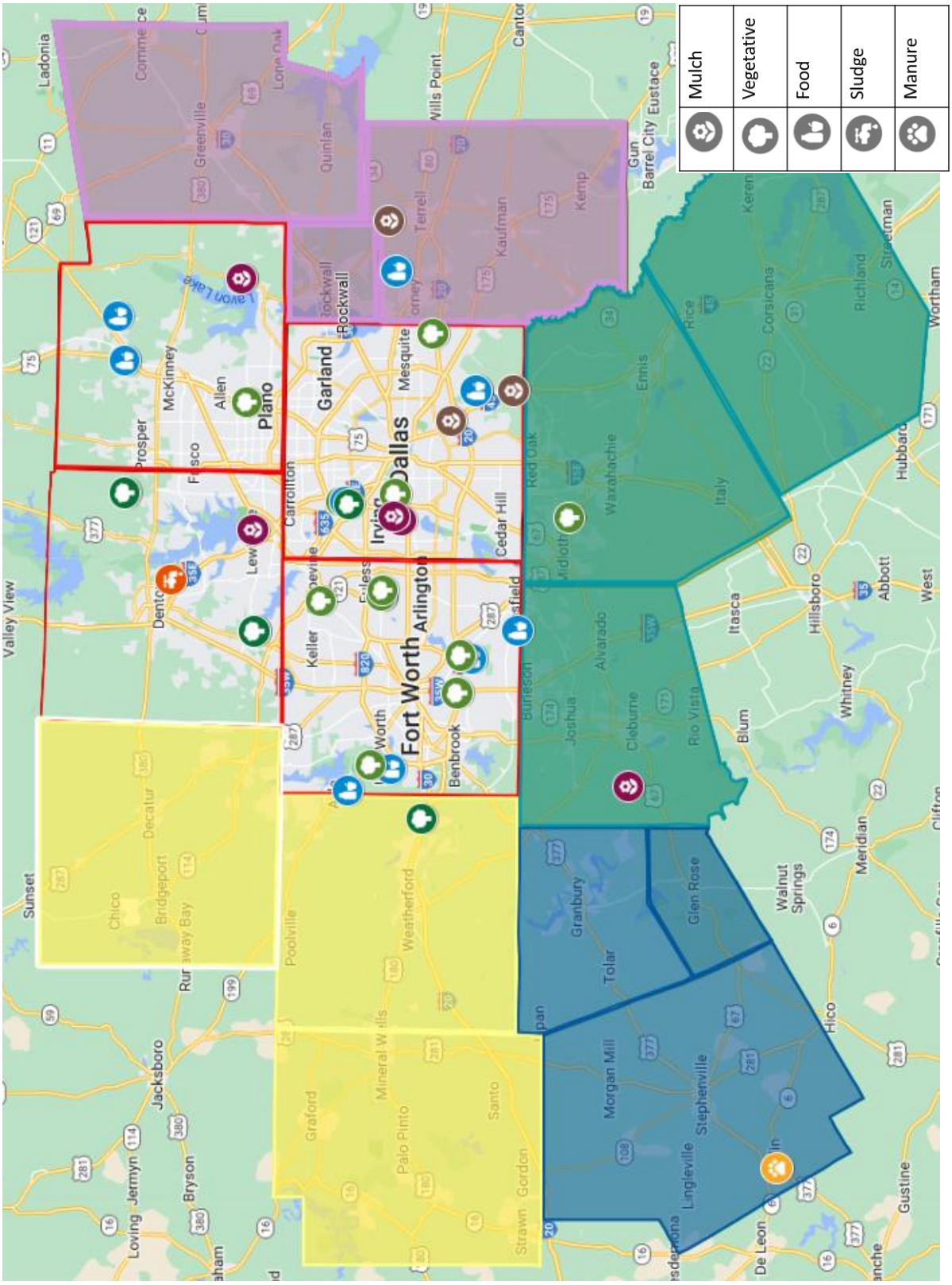


Figure 5-1 Mulch & Compost Sites

The example below is just for vegetative waste in Dallas County and does not include the even wider gaps for food residuals and sludge.

- Dallas County Estimated Generation of Total Vegetative Waste: 533,700 tons/year
- Dallas County Estimated Processing Capacity for Wasted Organics: 210,000 to 350,000 tons/year
- Dallas Vegetative Gap = 153,700 to 323,700 tons per year

Gaps are addressed in more detail in Section 8.

Table 5-4 also includes an order of magnitude calculation of the percent of feedstocks that are being processed by county facilities. Each site was evaluated using Google Earth to determine the estimated acreage for processing and storing feedstocks. This analysis yielded a range of approximately 1,500 to 2,500 tons of feedstock per acre of processing and storage area. Region-wide, the estimated throughput of feedstocks is between 568,000 and 947,000 tons per year. This compares to the overall organic waste generation of 2,8 million tons per year. ***So, the estimated Region-wide feedstocks processed is between 20% and 30% of the total gross organics generated.***

As mentioned, most feedstocks processed in the Region are vegetative waste. In Section 4, it is reflected that the total gross generation of vegetative waste is 1.36 million tons per year. The US EPA estimated that 63% of vegetative waste is being recovered in the United States. If most of the feedstocks processed by mulch/compost facilities in the Region are vegetative waste, the recovery rate is approximately 45% to 75%; the EPA estimate of 63% falls in the middle of this range.

Table 5-4 Number of Facilities by County, Indicating Those with Zero Capacity		
County	**Zero Capacity**	**Number of Facilities**
Collin County		4
Dallas County		9
Denton County		4
Ellis County		1
Erath County		1
Hood County	x	
Hunt County	x	
Johnson County		1
Kaufman County		2
Navarro County	x	
Palo Pinto County	x	
Parker County		1
Rockwall County	x	
Somervell County	x	
Tarrant County		11
Wise County	x	
Total	7	34
Based on observable sites		

Products

While Denton is the only sludge composting facility in the Region, it does produce a range of typical products marketed by processors in the Region. Compost is typically offered as pure compost and in various blends. Mulch is often offered in various forms, as well. While efforts were made to identify outputs from facilities in the region, most producers were reluctant to provide detailed information. However, most producers have stated that their final products include a mix of materials, including compost, mulch, and soil blends.

Table 5-5 City of Denton Outputs	
Material	**Cubic Yards**
Dyno Dirt (bulk)	31,452
Dyno Dirt (bagged)	10,115
Dyno Soil (blended product)	11534
Dyno Lite (blended product)	510
Decorative Colored Mulch	6,452
Double Grind Fine	1,180
Erosion Control (culls)	2,023
Source: City of Denton	

Anaerobic Digestion Facilities

Seven wastewater treatment plants have anaerobic digesters for sludge in Dallas, Denton, Collin and Tarrant Counties.[1] They are listed below. Presumably, these facilities may have excess anaerobic digester capacity that may be available to accept source-separated food residuals for co-digestion with wastewater treatment residuals, resulting in the generation of additional methane for energy recovery. The available capacities of these digesters for co-digestion of source-separated food residuals have not been quantified. Similarly, it is not known whether the operators of these facilities would be receptive to the possibility of accepting any given food residual. Energy recovered from such co-digestion activities could generate renewable energy credits that might augment the economic feasibility of these organics recovery options. The estimated processing capacity in these four counties could be increased by the unused sludge digester capacity that may be available.

Dallas County

- City of Dallas Central Regional
- City of Dallas Southside
- Trinity River Authority Ten Mile Creek

Denton County

- City of Denton Pecan Creek

Collin County

- City of Garland Rowlett Creek Regional

Tarrant County

- City of Fort Worth Village Creek
- Fort Worth Brewery

New Capacity and Facility Site Selection

To develop future capacity for compost/mulch production, private or public facility developers have the option of either expanding current sites or building new facilities. For expansions, issues such as available land and regulatory issues will have to be taken into consideration.

For new facilities, site selection criteria will vary depending on the feedstocks being managed at the site.

For mulch and vegetative-only facilities, the site location restrictions are minimal. There are no stated location restrictions for Notice of Intent facilities. All facilities must address the general requirements of TAC 332 which states the following:

> "The composting, mulching, and land application of material shall be conducted in a sanitary manner that shall prevent the creation of nuisance conditions as defined in 330.3 of this title (relating to definitions) and as prohibited by the Texas Health and Safety Code, Chapters 341

[1] North Central Texas Council of Governments North Central Texas Waste to Fuel Feasibility Study, Burns & McDonnell, 2022.

and 382 (Minimum Standard of Sanitation and Health Protection Measures; and Clean Air Act), the Texas Water Code, Chapter 26 (Water Quality Control), 101.4 of this title (relating to Nuisance), and any other applicable regulations or statutes."

For registration or permitted sites, the provisions of Chapter 332.26 (location standards) are required to be met. This study does not include a specific site selection task.

Per TAC 332.26, compost facilities shall meet all of the following locational criteria.

(1) One-hundred-year floodplain. The facility shall be located outside of the 100-year floodplain unless the applicant can demonstrate that the facility is designed and will operate to prevent washout during a 100-year storm event, or obtains a Conditional Letter of Map Amendment (CLOMA) from the Federal Emergency Management Administration (FEMA) Administrator.

(2) Drainage. The facility shall not significantly alter existing drainage patterns.

(3) Wetlands. The facility shall not be located in wetlands.

(4) Water wells. The facility shall be located at least 500 feet from all public water wells and at least 150 feet from private water wells.

(5) Surface water. The facility shall be located at least 100 feet from creeks, rivers, intermittent streams, lakes, bayous, bays, estuaries, or other surface waters in the state.

(6) Setback distance from facility boundary. The setback distance from the facility boundary to the areas for receiving, processing, or storing feedstock or final product shall be at least 50 feet.

(7) Edwards Aquifer recharge zone. If located over the Recharge Zone of the Edwards Aquifer, a facility is subject to Chapter 213 of this title (relating to Edwards Aquifer). The Edwards Aquifer Recharge Zone is specifically that area delineated on maps in the office of the executive director."

Other site selection criteria should include the following:

Surrounding land uses. Avoid areas located near sensitive land uses including near schools, hospitals, churches, airports, and other similar land uses.

Sufficient acreage. The site should, at a minimum, meet the facility sizing requirements described above. Additional acreage will increase the size of the buffer zone which can help reduce potential nuisances associated with the operation.

Access. The site should have good access to roads that are designed to allow the estimated heavy truck traffic.

Near the generation centroid. Proximity to the generation centroid will reduce overall transportation costs for all feedstock customers, thereby supporting higher tipping fees in a competitive market.

Available infrastructure. Access to water and sewer infrastructure helps provide the necessary water for processing, fire prevention, and sanitation. The facility will require electric service.

Access to markets. Proximity to final markets will reduce haul costs of the finished product to material markets, thereby supporting higher product pricing in a competitive market.

Proximity to the workforce. Locating the site close to population centers will improve access to a labor force.

Transportation Costs

Transportation costs should be taken into consideration along with O&M costs for a proposed facility, as compared to competing disposal and processing options. The Project Team developed transportation cost estimates for three hypothetical scenarios intended to represent typical haul costs for different vehicle types and materials, assuming urban, suburban, and rural driving conditions. The purpose of this exercise is to provide a tool for estimating transportation costs for communities and private entities considering the feasibility of developing new processing capacity at a given location in the Region. As shown in Table 5-6 below, for each hauling scenario, a central address was selected in order to map the miles to and from the respective facility location. The time to drive each trip was also mapped, considering drive time to, and returning from the facility. (Note that turnaround time at the respective facility is not included, as turnaround time can vary widely.)

Table 5-6
Hypothetical Hauling Scenarios

Scenario	Description	Roundtrip Miles	Roundtrip Time (min)	Roundtrip Time (max)	Roundtrip Time (Avg)
Urban	Carrollton to McCommas Bluff Landfill	57.2	70 minutes	114 minutes	92 minutes
Suburban	Frisco to 121 Regional Landfill	50.4	72 minutes	84 minutes	78 minutes
Rural	Glen Rose to Weatherford	84.5	102 minutes	108 minutes	105 minutes

With these three scenarios selected, the Project Team compiled and analyzed hauling cost data from several cities within the Region as well as additional data from some cities outside the Region. Haul cost data analyzed included purchase price of different types of vehicles, average capacity of the different types of vehicles, average miles per gallon per vehicle type, average annual maintenance costs per vehicle type, and average salary and benefits for drivers per vehicle type. The data were gathered and analyzed for vehicles that would likely be used to haul each of the three organic types of feedstocks (vegetative waste, sludge, food residuals) as well as end products (mulch, compost) including front-load vehicles (FEL), rear-load vehicles (REL), roll-offs, grapples, and transfer trailers.

The average cost per hour per vehicle was calculated based on capital, labor, and operations estimates analyzed before accounting for fuel. The cost per hour was multiplied by each scenario's estimated roundtrip time. Then, fuel efficiency (miles per gallon), and the average cost for fuel were taken into account to estimate the fuel cost per roundtrip per scenario to estimate the average total roundtrip cost per vehicle type.

Pounds per cubic yard assumptions were used to estimate load weight, except where TxDMV weight limits would be exceeded. For a 30 cubic yard capacity FEL, 12 tons of capacity is the maximum assumed due to weight restrictions. For Roll Offs, 14 tons of capacity is the maximum assumed due to weight restrictions. For 28 cubic yard capacity grapples, 4.5 tons of capacity is the maximum assumed due to weight restrictions. For transfer trailers, 22.5 tons of capacity is the maximum assumed due to weight restrictions. For yard waste collected in FEL, REL, and Roll Off, a 640 pounds per cubic yard assumption was used based on US EPA density estimates.

As shown in each of the following tables, it is assumed that food residuals would be hauled in FEL, Roll Off or Transfer Trailers. Yard waste would be hauled in FEL, REL, Roll Off, Grapple, or Transfer Trailers. Sludge would be hauled in Roll Offs. Mulch and compost (end products) would be hauled in Transfer Trailers. (Note that average total roundtrip costs have been rounded to the nearest ten dollars and cost per ton mile calculations have been rounded to the nearest dollar.)

Table 5-7
Urban (Carrollton to Mc Commas Bluff Landfill) Estimated Cost per Ton-Mile

Truck Type	Avg CY	Average Total Roundtrip Cost	Capacity (Tons)					Cost per Ton Mile (Avg)				
			Food	Yard Waste	Bio-solids	Mulch (out)	Compost (out)	Food	Yard Waste	Biosolids	Mulch (out)	Compost (out)
Front-load	30	$ 690	12.0	9.6	-	-	-	$ 57	$ 71			
Rear-load	24	$ 810	-	7.7	-	-	-		$ 106			
Roll Off	30	$ 590	14.0	9.6	14.0	-	-	$ 42	$ 61	$ 42		
Grapple	28	$ 750	-	4.5	-	-	-		$ 166			
Transfer Trailer	NA	$1,370	22.5	22.5	-	22.5	22.5	$ 61	$ 61		$ 61	$ 61

Table 5-8
Suburban (Frisco to 121 Regional Landfill) Estimated Cost per Ton-Mile

Truck Type	Avg CY	Average Total Roundtrip Cost	Capacity (Tons)					Cost per Ton Mile (Avg)				
			Food	Yard Waste	Biosolids	Mulch (out)	Compost (out)	Food	Yard Waste	Biosolids	Mulch (out)	Compost (out)
Front-load	30	$ 600	12.0	9.6	-	-	-	$ 50	$ 63			
Rear-load	24	$ 710	-	7.7	-	-	-		$ 93			
Roll Off	30	$ 520	14.0	9.6	14.0	-	-	$ 37	$ 54	$ 37		
Grapple	28	$ 660	-	4.5	-	-	-		$ 146			
Transfer Trailer	NA	$ 1,200	22.5	22.5	-	22.5	22.5	$ 54	$ 54		$ 54	$ 54

Table 5-9
Rural (Glen Rose to Weatherford) Estimated Cost per Ton-Mile

Truck Type	Avg CY	Average Total Roundtrip Cost	Capacity (Tons)					Cost per Ton Mile (Avg)				
			Food	Yard Waste	Biosolids	Mulch (out)	Compost (out)	Food	Yard Waste	Biosolids	Mulch (out)	Compost (out)
Front-load	30	$ 970	12.0	9.6	-	-	-	$ 81	$ 101			
Rear-load	24	$ 1,160	-	7.7	-	-	-		$ 150			
Roll Off	30	$ 840	14.0	9.6	14.0	-	-	$ 60	$ 88	$ 60		
Grapple	28	$ 1,080	-	4.5	-	-	-		$ 239			
Transfer Trailer	NA	$ 2,000	22.5	22.5	-	22.5	22.5	$ 89	$ 89		$ 89	$ 89

Observations

The estimated amount of material currently being processed as either compost or mulch is estimated to be 568,000 to 947,000 tons per year. For reference, this is approximately 7% to 10% of the amount of waste that is currently being landfilled in the Region.

There are several counties in the Region with no processing capacity.

Only 8 of the 40 facilities in the region are authorized under a tier that may allow the processing of food wastes other than vegetative food waste.

Only one facility is currently managing sludge – the City of Denton Compost Facility. The management of sludge will become an increasingly more challenging issue for the managers of wastewater treatment facilities. Below is a list of some of the issues confronting wastewater planners:

- What impact will US EPA's decisions regarding PFAS have on the management of sludge, including the potential impact on sludge composting facilities?
- How will decreasing landfill capacity and higher disposal fees impact decisions regarding landfill disposal of sludge?
- With increasing land development in the Region, it will become more difficult to identify parcels of land for land application or surface disposal of sludge.
- How will thermal hydrolysis processing (THP) of sludge at wastewater treatment facilities, or other methods of producing biosolids for unrestricted use impact the management of sludge in the future? It is already anticipated that TRA's Central Wastewater Treatment Facility will be implementing THP in the future. Such products can compete directly with compost.

The Cities of Dallas and Weatherford are in the early stages of considering opening new composting facilities. How will continued growth in compost production impact the future market for compost materials? Section 6 addresses market conditions and indicates that the large and growing population of the Region will support substantially more products than the quantities that are now produced.

6.0 Marketing Analysis

As part of NCTCOG's Organic Waste Gap Analysis, the Project Team sought to determine whether markets currently exist or can be developed for compost products manufactured by an expanded composting infrastructure. To do so, the Project Team completed preliminary market research in counties that encompass the NCTCOG.

The overall goal of these efforts is to better understand whether markets exist or can be developed for yard waste/brush, food residuals, and biosolids composts manufactured with an expanded composting infrastructure. The preliminary market research efforts were also used to provide:

- Insightful market research findings,
- Professional market demographics,
- An outline of market challenges, and a
- List of market development suggestions.

The Market Area

To better understand the overall market potential of the NCTCOG region, related demographic information was gathered and evaluated. It is well understood that the population, professional horticultural (business) demographic and agricultural statistics of a region impact the market potential for compost and related organic recycled products usage.

The NCTCOG is located in the Dallas/Fort Worth Metroplex and includes 16 counties, numerous cities, school districts, and special districts. Based in Arlington, the NCTCOG includes the counties of Collin, Dallas, Denton, Ellis, Erath, Hood, Hunt, Johnson, Kaufman, Navarro, Palo Pinto, Parker, Rockwall, Somervell, Tarrant, and Wise. As illustrated in Table 6-1, the NCTCOG region possesses a huge population that ranks as the most populous metropolitan area in both Texas and the Southern United States.

Table 6-1 Population Demographics			
Cities	**Counties**	**City 2020 Population**	**County 2020 Population**
Plano	Collin	285,494	1,064,465
Irving	Dallas	239,798	2,613,539
Dallas	Dallas	1,304,379	2,613,539
Garland	Dallas	226,879	2,613,539
Denton	Denton	139,869	906,422
Waxahachie	Ellis	41,140	192,455
Stephenville	Erath	20,897	42,545
Granbury	Hood	10,958	61,598
Greenville	Hunt	28,164	99,956
Cleburne	Johnson	31,352	179,927
Terrell	Kaufman	17,465	154,310
Corsicana	Navarro	25,109	52,624
Mineral Wells	Palo Pinto	14,820	28,409
Weatherford	Parker	30,854	148,222
Rockwall	Rockwall	47,251	107,819
Glen Rose	Somervell	2,699	9,205
Fort Worth	Tarrant	918,915	2,110,640
Arlington	Tarrant	394,266	2,110,640
Decatur	Wise	6,538	68,632
Totals		**3,786,847**	**7,840,768**

Sources:
*Population demographics from 2020 Census

Although the region is greatly urbanized, possessing a huge horticultural (lawn and garden) industry, it also possesses a significant agriculture base. Generally, as you move farther away from significant population bases in a region, the closer you move towards agricultural acreage. Table 6-2 illustrates that a significant number of horticultural businesses exist within the NCTCOG. This represents a substantial potential demand for compost and related products (mulch and blended soils). As in most geographical areas, a larger number of landscapers, garden centers, bulk landscape material suppliers and golf courses exist closer to larger population bases. It should also be noted that only a moderate amount of plant nurseries exist in the region and many of the companies designated as garden centers are actually mass merchandisers, which do not carry bulk landscape products.

The goal of many composting facilities is to market their compost within a 50-mile radius of their composting facility. However, distribution is often done within a 75-mile and sometimes even 100-mile radius depending on transportation costs and competitive forces. Products which possess a greater bulk density (weight per unit volume), such as many blended soils, are typically marketed closer to where they were produced, as their weight affects transportation (delivery) costs.

Table 6-2
Horticultural Market Demographics

	Landscape Designers	Landscape Contractors	Nurseries	Golf Courses	Landscaping Equipment & Suppliers	BULK MATERIALS		Garden Centers	Totals
Counties						**Topsoil**	**Mulches**		
Collin	34	205	8	43	8	0	4	27	329
Dallas	99	370	15	87	12	6	6	67	662
Denton	30	163	6	37	4	1	3	21	265
Ellis	4	29	2	6	1	0	0	5	47
Erath	3	12	2	2	2	0	0	2	23
Hood	3	19	1	10	1	1	0	1	36
Hunt	1	7	1	7	1	2	0	3	22
Johnson	5	27	1	5	2	4	0	4	48
Kaufman	2	10	1	2	1	0	0	4	20
Navarro	1	5	0	2	0	0	0	2	10
Palo Pinto	0	3	0	2	0	0	0	1	6
Parker	5	30	1	11	2	6	2	4	61
Rockwall	4	22	1	6	1	1	0	2	37
Somervell	1	2	0	1	1	0	0	0	5
Tarrant	58	338	11	68	30	20	9	53	587
Wise	5	14	0	5	0	0	0	2	26
TOTALS	**255**	**1,256**	**50**	**294**	**66**	**41**	**24**	**198**	**2,184**

Source: Infogroup, PowerFinder USA ONE v22 20VD

Table 6-3 illustrates that a substantially smaller number of companies exist which could use compost in agricultural or land reclamation (e.g., quarries, etc.) type applications. It should be stated that the agriculturally based 'business count' data in Table 3 is likely understated (a greater number of farmers and related companies exist), although little compost is used in commercial farming in Texas. Further, little, if any, compost is being used in Texas for land reclamation. The major environmental-type applications for compost in the NCTCOG region are its use in erosion control (primarily on TxDOT projects) and as a component in bioretention (and other stormwater management) media.

Table 6-3 Agricultural & Other Market Demographics								
	Farms	Farms - Crops	Farming Services	Sod	Sand & Gravel (MFR)	Quarries	Stone-crushed	Subtotal Volume
County								
Collin	39	0	1	7	1	0	2	**50**
Dallas	44	3	5	10	2	3	6	**73**
Denton	32	2	2	6	1	1	1	**45**
Ellis	12	1	1	2	2	0	1	**19**
Erath	7	1	0	2	0	0	0	**10**
Hood	3	0	1	1	0	0	0	**5**
Hunt	11	0	0	1	2	0	0	**14**
Johnson	11	1	0	0	1	0	2	**15**
Kaufman	4	0	0	1	2	0	2	**9**
Navarro	7	0	0	0	1	1	0	**9**
Palo Pinto	3	0	0	0	0	0	1	**4**
Parker	12	0	0	0	0	1	2	**15**
Rockwall	3	0	0	0	2	0	0	**5**
Somervell	0	0	0	0	0	0	1	**1**
Tarrant	44	0	2	9	4	2	9	**70**
Wise	8	0	0	1	1	2	3	**15**
TOTALS	**240**	**8**	**12**	**40**	**19**	**10**	**30**	**359**

Source: Inforgroup, Powerfinder USA One vs22 20VD

Although the NCTCOG region possesses over 4.6 million acres of agricultural land, much of this acreage is not cultivated (only 1.2 of the 4.6 million acres). Further, Table 6-4 illustrates that the largest crops (by acreage) cultivated in the region are grains and forage crops. Farmers growing these crops don't typically use compost because they can't afford to, since the crops are of lower value. There are a small amount of vegetable and nursery crops cultivated in the region, however composts are not typically being used in their cultivation. The general exception is the use of compost on organic farms and as a component in some nursery growing media.

Note that throughout Texas, changes in climate are causing more periods of drought and more intense rainstorms, leading to more watering restrictions and the installation of additional stormwater management infrastructure. These requirements actual increase the usage of both compost and mulch. A Program of the NCTCOG Regional Stormwater Management Coordinating Council, the Texas SmartScape™ program, is helping to promote education on pollution prevention through efficient and effective water use (www.txsmartscape.com). Further, the NCTCOG has been "pursuing funding from multiple partners and agencies to carry out Integrated Long-Range Planning of Regional Transportation and Stormwater Management in the western-most portion of the 16-county region that is also within the watersheds of the various Trinity River branches. The project area includes Wise County and portions of Dallas, Denton, Ellis, Hood, Johnson, Parker, and Tarrant counties". *(Source: NCTCOG website)* Allowing, promoting or requiring compost-based systems within the NCTCOG could help to address the issue of drought and flood (excessive stormwater volumes) while expanding the market for compost. California enacted the Municipal Water Efficient Landscape Ordinance to address the need to reduce landscape irrigation volumes and western Washington State enacted the Soils for Salmon Program to assist in stormwater management, both compost (and mulch-based) initiatives.

Table 6-4
Census of Agriculture Crop Acreage*

Counties	Total Land in Farms	Forage (hay / haylage)	Wheat (for grain)	Pecans, all	Sorghum (for grain)	Vegetables	Nursery stock crops	Soybeans for beans	Corn for grain	Cotton, all	Select Crop Totals
Collins	280,790	43,444	20,470	NR	7,102	NR	NR	NR	22,840	NR	**93,856**
Dallas	63,949	12,584	1,980	D	NR	NR	NR	1,316	NR	NR	**15,880**
Denton	359,442	52,828	31,277	NR	9,346	NR	NR	3,277	NR	3,310	**100,038**
Ellis	473,413	62,262	21,375	NR	NR	NR	NR	8,514	65,161	24,348	**181,660**
Erath	625,532	70,205	1,401	NR	1,449	NR	NR	NR	3,078	NR	**76,133**
Hood	205,407	23,503	D	D	NR	NR	124	NR	NR	NR	**23,627**
Hunt	482,794	70,340	20,412	NR	NR	NR	NR	13453	8275	5561	**118,041**
Johnson	411,151	56,063	15,826	NR	NR	NR	NR	4,056	21,843	3,634	**101,422**
Kaufman	455,021	61,220	10,143	NR	NR	NR	NR	14,324	10,058	NR	**95,745**
Navarro	558,947	60,256	6,562	NR	5813	NR	NR	NR	26,127	26,852	**125,610**
Palo Pinto	572,847	20,940	1,840	D	NR	NR	NR	NR	NR	NR	**22,780**
Parker	521,702	52769	219	1,086	NR	NR	NR	NR	NR	NR	**54,074**
Rockwall	40,384	5210	5,516	NR	5044	NR	NR	NR	4620	D	**20,390**
Somervell	82,967	10483	NR	387	NR	3	NR	NR	NR	NR	**10,873**
Tarrant	190,682	13,584	3,304	NR	D	NR	D	D	NR	NR	**16,888**
Wise	513,946	60,607	4,317	D	904	459	NR	NR	NR	NR	**66,287**
Totals	**4,661,380**	**676,298**	**144,642**	**1,473**	**29,658**	**462**	**124**	**44,940**	**162,002**	**63,705**	**1,123,304**

Source: Census of Agriculture 2017
*Other crops mentioned: Christmas trees (Palo Pinto), Oats (Jack), Rye (Palo Pinto), Sod (Hood), Corn/silage (Collins 999A), Sorghum/silage (Erath 1502 A), Sod (Dallas 1075 A)
NR-not reported; D-withheld

The Dallas/Fort Worth region possesses a humid subtropical climate with hot summers. It is also characterized by a wide annual monthly temperature range (monthly average highs 54 to 97°F, monthly average lows 33 to 74°F). Annual precipitation also varies considerably in the region, ranging from less than 20 inches to more than 50 inches. In most years, snow fall does not occur. The existing climate allows for landscaping almost year-round; however, landscaping activity slows in the summer heat and winter cold. The region possesses a variety of soils, some being sandy and some clay, while others are pure caliche. Caliche is calcium carbonate that binds with gravel, sand, clay and silt to form a particularly difficult soil in which to garden and landscape. There are very few soils in the region that are considered fertile; therefore, amending the soil is typically considered to be a necessity for gardening and landscaping. Considering the poor existing soil conditions, as well as the harsh climactic conditions, the use of compost and mulch is very typical in landscaping applications, as improved "soil health" is often sought. It should also be noted that the characteristics of the regional soils all make them prone to runoff, which exacerbates regional stormwater management efforts.

Market Research Findings

Excellent experience exists and market penetration has been achieved within the horticultural sector related to compost usage. Within the landscaping industry it has become a staple product, being used in a variety of forms and products. Almost all the individuals interviewed use or have used compost directly and/or resell it in bulk or packaged form. Many professional end users in the lawn and garden industry also use blended soils which contain compost and/or "native", "natural", or "hardwood" mulch which is often derived from recycled (and often, composted) brush. In Texas, more soil and mulch are used in the lawn and garden industry, than unblended (or 'straight') compost. This is why so many composters in the region offer all 3 of these types of products. The predominant type of compost produced and marketed in the region is brush-based compost. However, some large-scale food waste composters do exist (e.g., Silver Creek Materials, the City of Plano, etc.), as does a single biosolids composter (City of Denton). Some cow manure compost is also available in the region, but much of that is in packaged form.

Landscapers – As mentioned earlier, landscapers are very familiar with compost products in the NCTCOG region, while golf courses and nurseries are less so. Landscapers that manage turf are more familiar with compost and compost-based soil mixes than are sports turf managers as they tend to be more conservative [slow to change] buyers. Both cities and state entities (e.g., TxDOT) have proven to be substantial purchasers of compost in the past, but little information was attainable by these potential buyers because they were unresponsive through e-mail and telephone contact efforts. Homeowners are another popular lawn and garden market for compost in the NCTCOG region, as they purchase it both in bulk and in packaged form, directly from composters or through a well-established reseller network. The use of blended soils containing compost is also extremely popular throughout the NCTCOG region, more so than the use of unblended compost, and they are purchased through the same group of composters and resellers. Compost is typically used in landscape bed installation and in some turf establishment (and maintenance) projects, but larger volumes are used as a component in blended soils used in these same applications. It should be noted that most landscapers do not purchase compost in large truckload (40 to 50 CY) volumes, so accessing resellers is key. Landscapers purchasing compost directly from composters can get it at a lower price ($15 to $35 per cubic yard, picked up, with $25 to $30 being typical) than buying it through resellers ($38 to $45 per cubic yard, picked up). However, large truckload sized buyers are typically purchasing compost at the lower price ranges.

Resellers and Soil Blenders – These businesses serve an important function by marketing bulk landscape product on a retail basis, as well as marketing to small- to medium-sized professional end users.

Although many resellers offer differing retail and commercial pricing on bulk products, some do not (and retail and wholesale prices are the same). Compost can be purchased on a retail level from $25 to $60/CY. These companies' market different types of unblended composts or blend them into various landscape-grade and specialty soil products. This market segment uses much greater volumes of compost as an ingredient in blended soils than what they sell unblended as 'compost'. This is typical in most markets around the country, and it offers the product in a more 'ready-to-use' state. Further, resellers also usually market various mulch products, and sometimes sand and stone and other building products. Unlike many other markets, bulk landscape material resellers compete directly with large commercial compost manufacturers. This is because most composters in Texas market their products in less than truckload (40 to 50 CY) quantities, on both a retail and a wholesale basis.

Agriculture – The use of compost in agriculture is not typical in Texas. That stated, in the early 2000's, a Bosque Watershed protection program did promote compost production in Erath County by dairy farmers. Most of these manure composters no longer exist. While some of this compost did get used in agricultural applications, most was used in TxDOT and other landscaping projects. None of the composters interviewed during the project were marketing significant volumes of any compost into agriculture. As mentioned earlier, a substantial amount of crop acreage does exist within the NCTCOG region, but the crops that can afford to use compost are not grown there. Note that only specific farmers can afford to use compost (because of the relative value of their crop) and some would not use certain types of compost (e.g., biosolids) on crops such as fresh fruit and vegetable crops because of pathogen concerns.

Environmental - The use of compost in vegetation establishment, along with erosion control practices has been successfully completed in Texas for many years, primarily on Texas Department of Transportation (TxDOT) and other commercial vegetation projects. Specifications exist for the use of compost in these applications on TXDOT projects. A coarser compost is typically used in erosion control applications, so using a clean brush source as a bulking agent or the primary ingredient of the compost is key to producing this type of product. More compost is also being used in stormwater management, as a component in bioretention media. Bioretention features (e.g., rain gardens, etc.) use media containing sand and compost to capture and filter storm water. Compost is not typically used in Texas in reclaiming land (e.g., mines, quarries).

Existing NCTCOG Composters – Most of the larger composters in the NCTCOG region produce compost, as well as mulch and blended soils. Many of these facilities also participate in the US Composting Council's Seal of Testing Assurance (STA) Program, which allows them to market to TxDOT projects. While many other composting facilities do exist, they are primarily smaller in size. Some composters also promote their product through the STA Program's 'Compost Consumer Use Program' (CCUP). Overall, the quality of regionally manufactured compost is quite good. Again, the primary feedstock being composted is brush (yard trimmings and wood), but some food waste, manure and biosolids are also composted. Typically, biosolids and manure composts possess a greater nutrient content than the brush composts. Composters are selling truckload volumes of compost to professional customers for $15 to $35 per cubic yard, picked up. $25 to $30 per cubic yard is a more typical range. Retail prices are approximately $10 per cubic yard higher. Purchasing in larger truckload volumes can sometimes allow for additional pricing discounts. Composters are generally marketing all the product volumes that they are producing, regardless of the feedstock(s). Historically, compost marketing success has been determined more by overall product quality and marketing efforts, than by feedstock type and stigma. Interestingly, there are many examples of successful biosolids compost marketing programs, both within Texas and outside.

Compost Demand

As mentioned earlier, the horticultural (lawn & garden) sector in the NCTCOG region, on both a retail and commercial level, possesses a well-developed market for compost and derivative products. That is not the case for lower-value markets, such as in agriculture and environmental clean-up. While landscape markets for compost are strong, they can likely be expanded through the use of products in water conservation, erosion control, stormwater management, reclamation, and carbon sequestration. To develop agricultural markets, economic incentives may be required, as will education of that slow-to-change marketplace.

Based on the 1996 Statewide Iowa Compost Demand Study and the national "Battelle Study" on Compost Usage Potential, the estimated per capita use of compost ranges from 0.21 to 0.53 cubic yards per year (excluding agricultural markets). Using an average of the two figures (0.37 cubic yards per person) and the NCTCOG population base of 8.2 million people, that equates to a compost market of 3,034,000 cubic yards per year, without counting any usage in agriculture in the near term. This market estimate is for compost without accounting for material that may be blended with it prior to sale. Further, it does not account for composted yard trimmings or recycled wood that is processed into mulch.

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Expanding Geographical Compost Markets

Most compost manufactured in the NCTCOG region is done so in the more populous counties (Figure 6-1). This is strategic, as more brush is generated in these counties and larger markets exist for the finished products. The current composters operating in the Region are located such that every point in the Region is within approximately 50 miles of an existing compost or mulch facility. This means that compost can be efficiently delivered anywhere in the NCTCOG region. However, generally, the farther a potential end user is removed from Dallas or Fort Worth, the fewer compost choices they have at their disposal. This circumstance likely represses demand. If more composting facilities could be developed in the less populous counties, farther from Dallas and Fort Worth, then counties outside the NCTCOG region and their populations and businesses could be more easily and economically accessed. This, of course, would also increase market demand.

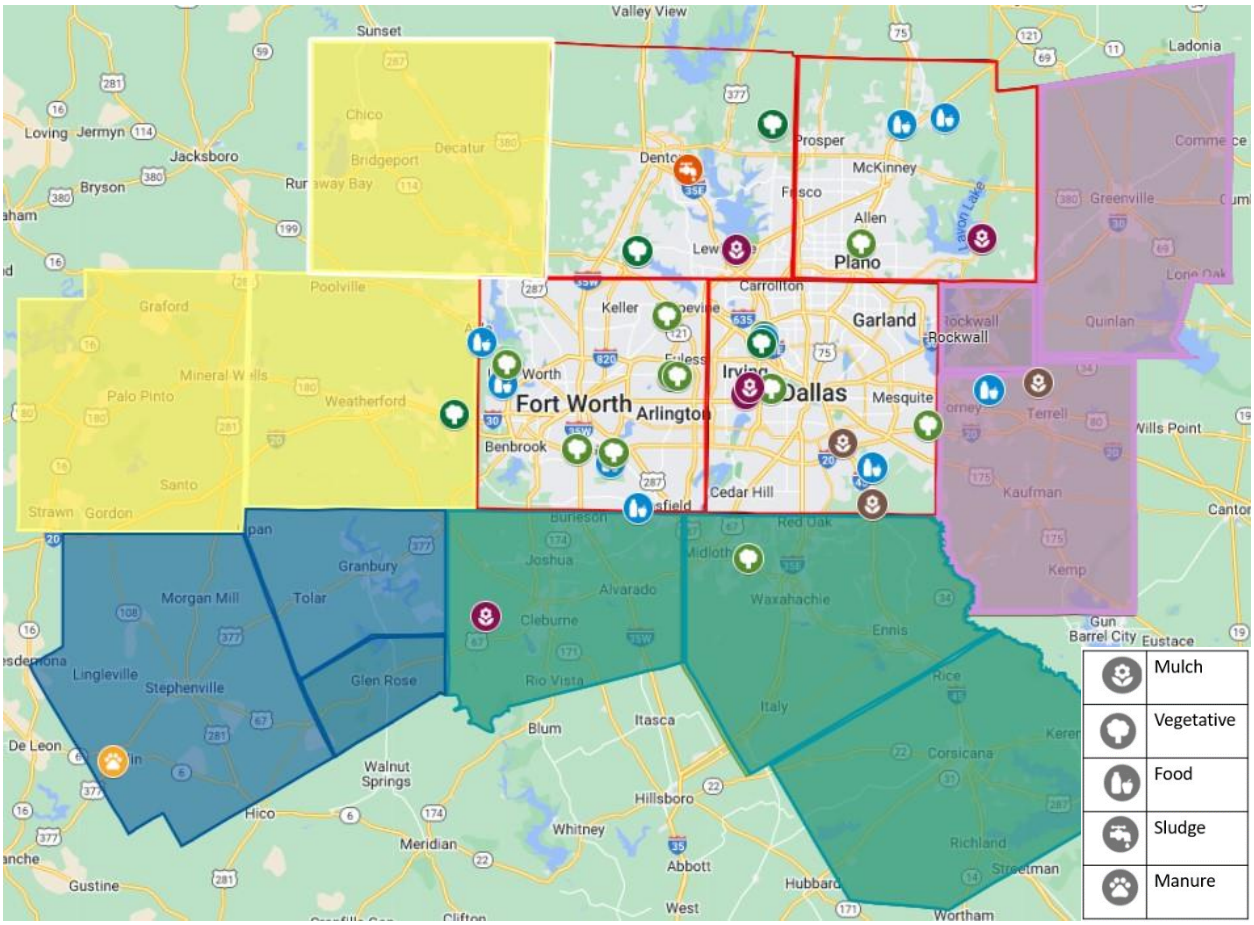


Figure 6-1 Compost and Mulch Facilities

Market Challenges and Suggestions

This section provides a series of market-related challenges and suggestions which can be used for a short-term compost marketing expansion plan.

Market Challenges

- A significant composting infrastructure exists for yard trimmings and wood in the region, but it is limited for biosolids and food waste. The infrastructural costs for managing these feedstocks is greater than brush because of the putrescibility of the feedstocks and concerns regarding contaminant migration (e.g., nutrients, heavy metals, etc.).
- Tracking compost production and sales volumes is difficult, because the lack of regulatory requirements to maintain records or report throughput makes it difficult to obtain numerical data and track market changes.
- Compost product quality could be more easily monitored if more composters participated in the US Composting Council's Seal of Testing Assurance program. This is the national compost testing and certification program.
- Few composters employ 'on the road' salespeople that engage large potential compost purchasers at their place of business; this can limit market expansion and education of the marketplace.

- Placement of compost into public entity project specifications is limited, as is using soil improvement as an inexpensive means to reduce outdoor water usage and better manage erosion and stormwater. Adding soil organic matter (SOM) or higher SOM requirements on project soils may serve the same purpose.
- With limited government oversight of many composting facilities and no soil amendment regulations in the state, greater education of the retail and commercial marketplace is necessary to make sure that potential compost customers understand what they are purchasing.

Marketing Suggestions

- Meet with the Dallas and Fort Worth districts of TxDOT and encourage them to use compost-based methods of erosion control and vegetation establishment in the NCTCOG region.
- Use public service announcements and the Texas SmartScape™ program (and other means) to promote soil improvement to reduce water usage (and rainwater absorption).
- Allowing, promoting or requiring compost-based stormwater management methods within the NCTCOG region could help to address the issue of drought and flood (excessive storm water volumes) while expanding markets for compost.
- Encourage NCTCOG regional composters to participate in US Composting Council programs that promote the production and usage of high-quality compost products. Several composters are already in these programs. The US Composting Council's Seal of Testing Assurance (STA) Program, allows composters to market to TxDOT projects, while the 'Compost Consumer Use Program' (CCUP) create standards for composts used in specific applications.
- Encourage the development of composting (brush processing) facilities at geographically farther distances from Dallas and Fort Worth, the major population bases.
- Encourage more member cities to require increased soil organic matter content in soils used on all publicly funded projects. This will improve plant establishment, reduce irrigation requirements, help minimize erosion and manage stormwater, while creating markets for compost products.
- Encourage farmers to become educated on the benefits of improving 'soil health', as well as USDA conservation practices based around organic matter addition.

Conclusions

Composters in the NCTCOG region are generally successful in marketing their compost, as an unblended soil amendment, in blended (enhanced) landscape soils and the coarser fraction as a mulch. Composters in the region are very active in the bulk landscape material resale network, many marketing to homeowners, and both small and larger professional end users. Large horticultural (lawn/garden) markets exist for compost and related products because of the large regional population and difficult soil and climatic (drought) conditions. Sales of compost into agricultural or environmental applications are not significant at this point in the region, because of economics and relatively limited environmental regulations compared to some other states. The largest markets for compost and related products appear to be with commercial landscapers, resellers of landscape products (e.g., home centers, garden centers, landscape material yards, topsoil dealers) and homeowners, in both bulk and packaged form. Compost is being used by government entities, but this could be significantly expanded by promoting its usage in soil improvement, carbon sequestration, erosion control and stormwater management.

7.0 Technology and Behavior Change

Trends in technology and broad behavior change could affect the generation and management of sludge, food residuals and vegetative wastes in the future. Behavior changes may be voluntary, arising out of economic, social or sustainability motivations. Behavior changes may also be the result of changes in public policy or mandates. This Section addresses some of the more significant emerging technologies in the field of organics management, as well as behavior changes that may be adopted by residents of the region. It also addresses factors affecting markets and funding opportunities.

Technology

Emerging technologies related to the generation and management of wasted organics are primarily associated with food residuals and sludge. Some are more broadly applicable. For example, anaerobic digestion as a large-scale waste management technique could be appropriate for any organic feedstock.

Vegetative Waste

Backyard Composting. Backyard composting for residential yard waste and kitchen food scraps is not new. Machines or mechanical apparatus for this purpose are not necessary; however, if homeowners perceive that they enable composting with less effort than a simple pile or bin, they can increase participation in the practice. Many forms of backyard tumblers and processers are available. No doubt, "new and improved" models are being developed for market. Backyard composters do produce a useable and beneficial compost product. Backyard composting have an insignificant effect on the quantity of wasted organics. However, like countertop machines for residential food residuals, they serve an important role in making people aware of the value of compost and composting. This results in increased support for larger scale composting operations in a community.

Biochar. There are several advanced technologies that process otherwise wasted organics into forms that are available for beneficial use. One such technology is the production of biochar. Biochar can be produced in air-curtain destructors (trench burners) or by other means which subject a range of organic materials to very high temperature in an oxygen-deficient environment. Due to the large quantity of brush and other vegetative material which is currently available in the Region, biochar is most likely to be employed to process wood and other vegetative wastes. Biochar may be added to other compost feedstocks to speed up the process (increased throughput capacity), reduce odors during processing and increase the nutrient content of the product. It can also be added to finished compost to further increase the water-holding capacity and organic content of soils. Because biochar provides a means of sequestering carbon in the soil, it provides an opportunity for generating carbon credits which can improve the economic viability of associated composting operations. Although biochar is not known to be produced in the Region at this time, it is reported to be produced in Grayson County.

Food Residuals

Countertop Appliances. Although this study is not generally focused on residential food residuals, it is significant that machines are reaching the home market that claim to convert kitchen scraps into useable compost, or at least produce a product that is less objectional in the kitchen than a typical countertop bucket for food scraps. The reality of the current technology is that these appliances do not

actually produce products that are appropriate for use in the garden.[1] However, they may "jump start" the composting process. The major benefit of such appliances is that some of them may reduce the "ick" factor in the kitchen prior to backyard composting or collection for commercial composting operations. In this way, they may increase diversion of residential food scraps from landfill disposal. This is a promising technology that may mature in the future to actually produce a finished product that can be used in home landscaping and gardens. Countertop appliances for food residuals are relatively expensive and not yet common; their impact on the generation of wasted organics is currently negligible.

Dehydrators. Dehydrators can be useful for food residuals when transportation costs are high. Non-residential generators of food residuals, which are typically very heavy due to high water content, may benefit from the use of dehydrators at the point of generation to facilitate on-site storage, reduce transportation costs, or both. Dehydrators are appropriate when food residuals are used for animal feed. Broader application of this technology for other end uses, such as composting, could make longer hauls to composting facilities more feasible. US EPA estimates that about 22% of all waste currently landfilled is food, and about 56% of that landfilled food is non-residential. Because this is such a large quantity, the potential reduction of landfilled food associated with dehydrators for composting may be significant where dehydrators make transportation to compost facilities feasible.

De-packaging. Food processors, wholesalers, distributors, and retailers are significant generators of food residuals. They generate foods and beverages that are off spec, expired, or damaged, or overstock that cannot be donated. Much of this material is packaged. Packaging is a significant deterrent to composting because it introduces significant contamination and is very difficult to remove. However, de-packaging equipment can be used at composting facilities intent on processing large quantities of these feedstocks. Although the technology is now well established, the cost of large-scale equipment can be prohibitive.

Co-digestion. Sludge is often anaerobically digested at wastewater treatment plants. Composting, which is based on aerobic digestion, is a disinfection process, whereas anaerobic digestion in sludge digesters is not. However, if existing anaerobic digesters at wastewater treatment plants have excess capacity, uncontaminated food residuals may be added to the sludge in the digester to increase methane generation. This process, termed co-digestion, is typically not appropriate for most residential food residuals because of the high level of contamination typically present. The exception to this restriction would be residential collection of food residuals through a subscription program or a drop-off program. Such programs typically have very low contamination rates. Fort Worth has co-digested food residuals in the past.

Stand-alone Anaerobic Digestion. Another anaerobic digestion technique sometimes used to process food residuals, as well as other organics, is a dedicated waste management facility. These facilities produce biogas for energy recovery. Solid digestate is typically composted, while liquid digestate may be used as fertilizer. Anaerobic digesters of this nature are large scale, costly, and require a source-separated organics stream. Given the relatively low cost of landfilling, the lack of mandatory separate collection of organics, and the lack of bans on landfilling organics, this form of anaerobic digestion is not expected to play a significant role in the Region.

Sludge

Thermal Hydrolysis Process (THP). THP is a method of heating and pelletizing sludge to produce a disinfected, dry material which can be land applied for beneficial use rather than disposed, just as

[1] Biocycle Magazine, "Connections, Household Food Waste Gadgets," Sally Brown, April 25, 2022.

compost can. THP reduces the volume of dry solids to be managed. Both THP biosolids and biosolids compost meet the standard for Class A, Exceptional Quality sludge. THP is an expensive process. To the extent that THP is implemented, the sludge thus treated would no longer require composting. The Trinity River Authority is implementing THP, at significant expense. If more composting facilities accepting sludge were operating in the Region, it may be less advantageous to implement THP as compared to composting. Conversely, as THP grows in the Region, the sludge thus treated will no longer require composting, so the result may be that sludge composting facilities will be less feasible in some locations.

Behavior Change

Behavior change can be voluntary or mandated through laws, regulations or ordinances. Changes in public policy regarding the management of wasted organics or, more broadly, sustainability and climate change mitigation can drive behavior change.

Landscaping

Widespread adoption of xeriscaping practices will accomplish two things. First, xeriscaping focuses on native plants with increased ability to survive in local climates. It may also include no-mow or low-mow grasses and typically de-emphasizes grass lawns in general. This would reduce the generation of vegetative waste on property where xeriscape techniques are practiced. Second, xeriscaping practices typically emphasize sustainable growing methods, often including maintaining high organic matter content in soils in order to increase water retention and reduce irrigation requirements. This consideration of soil health is often closely tied to the use of compost and mulch. Wide adoption of these landscaping methods would likely be slow to become popular without intensive public education of landscapers and the public of the environmental and economic benefits. Demonstrations of the aesthetic qualities of good xeriscape design would be important for success of such a program. The reduction of vegetative waste from landscaping, and the boost to the compost and mulch markets could be significant if xeriscaping were to become common in the Region.

Organics Collection

Cities can voluntarily change yard waste collection practices to enable more composting and other methods of diverting wasted organics to beneficial use. Specifically, enforcing no collection of grass clippings, as the City of Dallas does, is a simple first step. Separate collection of yard waste including brush from collection of bulky trash is important for capturing vegetative waste for composting. Separate collection of grass and leaves while disallowing plastic bags also creates a significant source-separated organics stream for composting. Plastic bags for yard trimmings create contamination that is extremely difficult to remove at composting facilities. Eliminating plastic bags in favor of paper bags or dedicated carts greatly increases the feasibility of composting vegetative waste. Residential food residuals may be added to carts for vegetative waste. It is important to implement an ongoing education campaign coupled with inspection and some form of enforcement to reduce contamination in residential organics collection. The same can be said for collection of food residuals from commercial, industrial and institutional sources – particularly for post-consumer food, which is notoriously contaminated.

As the public becomes more aware of the importance of recovering wasted organics for environmental reasons, they may participate more in subscription collection and drop-off programs. Such programs are typically very successful in collecting uncontaminated food residuals, even from residences. The volumes recovered through these programs are currently very small. If municipalities were to sponsor

more of these programs by providing drop-off facilities, and either providing subscription collection or contracting with private service providers, this form of recovery could become more significant.

At-Home Composting

At home composting, through backyard composting or more high-tech in-home machines, is entirely voluntary. As the public embraces the value of compost and the importance of soil health, these practices may become more mainstream, particularly for single-family homeowners who have yards and gardens. Similarly, homeowners may be encouraged through education not to bag their grass clippings ("grass-cycling"), even without ordinances to do so.

Food Rescue and Food Donation

The US EPA hierarchy of preferred methods for reducing food waste states that the highest priority is to divert food which would otherwise be wasted to feed people, whenever possible. Food rescue programs may continue to grow in popularity, especially given recent legislative actions to mitigate liability for generators of donated food. Food donation programs and food banks typically distribute high-quality food that would otherwise be wasted. Although composting is a valuable beneficial reuse of organics, it is clearly preferable to recover food for human consumption.

Policy and Regulations

Organics Bans at Landfills

Many states have banned various wasted organics from landfill disposal. Although Texas has no such ban in place, Texas does have the Compost Refund Program. This program offers an increased refund of solid waste disposal fees paid by landfills if the landfill operator voluntarily bans the disposal of yard waste. Banning landfill disposal of given organics is a means of accomplishing the objective of diverting huge quantities of organics for beneficial use. It does stimulate the development of all types of processing facilities. However, it is extremely important to ensure that adequate markets exist for the anticipated volumes of product to be produced. Without adequate product markets, disposal bans may result in extremely high tipping fees for processors, and extremely low product revenues.

Per- and Poly-fluoroalkyl Substances (PFAS)

How the US EPA and TCEQ ultimately determine management requirements for PFAS could have a significant impact on wastewater treatment facilities, landfill operations and compost facilities - particularly if these facilities are regulated as generators of hazardous substances in sludge, leachate, and compost. In addition, extremely low limits have been proposed for PFAS in drinking water, which could affect the use of biosolids and compost near drinking water sources. Compost, landfill and wastewater professionals are urging US EPA to exclude them from PFAS liability and regulation, on the basis that these facilities are passive receptors of PFAS, which is considered to be ubiquitous. The uncertainty associated with federal PFAS legislation, and the ultimate impact on local regulation and liability, has certainly had a chilling effect on those considering entering the composting arena. Sludge composting may be particularly affected because PFAS from municipal solid waste leachate and other materials accumulates in sludge. It is hoped that resolution of this uncertainty will be forthcoming.

Green Building Codes and Environmental Policy

Local government may implement green building codes for new development and even existing facilities. These codes or ordinances could mandate minimum soil organic content or incorporation of compost into soil, with the intent to accomplish the following objectives:

- Improved water-holding capacity to reduce flooding
- Improved water-holding capacity to reduce irrigation needs (This may be paired with restrictions on irrigation.)
- Improved establishment of vegetation to reduce stormwater contamination by erosion and sedimentation
- Carbon sequestration

Such policies could strengthen markets for compost, which could support more compost processors. Sludge composters, which are lacking in the Region, might be the most incentivized to enter because compost with diverse feedstocks is considered more valuable than compost from vegetative materials alone. Because of the rapid pace of development in the Region, widespread use of these types of policies could significantly affect Regional market conditions.

Market Development

Other forms of market development include re-establishment of the TxDOT market for compost, and development of the use of compost in the agricultural sector. These markets are addressed in more detail in Section 5 of this report. Any increase in the market for compost, whether through voluntary or mandatory programs, will further incentivize the establishment of compost facilities in the Region, while reducing the risk of oversaturating the market.

Grants

The Cultivating Organic Matter through the Promotion Of Sustainable Techniques Act (COMPOST Act) has been introduced in Congress and would provide grant funding to compost operators that are both small- and large-scale.[2] The grants would be administered by the US EPA and would not exceed $500,000 per award.[3] At the time of this writing, the COMPOST Act was recently re-introduced into the Senate Committee on Agriculture, Nutrition, and Forestry.

The US EPA recently released the initial round of recycling infrastructure and education grant programs. The Solid Waste Infrastructure for Recycling (SWIFR) Grant Program for Political Subdivisions of States and Territories has an estimated total program funding of $40,000,000, with the maximum award per project at $4,000,000 and the minimum awarded amount per project at $500,000. The grant program is expected to award a maximum of 25 entities. The Consumer Recycling Education and Outreach (REO) Grant Program has an estimated total program funding of $30,000,000, with the maximum award per project at $2,000,000 and the minimum award per project at $250,000, and 25 expected awardees. According to the US EPA, the scope of these grants is to recognize and encourage applications that demonstrate innovative solutions and programs that provide or increase access to prevention, reuse, recycling, anaerobic digestion, and composting opportunities in areas that currently do not have access.

Key Findings

- Public awareness of organic material management is increasing, but steps are still needed to increase widespread use and market demand. Technology has increased the options available to residents for in-home composting, but several are cost prohibitive.

[2] https://www.wastedive.com/news/congress-food-waste-compost-donation-booker/641937/
[3] https://juliabrownley.house.gov/wp-content/uploads/2021/07/COMPOST-Act.pdf

- Commercial pre-processing and processing technologies, including de-packaging, dewatering and biochar, may allow for better management of food waste and biosolids as technologies improve.
- The increasing attention paid to PFAS could complicate efforts to include biosolids in compost, as has been seen with recent legislation passed by the state of Maine.
- There are several options for drop-off or pickup of food waste in the region, but access is not universal and often requires a recurring cost.
- Collection programs targeting uncontaminated food residuals and vegetative material is key to significantly increasing diversion of larger quantities of these materials in the future. Increased food residual and sludge composting requires either increased vegetative waste collection, or capturing material from the mulch market for compost bulking agent.
- The use of compost in stormwater management projects is common but not required. Policy decisions could encourage the use of compost to enhance the region's drought management and flood mitigation efforts, while improving markets for compost.
- Other policies that ban materials from landfilling (i.e., yard waste, sludge) could generate demand for processing capacity, though sufficient infrastructure and market development would need to occur before implementing a ban.

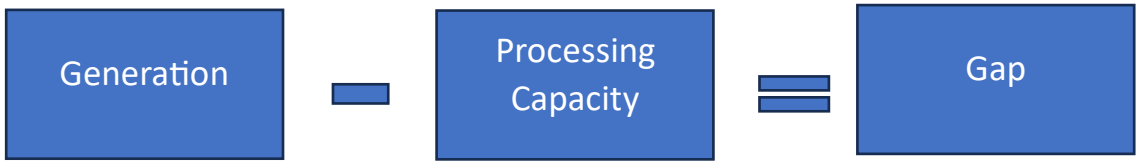
8.0 Gaps in Processing

A review of both generation and processing data indicates that there are several organic waste gaps throughout the Region. Gaps are defined as areas where there currently is insufficient capacity to process the organics generated within a specific geographic area. Once gaps are identified, policymakers and private entities can better evaluate the need for additional capacity.

This Study evaluates three major organic waste streams: vegetative waste, food residuals, and sludge. Section 4 evaluated the amounts of materials generated based on a variety of sources. It was determined that a total of 2.8 million gross tons per year of wasted organics are generated annually in the Region. Of these 2.8 million tons, a significant amount of waste, is already being processed and not disposed in landfills or through surface disposal. The wasted organics that are still being disposed of are referred to as "net" tons. These net tons are the focus of the Study. It is estimated that a total of 1.3 million net tons per year of wasted organics is generated. This includes material that is not recovered at existing processing facilities or used for other beneficial purposes such as composting, land application to improve croplands, or food wastes being recovered for animal feed, donations, or by other means. *If the City of Dallas sludge were considered as "net tons" because it does not provide a beneficial value, the amount of net tons would increase to 1.6 million tons per year.*

An assessment of the Region's current processing capacity for wasted organics is presented in Section 5. Based on a review of several resources, it was determined that there are 40 TCEQ-authorized mulch or compost facilities located in the Region. A review of Google Earth images verified 34 of these facilities as having actual operations underway.

Most of these facilities are owned and operated by private entities. As such, it was difficult to garner accurate data pertaining to site design capacity or annual facility throughput due to the confidential nature of the requested information. Some data was available for facilities that are either required to report to the TCEQ or are owned and operated by public entities. Based on the available information, the Project Team developed a range of throughput estimates for facilities where throughput was not available otherwise. Estimates are based on the size of the facility's operating area and throughput per acre for facilities that reported throughput. Regionally, throughput estimates for the 34 facilities are 568,000 to 947,000 tons per year. ***It should be noted that these are very rough estimates of processing throughput capacity. However, the estimates do provide an order-of-magnitude perspective of capacity.***



Because the facilities identified in this Study each is authorized under a regulatory tier based on the types of feedstocks accepted, the gap analysis evaluates vegetative waste, food residuals and sludge separately. The gap analysis does take into consideration that processors designated as food composters based on their authorization tier could accept vegetative waste in addition to food residuals. Similarly, facilities authorized to accept sludge based on their authorization tier could also accept vegetative waste

and food residuals. Therefore, when calculating the available processing capacity for vegetative waste, the capacity of food residue and sludge facilities are also included. Figure 8-1 illustrates that while there are only 17 authorized compost facilities that are authorized at the regulatory tier designated as accepting vegetative waste, all food, sludge, and manure operations may also accept vegetative wastes. Therefore, there are a total of 24 facilities that may accept vegetative waste. Mulch may be produced at any facility.

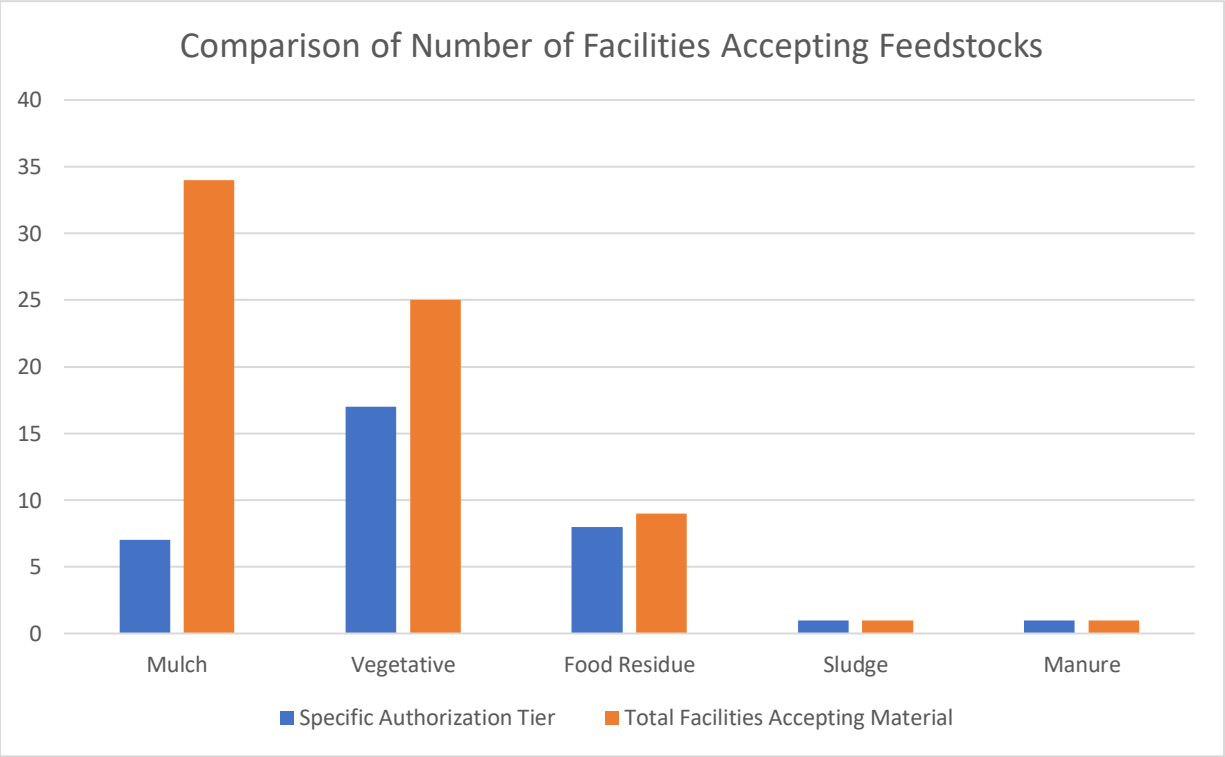


Figure 8-1 Comparison of the Number of Facilities Accepting Feedstocks

This section includes gap analysis tables that compare the estimated net amount of wasted organics generated compared to the estimated throughput processing by county (refer to Table 4-19).

The county throughput quantities are based on estimated amounts of material processed by facilities in the county, based on assumptions regarding facility operating size and estimated rates of processing per acre. Throughput does not necessarily correlate directly to acreage of processing activities. However, these values do provide an order-of-magnitude comparison of generation versus capacity in a given geographic area. Both low and high throughput ranges are used in these tables (refer to Table 5-2).

Processing gap tonnages are determined by subtracting generation from facility throughput capacity estimates. A negative number indicates insufficient processing capacity. Gap percentages indicate the magnitude of the gap for a given county. For example, while Dallas County has the highest projected throughput capacity, it also has the most material generated; therefore, its gap percentage is high compared to other counties with processing facilities.

Geographic Scope

Gap maps are also presented in this section. Based on typical industry conditions, a 30-mile radius of influence is assumed for attracting feedstocks. Gap maps illustrate the proximate access to mulching and compost facilities for various types of feedstocks. Factors that will affect this radius of influence include the following considerations.

- Comparative miles to alternative processing or disposal option
- Competitive fee charges at processing facilities (lower tipping fees compared to either landfills or competitor processing facilities)
- Time of travel
- Other factors including the generator's environmental goals

Vegetative Waste Gaps

There is a gross total of 1.36 million tons per year of vegetative waste generated in the Region. This material is processed at either mulch facilities or compost facilities. Of the 1.36 million gross tons per year, approximately 700,000 tons are recovered, and 612,000 tons of this material are disposed.

Because there are no data identifying the percentage of vegetative waste that is brush versus yard waste and other vegetative materials such as vegetative food residuals, mulch, and vegetative composting facilities are combined for the purpose of determining vegetative capacity. Twenty-four mulch and vegetative facilities, combined, have an estimated processing capacity of approximately 311,000 to 519,000 tons per year. However, all food residuals, sludge, and manure processing sites can also accept mulch and vegetative wastes if they choose to. Therefore, the total processing capacity for vegetative waste is a range of approximately 568,000 to 947,000 tons per year. Assuming a total generation of approximately 612,000 net tons per year, the overall vegetative discrepancy is between approximately 44,000 tons per year as a gap to a surplus capacity of approximately 335,000 tons per year. The gap range is affected by the actual amount of food residual or sludge composted at the 8 food compost, one sludge, and one manure compost facilities.

A review of the gap map for vegetative feedstocks shows that there is only a small percentage of the Region that does not have access to a mulch or compost facility. Areas where there is limited access include Navarro, Wise, and Palo Pinto Counties (Figure 8-2).

County Data

While the Region has good geographic coverage for vegetative waste, a preliminary assessment of generation versus available capacity shows that there is the potential for gaps in processing. Tables 8-1 and 8-2 present county data for vegetative waste, including the total generation and the available processing capacity for this material. Table 8-1 shows the gaps based solely on mulch and vegetative waste processing facilities. As mentioned, all compost facilities in the Region process some amount of vegetative waste. Table 8-2 presents the Regional and Sub-regional gap analysis comparing vegetative waste generation and total compost capacity. Counties with no processing capacity include Hood, Hunt, Navarro, and Palo Pinto.

Table 8-1
Vegetative Waste Gap Analysis – Mulch and Vegetative Facilities Only

County	Net Wasted Vegetative Material	Mulch & Vegetative Waste Only Low Throughput	Mulch & Vegetative Waste Only High Throughput	Gap Tons/Year Low Throughput	Gap Tons/Year High Throughput	% Gap Low Throughput	% Gap High Throughput
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year	%	%
Collin	82,944	20,055	33,425	62,889	49,519	76%	60%
Dallas	240,165	128,745	214,575	111,420	25,590	46%	11%
Denton	60,555	13,845	23,075	46,710	37,480	77%	62%
Ellis	12,602	NA	NA	NA	NA	NA	NA
Erath	3,031	NA	NA	NA	NA	NA	NA
Hood	3,912	-	-	3,912	3,912	100%	100%
Hunt	6,368	-	-	6,368	6,368	100%	100%
Johnson	11,562	NA	NA	NA	NA	NA	NA
Kaufman	8,794	42,000	70,000	(33,206)	(61,206)	-378%	-696%
Navarro	3,411	-	-	3,411	3,411	100%	100%
Palo Pinto	1,784	-	-	1,784	1,784	100%	100%
Parker	9,387	NA	NA	NA	NA	NA	NA
Rockwall	7,656	-	-	7,656	7,656	100%	100%
Somervell	673	-	-	673	673	100%	100%
Tarrant	155,227	81,855	136,425	73,372	18,802	47%	12%
Wise	4,509	-	-	4,509	4,509	100%	100%
Total	612,580	311,700	519,500	300,880	93,080	49%	15%
Northwest	15,680	6,000	10,000	9,680	5,680	62%	36%
Southwest	7,616	-	-	7,616	7,616	100%	100%
Northeast	22,818	42,000	70,000	(19,182)	(47,182)	-84%	-207%
Southeast	27,575	19,200	32,000	8,375	(4,425)	30%	-16%

Gap % = waste generation / throughput capacity. NA indicates only one facility in County, totals include all facilities. Totals do not foot due to inclusion of NA facilities in final total.

Table 8-2
Vegetative Waste Gap Analysis – All Facilities

County	Net Wasted Vegetative Material	All Facilities Low Throughput	All Facilities High Throughput	Gap Tons/Year Low Throughput	Gap Tons/Year High Throughput	% Gap Low Throughput	% Gap High Throughput
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year	%	%
Collin	82,944	69,525	115,875	13,419	(32,931)	16%	-40%
Dallas	240,165	210,345	350,575	29,820	(110,410)	12%	-46%
Denton	60,555	46,305	77,175	14,250	(16,620)	24%	-27%
Ellis	12,602	NA	NA	NA	NA	NA	NA
Erath	3,031	NA	NA	NA	NA	NA	NA
Hood	3,912	-	-	3,912	3,912	100%	100%
Hunt	6,368	-	-	6,368	6,368	100%	100%
Johnson	11,562	NA	NA	NA	NA	NA	NA
Kaufman	8,794	53,490	89,150	(44,696)	(80,356)	-508%	-914%
Navarro	3,411	-	-	3,411	3,411	100%	100%
Palo Pinto	1,784	-	-	1,784	1,784	100%	100%
Parker	9,387	NA	NA	NA	NA	NA	NA
Rockwall	7,656	-	-	7,656	7,656	100%	100%
Somervell	673	-	-	673	673	100%	100%
Tarrant	155,227	131,310	218,850	23,917	(63,623)	15%	-41%
Wise	4,509	-	-	4,509	4,509	100%	100%
Total	612,580	568,695	947,825	43,885	(335,245)	7%	-55%
		-	-				
Northwest	15,680	6,000	10,000	9,680	5,680	62%	36%
Southwest	7,616	32,520	54,200	(24,904)	(46,584)	-327%	-612%
Northeast	22,818	53,490	89,150	(30,672)	(66,332)	-134%	-291%
Southeast	27,575	19,200	32,000	8,375	(4,425)	30%	-16%

Gap % = waste generation / throughput capacity. NA indicates only one facility in County, totals include all facilities. Totals do not foot due to the inclusion of NA facilities in the final total.

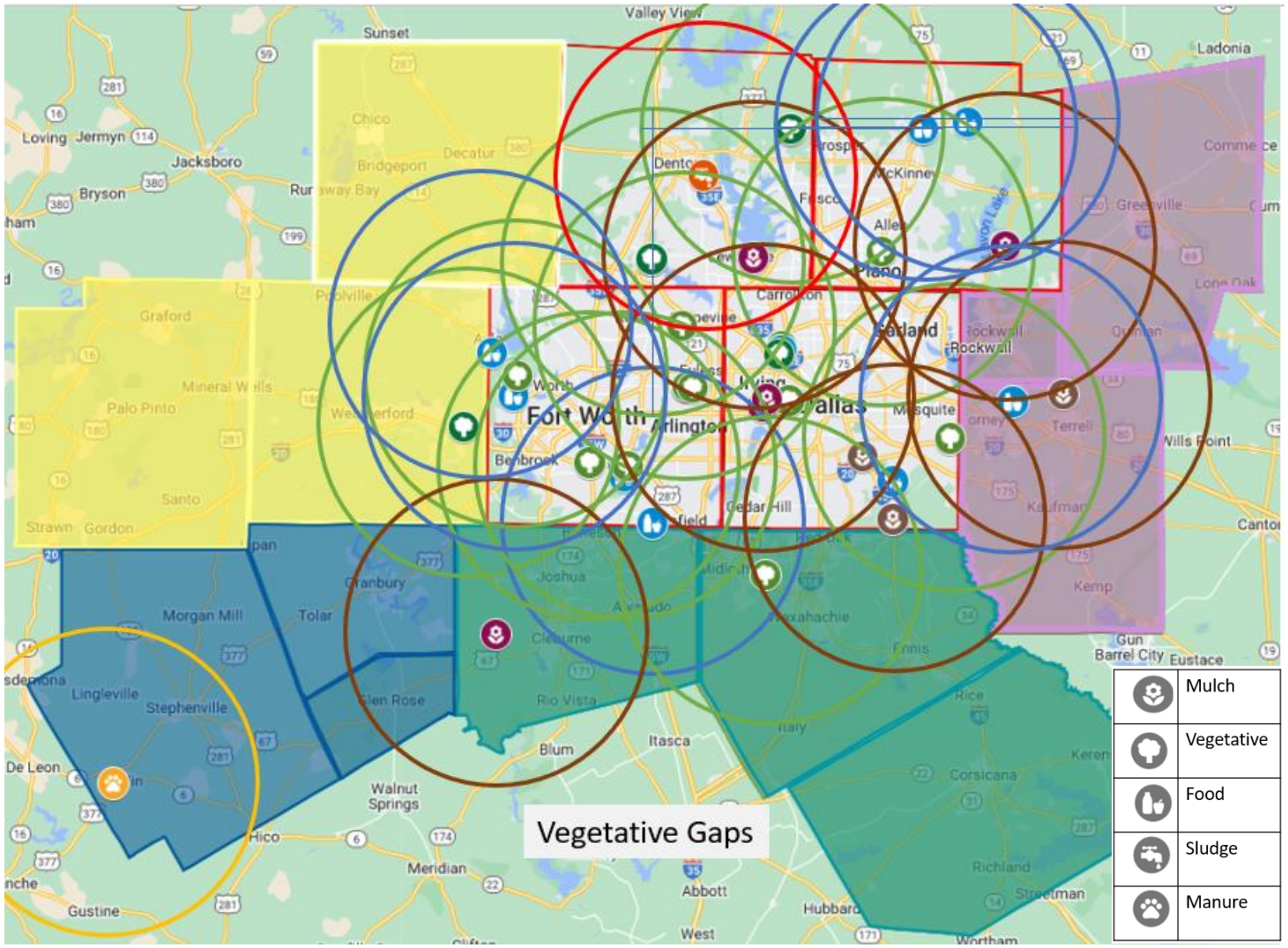


Figure 8-2 Vegetative Waste Gap Map (assumes feedstocks hauled from within 30-mile radius from facilities)

Food Waste Gaps

The Study relies on US EPA data to determine food waste generation. The US EPA study provides a broad range of generation estimates due to the methodology used. The focus of this Study is strictly on commercial and industrial generated food residuals, not food waste generated from the residential sector. Based on the analysis of the data, it is projected that there are approximately 230,000 to 1.34 million gross tons per year of food residuals generated. The food industry and institutions have developed a number of programs to reduce the amounts of waste generated, including donating food, use of the waste as animal feed, bio-chemical conversions, and other methods. Some food waste in the Region is also being composted. The result is a net food residual generation of between 105,000 to 705,000 tons per year (average net tons are 405,000 tons per year).

A total of ten compost facilities are authorized by TCEQ to accept food waste, defined for this purpose as food including animal byproducts, not just vegetative food residuals. Vegetative food residuals are categorized as able to be processed at the vegetative composting regulatory tier. The estimated capacity of these food residual composting facilities ranges between 224,000 and 374,000 tons per year (this includes capacity of Denton's sludge composting facility). This results in a Regional gap of 31,000 to 181,000 tons per year. A review of facility locations throughout the Region shows that the majority of food residual composting is in the four counties of Collin, Dallas, Denton, and Tarrant Counties. There are 11 counties that do not currently have food waste composting capacity for all types of food (Table 8-3).

Table 8-3 Food Residual Gap Analysis							
County	Net Wasted Food Material	All Facilities Capacity Low Throughput	All Facilities High Throughput	Gap Tons/Year Low Throughput	Gap Tons/Year High Throughput	% Gap Low Throughput	% Gap High Throughput
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year	%	%
Collin	46,345	49,470	82,450	(3,125)	(36,106)	-7%	-78%
Dallas	174,303	81,600	136,000	92,703	38,303	53%	22%
Denton	38,190	32,460	54,100	5,730	(15,910)	15%	-42%
Ellis	7,700	-	-	7,700	7,700	100%	100%
Erath	2,412	-	-	(30,109)	(51,789)	-1249%	-2148%
Hood	3,070	-	-	3,070	3,070	100%	100%
Hunt	4,616	-	-	4,616	4,616	100%	100%
Johnson	7,171	-	-	7,171	7,171	100%	100%
Kaufman	4,361	11,490	19,150	(7,130)	(14,790)	-164%	-339%
Navarro	2,263	-	-	2,263	2,263	100%	100%
Palo Pinto	1,149	-	-	1,149	1,149	100%	100%
Parker	4,228	-	-	4,228	4,228	100%	100%
Rockwall	4,412	-	-	4,412	4,412	100%	100%
Somervell	349	-	-	349	349	100%	100%
Tarrant	102,515	49,455	82,425	53,060	20,090	52%	20%
Wise	2,294	-	-	2,294	2,294	100%	100%
Total	**405,374**	**224,475**	**374,125**	**148,379**	**(22,952)**	**37%**	**-6%**
	-	-	-				
Northwest	7,670	6,000	10,000	7,670	7,670	100%	100%
Southwest	5,830	32,520	54,200	(26,691)	(48,371)	-458%	-830%
Northeast	13,388	53,490	89,150	1,898	(5,762)	14%	-43%
Southeast	17,134	19,200	32,000	17,134	17,134	100%	100%
Gap % = Generation/Facility Throughput							

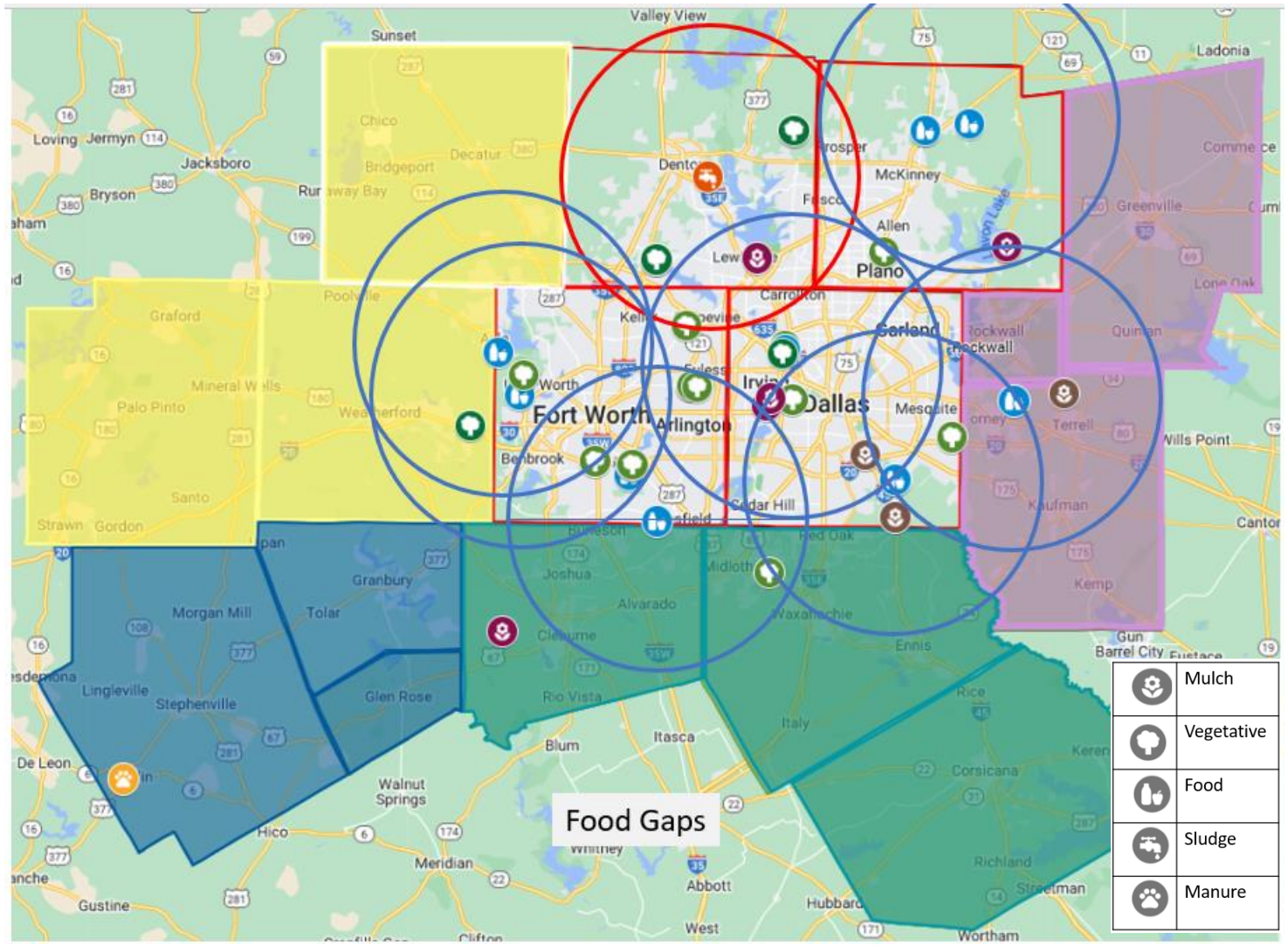


Figure 8-3 Food Residue Gap Map (assumes feedstock hauled from 30-mile radius of facilities)

Sludge and Manure Gaps

There are an estimated 238,000 tons per year of dry solids in wastewater treatment sludge generated by the Region's 95 public wastewater treatment facilities (Table 4-14). The Study does not include sludge generated by small private facilities and municipal utility districts' facilities. Most of the sludge generated in the Region is currently being land applied for beneficial use on cropland. The City of Fort Worth and TRA both rely on land application as the means of managing their biosolids. The City of Dallas manages its sludge through surface disposal and monofil on-site. The North Texas Municipal Water District disposes of sludge generated from their facilities in landfills. Most of the smaller wastewater treatment facilities also dispose of their sludge in landfills. It is estimated based on landfill records that 111,000 tons per year of wet sludge is disposed of in landfills.

City of Dallas Sludge

In determining "net tons", the City of Dallas sludge was not included as this material is not landfilled. Dallas is in a unique situation with respect to the Study. The sludge is not taking up landfill space, but it is also not being land applied for beneficial use. The City currently generates approximately 26,320 dry tons of sludge annually which is either land disposed or disposed in the City's monofil. The City's sludge is approximately 16.8% dry solids, which translates to 156,667 wet tons of sludge. This amount of sludge could require a total of approximately 49,350 tons of vegetative material for bulking purposes and would produce approximately 316,000 cubic yards per year of compost.

The City of Denton's compost facility is the only sludge composting facility in the Region. This facility accepts a total of 32,000 wet tons per year of sludge and additional vegetative waste that is used as a bulking agent. They produce a variety of products including finished mulch, soil blends, and compost.

The Green Cow compost facility located in Erath County is the only known manure compost facility in the Region.

Table 8-4 presents tons of dry solids in sludge generated in each county. As mentioned above, there is only one sludge composting facility. No data have been collected for this Study on the quantities of manure generated as this material is generally not disposed of in landfills.

Table 8-4 Sludge Gap Analysis							
County	Net Wasted Vegetative Material	All Facilities Capacity Low Throughput	All Facilities High Throughput	Gap Tons/Year Low Throughput	Gap Tons/Year High Throughput	% Gap Low Throughput	% Gap High Throughput
	Tons/Year	Tons/Year	Tons/Year	Tons/Year	Tons/Year	%	%
Collin	62,720			62,720	62,720	100%	
Dallas	39,624			39,624	39,624	100%	
Denton	102,240	32,460	54,100	69,780	48,140	68%	
Ellis	43,752			43,752	43,752	100%	
Erath	797			797	797	100%	
Hood	1,091			1,091	1,091	100%	
Hunt	1,693			1,693	1,693	100%	
Johnson	3,685			3,685	3,685	100%	
Kaufman	20,544			20,544	20,544	100%	
Navarro	771			771	771	100%	
Palo Pinto	1,525			1,525	1,525	100%	
Parker	3,160			3,160	3,160	100%	
Rockwall	5,757			5,757	5,757	100%	
Somervell	128			128	128	100%	
Tarrant	7,587			7,587	7,587	100%	
Wise	1,112			1,112	1,112	100%	
	-						
Total	**296,189**	**32,460**	**54,100**	**263,729**	**242,089**	**89%**	
	-	-	-				
Northwest	5,797	-	-	5,797	5,797	100%	
Southwest	2,016	-	-	2,016	2,016	100%	
Northeast	27,995	-	-	27,995	27,995	100%	
Southeast	48,208	-	-	48,208	48,208	100%	
Gap % = Generation/Facility Throughput							

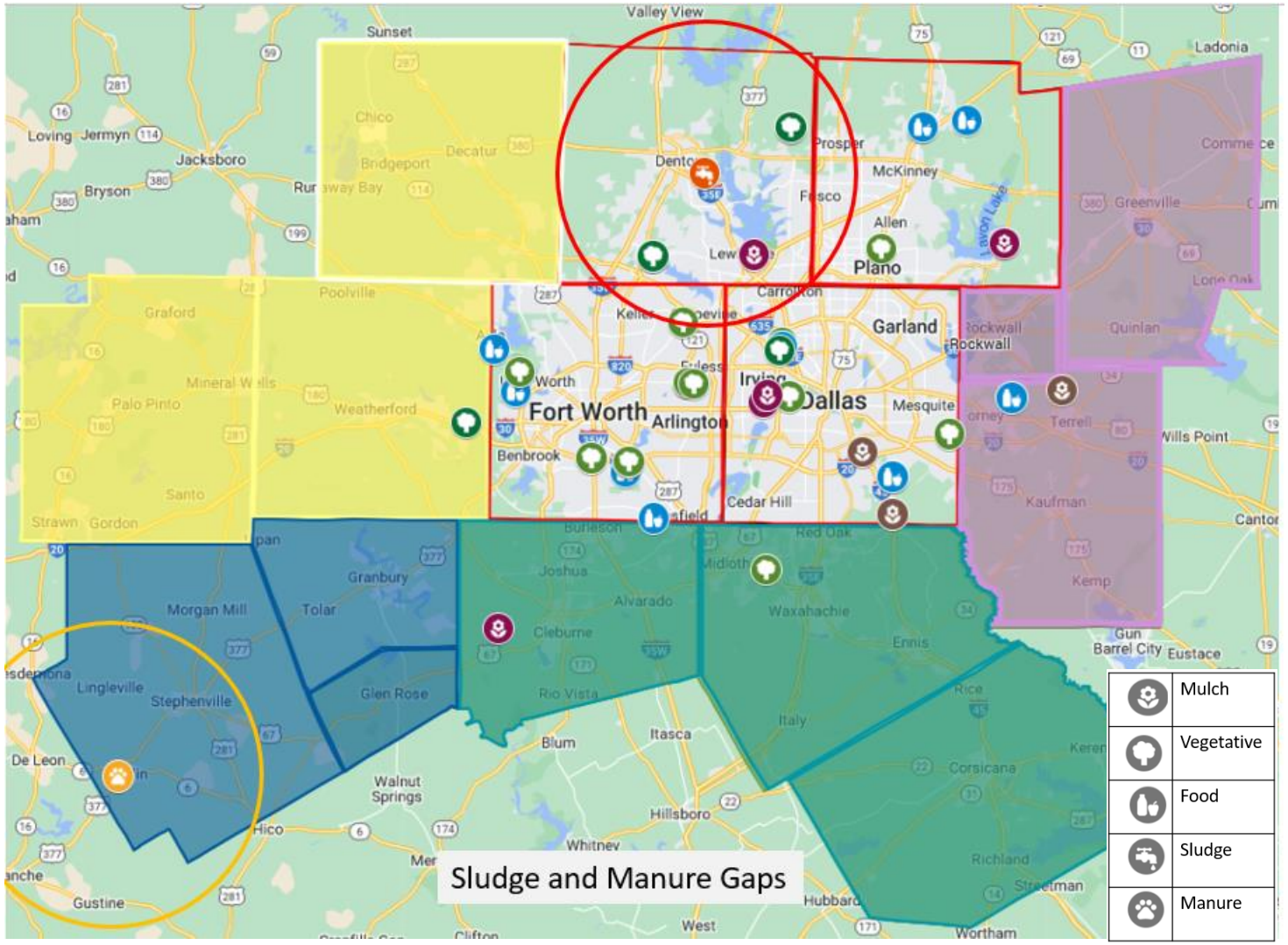


Figure 8-4 Sludge and manure Gap Map (assumes feedstocks hauled from 30-mile radius of facilities

Project Opportunities

One of the tasks associated with the Study's Scope of Services includes providing recommendations for potential projects that could be developed in the Region to address the gaps identified. The selection of these projects involves an evaluation of the following criteria:

· Access to available feedstocks for processing

· A gap in production capacity compared to the amount of material generated

· Interest in project development by a championing agency

The following is an initial list of opportunities based on these criteria and input received from members of the OAG. There are additional projects that could be developed given the large gaps identified in this report.

Dallas Water Utilities Southside and Denton Wastewater Treatment Anaerobic Digestion Pilot Programs

Recommendations from the Waste Food to Fuel project included the development of two pilot programs for managing food waste. These include pilot co-digestion projects at the Dallas Southside Wastewater Treatment facility and the Denton Pecan Creek Wastewater facility. It is recommended that these projects continue to move forward.

Weatherford Regional composting facility for sludge and vegetative materials

Weatherford is currently hauling biosolids to Turkey Creek Landfill. A feasibility study of several regional processing scenarios indicates that a regional facility accepting sludge from Weatherford, Azle, Glen Rose and Mineral Wells could be economically feasible. These potential municipal partners with Weatherford are selected as the most feasible in the initial phase of the project because they have contracts to haul their sludge with haulers that do not also own landfills currently accepting the sludge. Such a composting facility would also accept vegetative material as bulking agent, and could accept food residuals.

City of Denton

The City of Denton currently composts biosolids generated by the City and vegetative material (brush) diverted from the City of Denton Landfill at the gate. Because the Denton composting facility is the only composting facility authorized to accept sludge in the Region, and because of the large amount of sludge currently disposed in the Region, Denton has been identified as an opportunity for greatest benefit. The City of Denton is investigating the possibility of using other potential sources of waste, such as pre- and post-consumer wasted organics and sludge from other municipalities, in its composting process in order to prevent these materials from being landfilled or otherwise disposed. Ther City is evaluating different processing technologies that may produce different products, in order to maximize production within the current footprint of the composting facility.

City of Dallas

The City of Dallas has a composting facility authorized by TCEQ at its McCommas Bluff Landfill. That facility is authorized to accept vegetative material, food residuals and sludge. The facility has never been constructed or operated. The authorization held by the facility allows for the movement of the composting facility to various locations within the landfill permitted area as may be appropriate to accommodate expanding the footprint of the municipal solid waste disposal area.

Currently, the City of Dallas collects most brush and some yard trimmings with bulky waste. Yard trimmings are allowed to be deposited for collection in curb-side MSW carts if cart capacity allows. Other vegetative materials are currently collected loose or bagged along with bulky trash if it is not hauled to composting facilities, transfer stations or landfills by homeowners or landscapers. Dallas has conducted a small pilot study to separate the collection of brush and bulky trash. If separate collection were to be implemented City-wide, the brush and yard waste generated by residents could be diverted from landfill disposal to composting – either at its own facility or elsewhere. Dallas has an ordinance whereby grass clippings are not collected by the City; however, they may be hauled (along with other vegetative material) to the landfill by residents and landscapers. If composting were available, grass clippings and other vegetative waste could be banned from disposal at McCommas Bluff Landfill. This would enable a larger Compost Refund of landfill surcharge paid to TCEQ.

Dallas disposes of all sludge generated by Dallas Water Utilities, either by surface disposal (monofil) or land application on dedicated disposal sites operated by the City. Because of the large quantity of sludge generated by the City, the large quantity of brush and yard waste that could be collected separately, and the availability of a facility to accept these wasted organics, Dallas has been identified as an opportunity for greatest benefit.

North Texas Municipal Water District (NTMWD)

NTMWD generates a large quantity of sludge at its regional wastewater treatment plant in Collin County. The District also owns a composting facility that processes vegetative material and food residuals. For this reason, NTMWD is identified as an opportunity for greatest benefit. However, NTMWD is not currently authorized to accept sludge as a feedstock. The District does not control the feedstocks delivered to its composting facility by its member cities. So any additional diversion or organics would be at the discretion of the member cities participating in the solid waste program. NTMWD has no plans at this time to accept sludge as a feedstock at its current facility (with proper authorization).

Cities of Irving and Grand Prairie Brush Utilization

Both cities own and operate their landfills. Both cities also have similar brush collection and processing programs and generate equal amounts of brush. Most of the material generated from these facilities is either given to residents or used for city mulch purposes or used for erosion control at the landfill. The ground brush is often stored for extended periods of time and poses a fire risk if not properly managed. The cities may wish to evaluate potential marketing opportunities with existing mulch or compost

companies. Success with this type of program would be applicable to several counties throughout the region that currently have public works programs that generate large quantities of brush material that is often stored for long periods of time.

Cost of No Action

Organic material is a valuable resource that can be reused locally. If organic material is not diverted from the landfill, environmental, social, and financial impacts are realized by society. Because organic material contributes to the development of methane under anaerobic conditions, burying it in landfills equates to more greenhouse gases emissions and lower air quality.[1] Agricultural crops that do not employ the use of organic soil amendment such as compost see more erosion, increased water use, and higher dependency on synthetic pesticides and fertilizers.[2] Soil that is not enriched by a soil amendment like compost application have lower crop production per plant, resulting in lower yields.[3] The increased use of water and energy demand to transport the water for irrigation, coupled with a higher dependency on chemical fertilizers, means increased costs per unit of crop yield.

Landfilling organic material also shortens the usable life of existing landfills and requires that new ones be created sooner. As previously noted in Appendix A, the Region has an average of 35 remaining years of landfill capacity. Five of these facilities have less than 15 years of capacity, which is the approximate amount of time required to site, permit, and construct a new landfill. Using the net tons of vegetative waste, food residuals, and sludge shown in Table 4-19, and the average landfill tipping fee in Texas as reported by the TCEQ (2021 annual report), the estimated cost to landfill these wasted organics can be calculated. As shown in Table 8-5 below, assuming an annual 1.3 million total tons of organics being landfilled and an average tipping fee of $39.38, landfilling these materials costs an estimated $51.2 million, a cost currently borne by generators and haulers in the Region. As the Region's population increases, tonnage and tipping fees will rise, meaning each year the cost to landfill these materials will increase.

Table 8-5
Landfill Cost Estimate

	Tons
Vegetative	612,580
Food Residual	405,374
Sludge	296,189
Total Organics	**1,314,142**
Average Landfill Tipping Rate, 2021 (TCEQ)	$39.38 per ton
Total Cost of Landfilling Net Wasted Organics	**$51,233,852**

[1] Best Management Practices for Curbside Collection of Organic Waste – British Columbia https://www2.gov.bc.ca/assets/gov/environment/waste-management/organic-waste/org-infrastructure-program/best_management_practices_organic_waste_curbside_collection.pdf

[2] https://calrecycle.ca.gov/organics/compostmulch/benefitsof/

[3] https://www.epa.gov/sustainable-management-food/reducing-impact-wasted-food-feeding-soil-and-composting

To estimate the "lost revenue" of not taking action to compost organics in the Region, using the 612,580 net tons of vegetative waste shown in Table 4-1 and the 701,596 net tons of food and sludge shown in Table 4-19 generated annually in the Region would result in an estimated 3.8 million cubic yards of finished compost. This calculation is based on assuming approximately a 3:1 ratio of vegetative waste to food and sludge needed to make compost, and a 40% volume reduction during the composting process.

Table 8-6
Finished Compost Calculations

	Cubic Yards (1000)
Net Brush and Yard Waste[1]	4,900
Net Food Residual and Sludge[2]	1,403
Total Feedstock	**6,303**
40% volume reduction during composting	(2,521)
Approximate Finished Compost	**3,782**

1. Assumes 250 pounds per cubic yard
2. Assumes 1,000 pounds per cubic yard

Estimating the sale value of the material currently being landfilled provides insight into the foregone revenues currently occurring. To calculate this figure, the amount of finished compost shown in Table 8-6 above is multiplied by estimated price per cubic yard for finished compost. Table 8-7 shows the estimated ranges of resulting revenues from the sale of finished compost based on ranges in price per cubic yard described in Section 6.

Table 8-7
Potential Gross Revenue Opportunity

		Low	High	Average
	Cost per CY	Lost Revenue Estimate ($1000)	Lost Revenue Estimate ($1000)	Lost Revenue Estimate ($1000)
Landscapers Purchasing Compost (Wholesale)	$ 15 - $35	$ 56,730	$ 132,370	$ 94,550
Resellers and Soil Blenders & Retail	$ 25 - $60	$ 94,550	$ 226,920	$ 160,735

While this exercise does not consider the processing costs for organic materials to be composted, it does indicate the estimated foregone revenue can be significant and could range from $56 million to $160 million.

9.0 Conclusions and Recommendations

Conclusions

Achieving the Region's recycling goals is important to reducing the environmental impacts of waste generation and preserving valuable landfill space. The purpose of this Study is to more clearly define the quantities of materials generated and determine whether there are gaps in production capabilities or product markets that could be filled to remove more wasted organics from landfills. Determining where and whether gaps do exist requires an understanding of the following factors:

- Quantities of wasted organics generated
- Infrastructure existing currently to process this material
- Availability of markets for products produced from wasted organic resources

Organic Waste Generation

It is estimated that over 2.8 million tons per year of wasted organics are generated annually in the Region. This includes vegetative waste, non-residential food residuals, and sludge. This waste is generated by landscapers, tree-trimming companies, local governments, food industries, institutions, and wastewater treatment facilities. It is anticipated that as the Region continues to grow in both population and economic activity, the amount of wasted organics will also increase. The total amount of wasted organics, including organics generated by sources outside the scope of this study, will increase from an estimated 3.3 million tons per year in 2022 to over 4.7 million tons per year by 2042.

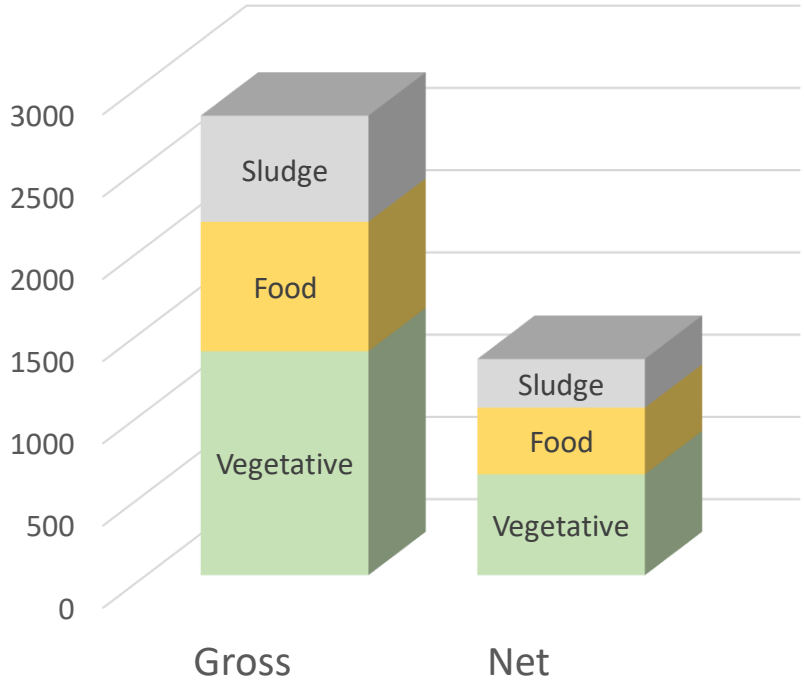


Figure 9-1 From Gross Generation to net disposed (1,000 tons/year)

Figure 9-1 illustrates the amounts of the three categories of wasted organics evaluated in this Study. There has often been a misperception regarding "organic waste." Although the term implies that this material is a waste without value, which is to be disposed, industries such as food processors, wastewater treatment facilities and tree-trimming businesses actually generate by-products which are marketable "organic resources." Examples include the use of food waste for animal feed and sludge for land application to improve soil quality. Similarly, many landscaping and tree trimming businesses have long recovered their byproducts as mulch and compost. The "gross tons" shown in Figure 9-1 represent the wasted fraction of these by-products, much of which is recoverable. After

subtracting the amount of materials currently recovered, a remaining "net" remains. This net quantity is the focus of the Study. *How can we further recover the quantity of organic resources from landfills?*

It is significant that included in the reduction of material from gross to net is a large quantity of sludge that is being land applied. The City of Fort Worth currently is treating their sludge using thermal hydrolysis which produces a material that is appropriate for land application for beneficial use. TRA is considering using this same process in the near future. Sludge that has not been treated using thermal hydrolysis or another means to make it approved for unrestricted use may have to be either landfilled or land disposed if it is not processed in a compost facility. Future regulation of PFAS may affect available options.

Industry

There are an estimated 40 mulch and compost facilities located in the Region. These facilities either process mulch only or produce mulch along with compost made from vegetative waste, which may include vegetative food, all food, sludge or cattle manure. Figure 9-2 illustrates the numbers of the types of facilities in the Region (34 sites observed through Google Earth). Each category is authorized by regulation to accept all feedstocks in columns to its left in Figure 9-2.

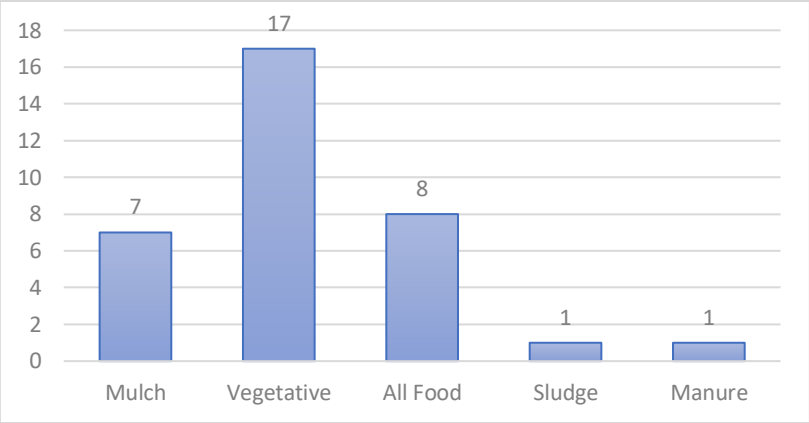


Figure 9-2 Numbers of mulch/compost facilities by feedstock

One of the challenges faced by a Study that requires information from the private sector is that public documentation of sensitive data could impact a company's competitive position. When this occurs, it is necessary to formulate reasonable estimates from available data. Using a combination of estimates and available data, it is possible to project that a total of between 568,000 and 947,000 tons per year of material are processed to produce mulch or compost in the Region. Figures 9-3 and 9-4 illustrate the estimated feedstock blend by weight and by the county in which it was produced. This is based on authorized feedstocks, not necessarily the actual type of material processed. Based on anecdotal and observed information, it is anticipated that a larger percentage of vegetative material is being processed in comparison to food residuals. Note that these are order-of-magnitude estimates. Eighty-three percent of the material generated is in Collin, Denton, Dallas or Tarrant Counties.

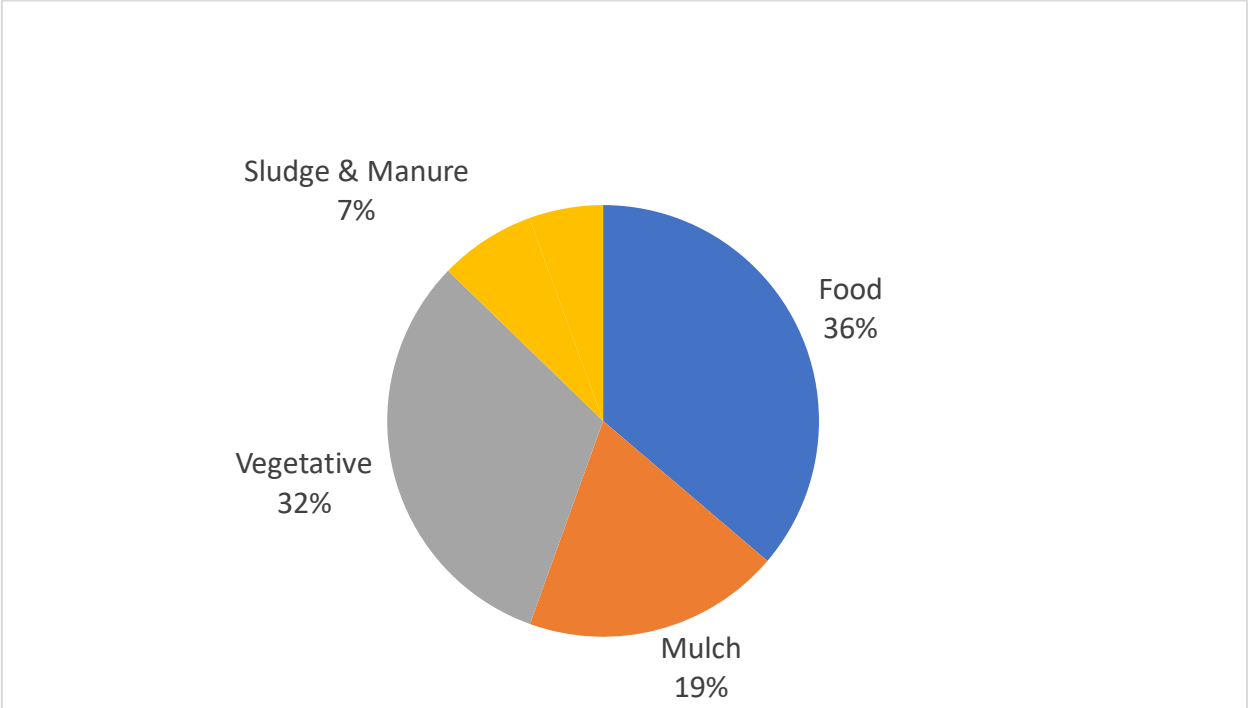


Figure 9-3 Percentage by weight of material production based on authorized feedstock type

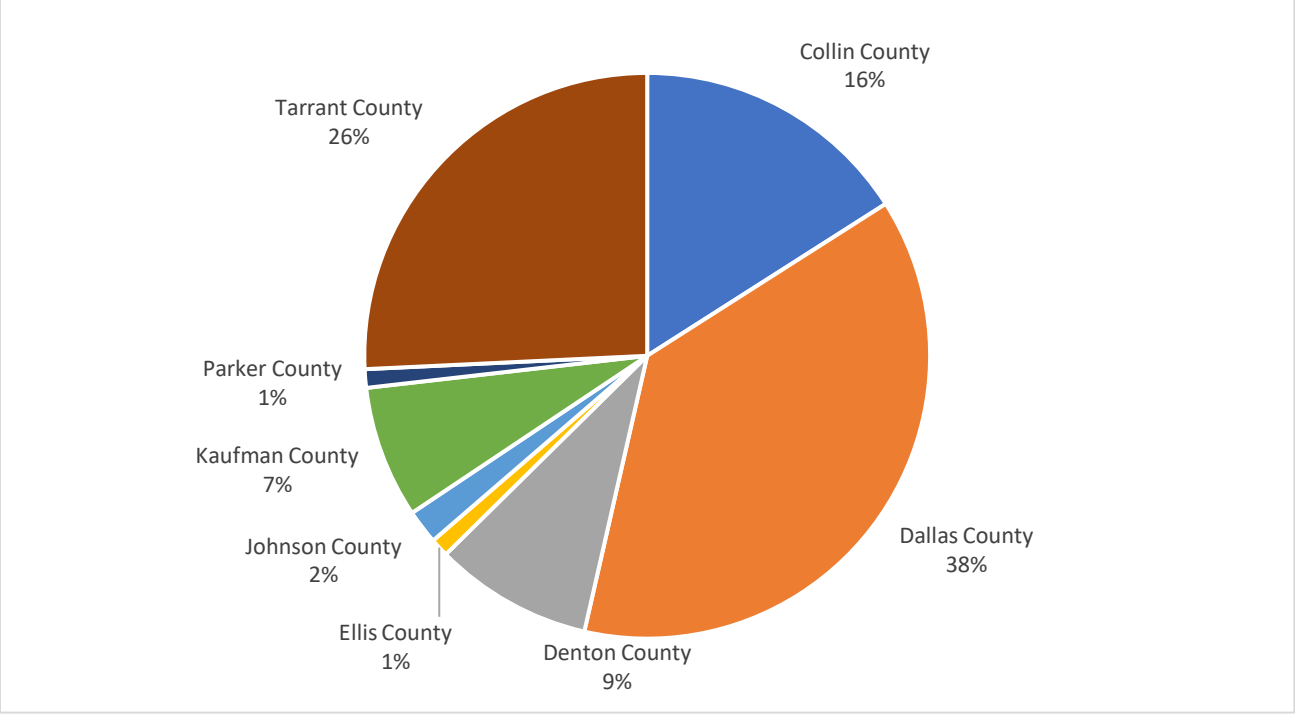


Figure 9-4 County Production; percent of total annual production

Material Markets

Based on the 1996 Statewide Iowa Compost Demand Study and the national "Battelle Study" on Compost Usage Potential, the estimated per capita use of compost ranges from 0.21 to 0.53 cubic yards per capita per year (excluding agricultural markets). Using an average of the two figures (0.37 cubic yards per year per person) and the NCTCOG population base of 8.2 million people, that equates to a compost market of 3,034,000 cubic yards per year, without counting any usage in agriculture in the near term. This market estimate is for compost without accounting for material that may be blended with it prior to sale. Further, it does not account for composted yard trimmings or recycled wood that is processed into mulch.

If all the net tons of organic wastes identified in this Study were to be converted to compost, a total of 3.7 million cubic yards would be produced. This exceeds the current market demand estimated middle of the market range of 3.0 million cubic yards. **This "market gap" highlights the need to develop markets as a significant effort to reduce organic waste disposal.**

Composters in the NCTCOG region are generally successful in marketing their compost, as an unblended soil amendment, in blended (enhanced) landscape soils and the coarser fraction as a mulch. Composters in the region are very active in the bulk landscape material resale network, many marketing to homeowners, and both small and larger professional end users. Large horticultural (lawn/garden) markets exist for compost and related products because of the large regional population and difficult soil and climatic (drought) conditions. Sales of compost into agricultural or environmental applications are not significant at this point in the region, because of economics and limits on environmental regulation. The largest markets for compost and related products appear to be with commercial landscapers, resellers of landscape products (e.g., home centers, garden centers, landscape material yards, topsoil dealers) and homeowners, in both bulk and packaged form. Compost is being used by government entities, but this could be significantly expanded by promoting its usage in soil improvement, carbon sequestration, erosion control and stormwater management.

Gaps

Processing Gaps

One of the goals of this Study is to identify organic management gaps in the Region. For this Study, a "gap" is an area where there is insufficient processing capacity to manage the wasted organics generated. Based on a review of organic waste generation and available processing capacity, the following gaps were identified in Section 8 of this Study. Table 9-1 presents a summary of key gap issues.

Table 9-1
Gap Summary by Feedstock

Feedstock Processing	Gap Observations
Vegetative	A total of 34 operating mulch and composting sites exist throughout the Region and each of these facilities can and does process vegetative waste which may include yard waste, brush and vegetative food residuals.

	Major gap areas were identified in the western and southeastern parts of the Region. Although there is significant processing capacity in Dallas, Denton, and Tarrant counties, processing gaps in those counties still remain due to the large amount of material generated in them .
Food	A total of 8 facilities exist that have food residual processing capacity, including meat, fish, dairy and fats. These are generally limited to Collin, Dallas, Denton, and Tarrant counties. Even with the 8 facilities, it is uncertain how much of the capacity of these facilities is used for food waste composting compared to just vegetative composting.
Sludge	The City of Denton's sludge composting facility is the only sludge composting facility in the Region. A majority of the sludge generated from TRA, the City of Dallas, and the City of Fort Worth is either land applied or managed through surface disposal. The City of Weatherford is currently evaluating the feasibility of a regional sludge composting facility in the western part of the Region.

Material Gaps

The composting of food waste and sludge requires the blending of these materials with mulch or other bulking agent, typically produced from brush or wood waste. Typically, a volumetric ratio of 3 parts mulch or yard waste to 1 part food or sludge is a reasonable balance of feedstocks. Currently, most of the compost produced in the Region is the result of composting vegetative wastes. If there were a significant increase in the amounts of sludge and food waste to be composted, the availability of brush or tree waste, or other bulking agent to blend with these materials could be a limiting factor on the amounts of material that could be processed.

Policy Options and Recommendations

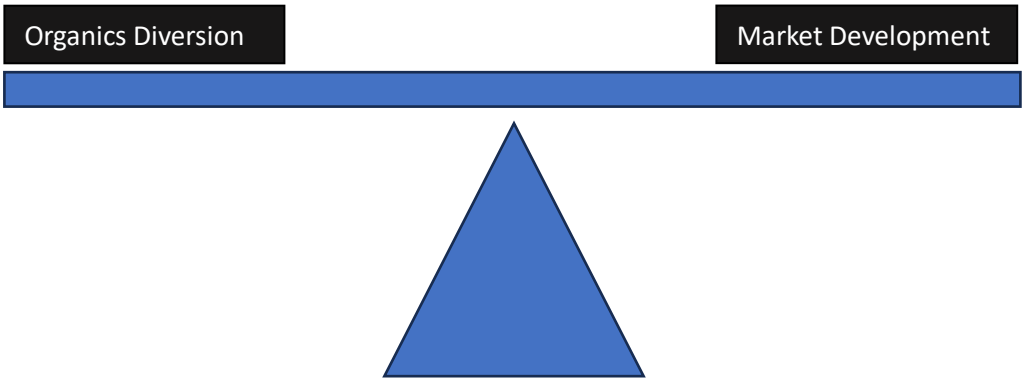
Compost and mulch facilities rely on these two revenue streams to remain profitable:

- Front-end tipping fees for materials managed at the site
- Back-end sale prices for mulch and compost produced

One of the goals of this analysis is to determine how to decrease the Region's reliance on landfill disposal of wasted organics. Increased quantities of material sent to existing processing facilities will increase front-end revenues. Increased demand for processing capacity will also likely lead to investments in existing facilities and the development of new capacity. Increased production of mulch or compost can also lead to lower final product prices if there is not a corresponding increase in the demand for final products.

Increasing the quantities of materials produced without adequate product markets will lead to lower market prices and threaten producer profitability.

Recommendations are presented to address both sides of the balance.



The following are policy options for the NCTCOG and local governments in the Region that are designed to address both material diversion and market development issues.

Ongoing communication and information transfer

The NCTCOG established an Organics Advisory Group (OAG) to assist in the development of this Study. Given the fast-track nature of the Study, the OAG was only able to meet 2 times. These meetings provided a forum for public and private stakeholders to meet and share information to identify collaborative opportunities. They also provided an opportunity to discuss important issues facing the organics industry. It is recommended that the OAG, possibly with an expanded membership, continue to meet to better understand the challenges facing the industry and to assist the NCTCOG in implementing some of the recommendations presented in the Study. The following list provides other issues that the OAG should consider:

- Status of PFAS regulation
- New organics projects
- Development of a regional mulch/compost market development program to increase demand for these products
- Outreach efforts to generators of wasted organics to encourage the use of mulch/compost facilities as opportunities for additional recovery of their organic resources.
- Presentation of findings of the study to Texas Restaurant and Food Processing Industry
- Presentation of findings to agricultural stakeholders in the Region

The NCTCOG should also include in its collaboration program efforts to work jointly with associations such as the Texas Composting Council, the US Composting Council, the Texas Nursery and Landscape Association, and the STAR Business Council. Each of these organizations is a key stakeholder in the development of policies and programs to encourage further development of the organics recovery industry.

Organic Material Diversion Recommendations

Recommendations to the NCTCOG for diversion of wasted organics from disposal to recovery are presented in Table 9-2. Recommendations for action by local governments are presented in Table 9-3.

Table 9-2
Policy and Program Options for Diverting Wasted Organics from Disposal

NCTCOG Policy and Program Options	Market Sector	Complexity	Costs	Impact	Priority
Create an organics exchange program letting major organic generators and processors understand where additional diversion opportunities exist.	All	Mid	Low	Mid	High
Encourage local government efforts to divert materials, from landfill disposal through feasibility studies and pilot program funding, through grants.	All	Low	Mid	Mid	High
Provide ongoing information on PFAS regulations and opportunities for advocacy.	Sludge, Food, Products	Mid	Low	Mid	High
Prepare model ordinances for mandatory separate organics collection.	Vegetative, Food	High	Mid	Mid / High	High
Provide information to local governments and institutions related to the existence of firms specializing in the collection and processing of wasted organics.	All	Mid	Low	Mid	Mid
Conduct a feasibility study designed to reduce restaurant and wholesale food waste disposal.	Food	Mid	Mid	Low/Mid	Mid
Develop public information materials supporting residential diversions of food waste.	Food	Low	Low	Low/Mid	Mid
Prepare model ordinances for processing vegetative waste, e.g.. contracting for brush grinding and material marketing.	Vegetative	Mid	Low	Low / Mid	Mid

Continue to promote don't-bag-it practices and proper yard waste segregation to reduce contamination as part of the existing "Know What to Throw" Program.	Vegetative	Low	Low	Low/Mid	Low

Table 9-3
Local Government Policy and Program Options for Diverting Wasted Organics from Disposal

Local Government Policy and Program Options	Market Sector	Complexity	Costs	Impact	Priority
Implement collection programs that divert yard waste and brush from the MSW stream.	Vegetative	High	Mid / High	Mid	High
Identify opportunities for diverting wastewater sludge from landfill disposal or surface disposal to composting once capacity becomes available. Prepare sludge hauling and disposal contracts that require a preference for composting over disposal.	Sludge	Mid / High	Mid	Mid	High
Adopt mandatory food waste recycling ordinances for the commercial sector, including the capture of pre-consumer food waste.	Food & Vegetative	High	High	High	Mid
Encourage residents to reduce yard waste collection through don't-bag-it programs and xeriscaping practices.	Vegetative	Low	Low	Low	Mid
Establish drop-off locations for food waste and vegetative waste.	Food Vegetative	Mid	Mid / High	Mid	Mid
Evaluate the feasibility of either purchasing brush processing equipment or contract-grinding of brush material generated from public works and other city or county operations.	Vegetative	Mid	Mid / High	Mid	Mid
Implement in-house food collection programs at local government facilities where feasible, i.e. practicing what is being preached.	Food	Mid	Mid	Low	Low

Market Development

Encouraging programs to increase the availability of materials for composting and the creation of additional processing facilities, without a sound marketing plan would result in failed facilities. In addition to marketing plans developed by and for individual processing facilities, local

governments and the NCTCOG can implement programs to encourage greater use of compost and mulch. Table 9-4 includes recommendations for market development.

Table 9-4
NCTCOG Policy and Program Options – Market Development

NCTCOG Policy and Program Options	Market Sector	Complexity	Costs	Impact	Priority
Use the NCTCOG's transportation program to encourage the use of compost and mulch for roadway projects, specifically for erosion control.	All	Low	Low / Mid	Mid	High
Adopt stormwater management guidelines that recognize the value of compost and mulch in sustainable stormwater management.	All	Mid	Low	Mid	High
Promote, or require, compost-based stormwater management methods within the NCTCOG region to help to address the issue of drought and flood by expanding markets for compost.	All	Mid	Low	Mid / High	High
Meet with the Dallas and Fort Worth districts of TxDOT and encourage them to once again specify compost for erosion control and vegetation establishment in the NCTCOG region.	All	High	Low	High	High
Encourage the development of composting and brush processing facilities at geographically farther distances from Dallas and Fort Worth, the major population bases.	All	Mid	Mid / High	Mid / High	High
Develop a model request for proposals for the marketing of mulch material currently stockpiled in the Region.	Vegetative	Mid	Low	Low/ Mid	High
Encourage farmers to become educated on the benefits of improving soil health through compost usage, including USDA conservation practices based on organic matter addition.	All	Mid / High	Mid	Low/Mid	Mid
Encourage more member cities to require increased soil organic matter content in soils for water quality, water conservation, carbon sequestration and other public benefits.	All	Mid	Mid	Mid/ High	High
Update the NCTCOG Recycling Map program to include all mulch and compost facilities.	All	Low	Low	Low	Mid

Identify and publicize specific research related to agriculture and golf courses on the benefits of compost and mulch in their operations. Identify specific media outlets that can be utilized.	All	Mid	Low	Mid	Mid
Develop model ordinances for green stormwater management.	All	Mid	Mid	Mid	Mid
Use public service announcements and the Texas SmartScape™ program (and other means) to promote soil improvement for water conservation, water quality, flood control, plant health, carbon sequestration and other benefits.	All	Low / Mid	Mid	Low	Low / Mid
Encourage NCTCOG regional composters to participate in programs that promote the production and usage of high-quality compost products, such as the US Composting Council's Seal of Testing Assurance and Compost Consumer Use Program.	All	Low	Low	Mid	Mid

Table 9-5 provides an analysis of actions that can be taken by local governments and policymakers to support market development for compost and mulch products.

Table 9-5 Local Government Policy and Program Options – Market Development					
Local Government Policy and Program Options	**Market Sector**	**Complexity**	**Costs**	**Impact**	**Priority**
Adopt Green Building Ordinances which require minimum organic content standards for landscaping, to be incorporated into building design and landscaping specifications.	All	High	Mid	Mid / High	High
Evaluate Parks and Public Works operations to identify opportunities to utilize mulch and compost in their operations.	All	Low	Mid	Low / Mid	Mid
Evaluate stormwater management ordinances to identify opportunities to utilize more mulch or compost. Adopt changes that encourage the use of these materials.	All	Mid	Mid	Mid	High
Evaluate the potential to market existing ground waste brush/wood piles to reduce potential fire hazards and to utilize these products for useful purpose (applies to brush piles at city-owned landfills and county or city public works and parks departments)	Vegetative	Low	Low / Mid	Low / Mid	Mid
Review existing disaster debris management plans to identify specific opportunities to segregate brush material from the debris stream. Identify potential markets for this material in disaster debris management plans. Require contractor managing disaster debris to segregate brush and tree waste when feasible.	All	Low / Mid	Mid / High	Mid / High	Mid

Summary

The following are high-priority recommendations based on the above evaluation. It is important that any public sector actions be balanced to increase the amount of material diverted and market development. Without this balanced approach, there are going to be market distortions that will not benefit the existing mulch/compost industry.

Material Diversion High Priority Recommendations

NCTCOG

- Create organics exchange program letting major organic generators and processors understand where additional diversion opportunities exist.
- Encourage local government efforts to divert materials from disposal through grants for feasibility studies and pilot programs.
- Provide ongoing information on PFAS regulations and opportunities for advocacy.
- Prepare model ordinances for mandatory separate organics collection.

Local Governments

- Implement collection programs that divert uncontaminated yard waste and brush from the MSW stream.
- Identify opportunities for diverting wastewater treatment plant sludge from landfill disposal to composting once capacity becomes available. Prepare sludge hauling and disposal contracts that require a preference for composting over landfill disposal.

Market Development High Priority Recommendations

NCTCOG

- Use the NCTCOG's transportation program to encourage the use of compost for roadway projects, specifically for erosion control.
- Adopt stormwater management guidelines that recognize the value of compost in sustainable stormwater management.
- Meet with the Dallas and Fort Worth districts of TxDOT and encourage them to once again specify compost for erosion control and vegetation establishment in the NCTCOG region.
- Promote or require, compost-based stormwater management methods within the NCTCOG region to help to address the issue of drought, flooding and water quality while expanding markets for compost.
- Encourage the development of composting and brush processing facilities at geographically farther distances from Dallas and Fort Worth, the major population bases.
- Develop a model request for proposals for the marketing of existing ground mulch material.
- Encourage member cities to require increased organic matter in soil for developments.

Local Governments

- Adopt Green Building Ordinances which require a certain percentage of organic material to be incorporated into building design and landscaping.
- Evaluate Parks and Public Works operations to identify opportunities to utilize mulch and compost in their operations.

- Evaluate stormwater management ordinances to identify opportunities to utilize more mulch and compost. Adopt changes that encourage the use of these materials in public works projects.

Appendices

Appendix A – Landfill Data for North Central Texas Council of Governments

Source: TCEQ Annual Summary of MSW in Texas

COG 4: North Central Texas Council of Governments—List of Landfills

COG	Permit	Site Name	County	Type	2021 Tons	Rem Yds	Rate	Rem Tons	Rem Yrs
4	2278	Osttend C and D Waste Landfill	Collin	4	297,484	11,199,342	946	5,297,289	18
4	2294	121 Regional Disposal Facility	Collin	1	962,918	111,483,408	1,214	67,670,429	70
4	42D	Waste Management Skyline Landfill	Dallas and Ellis	1	1,825,949	35,711,480	1,460	26,069,380	14
4	62	City of Dallas McCommas Bluff Landfill	Dallas	1	1,618,387	71,359,897	1,469	52,413,844	32
4	996C	City of Grand Prairie Landfill	Dallas	1	265,881	10,022,675	1,437	7,201,292	30
4	1394B	Hunter Ferrell Landfill	Dallas	1	179,271	11,514,499	978	5,630,590	31
4	1895A	Charles M Hinton Jr Regional Landfill	Dallas	1	590,343	26,140,325	1,469	19,200,069	33
4	1025B	DFW Recycling and Disposal Facility	Denton	1	728,907	2,244,584	1,720	1,930,342	3
4	1312B	Camelot Landfill	Denton	1	808,196	31,493,685	1,623	25,557,125	32
4	1590B	City of Denton Landfill	Denton	1	436,674	45,110,544	1,276	28,780,527	66
4	1749B	Lewisville Landfill	Denton	4	13	20,012,642	1,698	16,990,733	100
4	1209B	CSC Disposal and Landfill	Ellis	1	12	30,963,658	1,051	16,271,402	100
4	1745B	Ellis County Landfill	Ellis	1	172,957	38,235,976	1,363	26,057,818	150
4	664	City of Stephenville Landfill	Erath	4	16,434	705,115	1,200	423,069	25
4	1195B	Republic Maloy Landfill	Hunt	1	158,802	34,198,314	1,270	21,715,929	100
4	534	City of Cleburne Landfill	Johnson	1	372	13,341	1,000	6,671	14
4	1417C	Turkey Creek Landfill	Johnson	1	676,662	8,443,013	1,700	7,176,561	13
4	2190	City of Corsicana Landfill	Navarro	1	106,610	22,009,128	1,000	11,004,564	103
4	47A	Weatherford Landfill	Parker	1	129,803	89,288	1,500	66,966	0.5
4	218C	City of Fort Worth Southeast Landfill	Tarrant	1	761,624	18,639,267	1,571	14,641,144	20
4	358B	City of Arlington Landfill	Tarrant	1	932,000	44,008,680	1,531	33,688,645	36
4	1983D	Fort Worth C and D Landfill	Tarrant	4	470,868	9,712,125	1,242	6,031,230	12

Appendix B

Municipal Collection Programs

Collection Practices - Data from City Web Sites (July 2023)						
City	Single-Family Households	Multi-family Households	Don't Bag It or Cart Collection	Separate Yard Waste	Separate Brush	Combined Brush/Bulky
Allen	29,588	5,945	y	y	y	
Arlington	96,379	45,981	y			
Bedford	13,572	8,120				y
Burleson	14,752	2,548				
Carrollton	32,979	17,462	y			y
Cedar Hill	15,050	1,923	y			y
Celina	7,286	203	y			y
Coppell	12,042	2,772		y	y	
Dallas	275,788	249,982	y			y
Denton	39,628	14,822		y	y	
DeSoto	16,703	3,787			y	
Duncanville	11,408	2,271			y	
Euless	12,473	12,379		y	y	
Farmers Branch	9,760	6,113			y	
Flower Mound	23,351	2,752	y			
Fort Worth	247,217	85,118	y		y	
Frisco	54,463	20,586		y	y	
Garland	64,357	17,990	y		y	
Grand Prairie	46,246	18,422			y	
Grapevine	12,001	9,157		y	y	
Haltom City	11,907	4,382	y			
Hurst	11,860	3,665				
Irving	44,619	51,183			y	
Keller	12,687	2,922		y	y	
Lancaster	11,472	2,215	y			
Lewisville	23,813	25,960		y	y	
Little Elm	12,647	3,923				
Mansfield	53,453	18,656		y	y	
McKinney	19,953	4,760				
Mesquite	38,592	12,131		y	y	
Midlothian	10,864	1,092				
North Richland Hills	21,231	6,520		y	y	
Plano	75,266	35,122		y	y	
Prosper	9,697	819				
Richardson	30,258	17,077		y	y	
Rockwall	14,930	2,381				
Rowlett	18,903	3,397	y			y
The Colony	11,740	6,558		y	y	
Waxahachie	13,614	1,780				
Wylie	16,519	1,276	Y			Y
Total	1,499,068	734,152	13	14	21	7

Appendix C

EPA Food Waste Mapper Methodology

2. Sector-Specific Data Sources and Excess Food Estimation Methodologies for Generators

2.1. Overview

This chapter describes the methods and data sources used to estimate the excess food generation rates for individual establishments in the 76 identified ICI industries and three school types. For the purposes of this report, "excess food" refers broadly to post-harvest food that is produced for human consumption but removed from the supply chain to be recovered, recycled, or disposed (refer to Appendix B for full definition). The definition does not include unharvested crops or on-farm processing excess and excess food or other organic material disposed of by the residential sector.

These 76 industrial, commercial and institutional (ICI) industries and three school types were grouped into the following sectors: food manufacturers and processors (46), food wholesale and retail (17), educational institutions (3), the hospitality industry (3), correctional facilities (1), healthcare facilities (3), and restaurants and food services (6). The full list of industries, and associated excess food characteristics, is provided in Appendix A.

Establishment-level data for most industries came from Hoover's, Inc. and included contact information, location details (geo-coordinates and physical addresses), establishment type (headquarters, branch, or single location), revenue ($USD), and number of employees. Similar establishment-level data for educational institutions was obtained from the National Center for Education Statistics (NCES 2018a, 2018b, 2018c), and data for healthcare facilities was obtained from the U.S. Department of Homeland Security (DHS (2017)).

In general, sector-specific methodologies for estimating excess food generation rates were adopted from existing studies conducted by state environmental agencies, published articles, and other sources, such as the Food Waste Reduction Alliance (FWRA). All adopted studies used methodologies based on commonly tracked business statistics to estimate excess food generation rates for several or all the targeted sectors. These business statistics include number of employees, annual revenue, number of students (for educational institutions), number of inmates (for correctional facilities) and number of beds (for healthcare facilities).

Using establishment-specific statistics collected in the Dataset, the methodologies were used to estimate the amount of excess food from each establishment in each of the targeted sectors. More than one methodology was available for every sector, so a range of excess food estimates was calculated for each establishment, and the high and low estimates are displayed in the Map and Dataset. The excess food estimate includes edible as well as inedible food to the extent accounted for by the studies. EPA did not attempt to estimate the portions of excess food generation rates that are potentially recoverable for human consumption. If data were not available to generate an excess food estimate, the establishment was still mapped, but no estimate was provided. Data were available to calculate estimates for 97.8% of establishments in Version 2.0 of the Map.

Appendix D

Major Food Waste Generators

NAME	NAICS_CODE_DESCRIPTION	CITY	COUNTY	EXCESSFOOD_TONYEAR_	EXCESSFOOD_TONYEAR_HIGHEST
Bimbo Bakeries Usa, Inc	Commercial Bakeries	Plano	Collin County	NULL	NULL
Yogurtville	Ice Cream and Frozen Dessert Manufacturing	Allen	Collin County	NULL	NULL
Frito-Lay North America, Inc.	Other Snack Food Manufacturing	Plano	Collin County	NULL	NULL
Pepsi-Cola Metropolitan Bottling Company, Inc.	Soft Drink Manufacturing	Plano	Collin County	NULL	NULL
Pepsico, Inc.	Other Snack Food Manufacturing	Plano	Collin County	NULL	NULL
Godiva Chocolatier, Inc.	Chocolate and Confectionery Manufacturing from Cacao Beans	Plano	Collin County	NULL	NULL
Pepsi-Cola Metropolitan Bottling Company, Inc.	Soft Drink Manufacturing	Plano	Collin County	NULL	NULL
Pepsico, Inc.	Soft Drink Manufacturing	Plano	Collin County	NULL	NULL
Millercoors LLC	Breweries	Plano	Collin County	NULL	NULL
CSM Bakery Solutions LLC	All Other Miscellaneous Food Manufacturing	Dallas	Dallas County	NULL	NULL
Flowers Bakeries, LLC	Commercial Bakeries	Dallas	Dallas County	NULL	NULL
Southern Foods Group, LLC	Fluid Milk Manufacturing	Dallas	Dallas County	NULL	NULL
Community Coffee Company, L.L.C.	Coffee and Tea Manufacturing	Dallas	Dallas County	NULL	NULL
Frito-Lay North America, Inc.	Other Snack Food Manufacturing	Dallas	Dallas County	NULL	NULL
Gruma Corporation	Soybean and Other Oilseed Processing	Irving	Dallas County	NULL	NULL
Johnson Bros. Bakery Supply, Inc.	Retail Bakeries	Carrollton	Dallas County	NULL	NULL
Darling Ingredients Inc.	Rendering and Meat Byproduct Processing	Dallas	Dallas County	NULL	NULL
Coca-Cola Refreshments Usa, Inc.	Soft Drink Manufacturing	Dallas	Dallas County	NULL	NULL
Dallas Tortillas Inc	Tortilla Manufacturing	Grand Prairie	Dallas County	NULL	NULL
Bridgford Foods Corporation	Flour Milling	Dallas	Dallas County	NULL	NULL
Bbu, Inc.	Retail Bakeries	Irving	Dallas County	NULL	NULL
Bimbo Bakeries Usa, Inc	Tortilla Manufacturing	Irving	Dallas County	NULL	NULL
I Chill Beverages, LLC	All Other Miscellaneous Food Manufacturing	Irving	Dallas County	NULL	NULL
Franklin Baking Company, LLC	Commercial Bakeries	Grand Prairie	Dallas County	NULL	NULL
The Hillshire Brands Company	Retail Bakeries	Carrollton	Dallas County	NULL	NULL
Treehouse Private Brands, Inc.	Cookie and Cracker Manufacturing	Carrollton	Dallas County	NULL	NULL
Pilgrim's Pride Corporation	Poultry Processing	Dallas	Dallas County	NULL	NULL
ABI Prima, LLC	Ice Cream and Frozen Dessert Manufacturing	Dallas	Dallas County	NULL	NULL
Quality Sausage Company, Inc.	Meat Processed from Carcasses	Dallas	Dallas County	NULL	NULL
McCormick & Company, Incorporated	Spice and Extract Manufacturing	Irving	Dallas County	NULL	NULL
The American Bottling Company	Soft Drink Manufacturing	Irving	Dallas County	NULL	NULL
The Heinz Kraft Company	Fruit and Vegetable Canning	Garland	Dallas County	NULL	NULL
Chiquita Brands International, Inc.	All Other Miscellaneous Food Manufacturing	Grand Prairie	Dallas County	NULL	NULL
Frito-Lay North America, Inc.	Other Snack Food Manufacturing	Carrollton	Dallas County	NULL	NULL
Omnilife Usa, Inc.	All Other Miscellaneous Food Manufacturing	Dallas	Dallas County	NULL	NULL
Dean Foods Company	Fluid Milk Manufacturing	Dallas	Dallas County	NULL	NULL
Border Foods, Inc.	Specialty Canning	Irving	Dallas County	NULL	NULL
Eastwest Bottlers, LLC	Soft Drink Manufacturing	Dallas	Dallas County	NULL	NULL
Paleteria La Super	Ice Cream and Frozen Dessert Manufacturing	Garland	Dallas County	NULL	NULL
Dawn Food Products, Inc.	Dry Pasta, Dough, and Flour Mixes Manufacturing from Purchased Flour	Garland	Dallas County	NULL	NULL
Remy Cointreau Usa, Inc.	Distilleries	Dallas	Dallas County	NULL	NULL
A & J Bakery	Retail Bakeries	Dallas	Dallas County	NULL	NULL
Frito-Lay North America, Inc.	Commercial Bakeries	Dallas	Dallas County	NULL	NULL
Daisy Brand, LLC	Fluid Milk Manufacturing	Garland	Dallas County	NULL	NULL
Rudolph Foods Company, Inc.	Other Snack Food Manufacturing	Dallas	Dallas County	NULL	NULL
CRS Proppants LLC	Fats and Oils Refining and Blending	Dallas	Dallas County	NULL	NULL
Gruma Corporation	Other Snack Food Manufacturing	Dallas	Dallas County	NULL	NULL
Pepperidge Farm, Incorporated	Retail Bakeries	Garland	Dallas County	NULL	NULL
Kerry Inc.	Spice and Extract Manufacturing	Dallas	Dallas County	NULL	NULL
Dr Pepper Snapple Group, Inc.	Soft Drink Manufacturing	Dallas	Dallas County	NULL	NULL
Tyson Foods, Inc.	Animal (except Poultry) Slaughtering	Dallas	Dallas County	NULL	NULL
Coco Lopez, Inc.	Fruit and Vegetable Canning	Desoto	Dallas County	NULL	NULL
Dr Pepper/Seven Up, Inc.	Soft Drink Manufacturing	Dallas	Dallas County	NULL	NULL

The American Bottling Company	Soft Drink Manufacturing	Dallas	Dallas County	NULL	NULL
Pepsi-Cola Metropolitan Bottling Company, Inc.	Soft Drink Manufacturing	Mesquite	Dallas County	NULL	NULL
Frito-Lay North America, Inc.	Other Snack Food Manufacturing	Addison	Dallas County	NULL	NULL
Mizkan Americas, Inc.	Spice and Extract Manufacturing	Dallas	Dallas County	NULL	NULL
Texas By-Products Partnership	Rendering and Meat Byproduct Processing	Dallas	Dallas County	NULL	NULL
Snap Kitchen 3, LLC	All Other Miscellaneous Food Manufacturing	Dallas	Dallas County	NULL	NULL
Dread Head Chef, LLC	All Other Miscellaneous Food Manufacturing	Dallas	Dallas County	NULL	NULL
C.H. Guenther & Son LLC	Flour Milling	Duncanville	Dallas County	NULL	NULL
The Coca-Cola Company	Soft Drink Manufacturing	Dallas	Dallas County	NULL	NULL
Frito-Lay North America, Inc.	Other Snack Food Manufacturing	Irving	Dallas County	NULL	NULL
Le Raisin Imports LLC	Wineries	Dallas	Dallas County	NULL	NULL
Frost Cupcakery, Inc.	Frozen Cakes, Pies, and Other Pastries Manufacturing	Coppell	Dallas County	NULL	NULL
Bimbo Bakeries Usa, Inc	Commercial Bakeries	Richardson	Dallas County	NULL	NULL
Snap Kitchen 3, LLC	All Other Miscellaneous Food Manufacturing	Dallas	Dallas County	NULL	NULL
Del Norte Bakery Inc	Retail Bakeries	Dallas	Dallas County	NULL	NULL
Exel North American Logistics, Inc.	Perishable Prepared Food Manufacturing	Grand Prairie	Dallas County	NULL	NULL
Bridgford Foods Corporation	Frozen Specialty Food Manufacturing	Dallas	Dallas County	NULL	NULL
The Hillshire Brands Company	Meat Processed from Carcasses	Irving	Dallas County	NULL	NULL
E. A. Sween Company	All Other Miscellaneous Food Manufacturing	Lewisville	Denton County	NULL	NULL
Farmer Bros. Co.	Coffee and Tea Manufacturing	Northlake	Denton County	NULL	NULL
O D C L Inc	All Other Miscellaneous Food Manufacturing	Lewisville	Denton County	NULL	NULL
E. & J. Gallo Winery	Wineries	Frisco	Denton County	NULL	NULL
Godiva Chocolatier, Inc.	Chocolate and Confectionery Manufacturing from Cacao Beans	Frisco	Denton County	NULL	NULL
Savannah's Sweet Treats LLC	Retail Bakeries	Lewisville	Denton County	NULL	NULL
Nestle Usa, Inc.	Dry, Condensed, and Evaporated Dairy Product Manufacturing	Carrollton	Denton County	NULL	NULL
Bimbo Bakeries Usa, Inc	Commercial Bakeries	Denton	Denton County	NULL	NULL
Schreiber Foods, Inc.	Cheese Manufacturing	Stephenville	Erath County	NULL	NULL
AB Mauri Food Inc.	Commercial Bakeries	Greenville	Hunt County	NULL	NULL
The American Bottling Company	Soft Drink Manufacturing	Corsicana	Navarro County	NULL	NULL
Zeeland Farm Services, Inc.	Soybean and Other Oilseed Processing	Millsap	Parker County	NULL	NULL
Bimbo Bakeries Usa, Inc	Commercial Bakeries	Weatherford	Parker County	NULL	NULL
Pepsi-Cola Metropolitan Bottling Company, Inc.	Soft Drink Manufacturing	Arlington	Tarrant County	NULL	NULL
Heinz Kraft Foods Company	All Other Miscellaneous Food Manufacturing	Fort Worth	Tarrant County	NULL	NULL
Ventura Foods, LLC	Fats and Oils Refining and Blending	Saginaw	Tarrant County	NULL	NULL
Nestle Usa, Inc.	Dry, Condensed, and Evaporated Dairy Product Manufacturing	Fort Worth	Tarrant County	NULL	NULL
The Dannon Company Inc	Fluid Milk Manufacturing	Fort Worth	Tarrant County	NULL	NULL
Nestle Usa, Inc.	Dry, Condensed, and Evaporated Dairy Product Manufacturing	Fort Worth	Tarrant County	NULL	NULL
Dean Foods Company	Fluid Milk Manufacturing	Fort Worth	Tarrant County	NULL	NULL
Refresco Beverages US Inc.	Breweries	Fort Worth	Tarrant County	NULL	NULL
CSC Sugar, LLC	Cane Sugar Manufacturing	Fort Worth	Tarrant County	NULL	NULL
Royal Cup Inc.	Coffee and Tea Manufacturing	Arlington	Tarrant County	NULL	NULL
Conagra Brands, Inc	Flour Milling	Saginaw	Tarrant County	NULL	NULL
Agrana Fruit Us, Inc.	Fruit and Vegetable Canning	Fort Worth	Tarrant County	NULL	NULL
C.H. Guenther & Son LLC	Commercial Bakeries	Arlington	Tarrant County	NULL	NULL
Burgundy Pasture Beef	Animal (except Poultry) Slaughtering	Fort Worth	Tarrant County	NULL	NULL
Austin Coca-Cola Bottling Company	Soft Drink Manufacturing	Fort Worth	Tarrant County	NULL	NULL
The Coca-Cola Company	Soft Drink Manufacturing	Fort Worth	Tarrant County	NULL	NULL
Dairy Farmers of America, Inc.	Fluid Milk Manufacturing	Grapevine	Tarrant County	NULL	NULL
The Hillshire Brands Company	Frozen Specialty Food Manufacturing	Fort Worth	Tarrant County	NULL	NULL
Jbs USA Food Company	Animal (except Poultry) Slaughtering	Fort Worth	Tarrant County	NULL	NULL
Ardent Mills LLC	Flour Milling	Saginaw	Tarrant County	NULL	NULL
Crossroads Winery	Wineries	Grapevine	Tarrant County	NULL	NULL
BOBBY G SMITH DO	Wineries	Grapevine	Tarrant County	NULL	NULL
La Nueva Riograndese Inc	Tortilla Manufacturing	Fort Worth	Tarrant County	NULL	NULL

Keebler Company	Cookie and Cracker Manufacturing	Fort Worth	Tarrant County	NULL	NULL
Conagra Brands, Inc	All Other Miscellaneous Food Manufacturing	Fort Worth	Tarrant County	NULL	NULL
Frito-Lay North America, Inc.	Other Snack Food Manufacturing	Fort Worth	Tarrant County	NULL	NULL
Bimbo Bakeries Usa, Inc	Commercial Bakeries	River Oaks	Tarrant County	NULL	NULL
Celebrity Cafe Management LLC	Retail Bakeries	Colleyville	Tarrant County	NULL	NULL
Bimbo Bakeries Usa, Inc	Commercial Bakeries	Watauga	Tarrant County	NULL	NULL
Evans Foods, Inc.	Other Snack Food Manufacturing	Arlington	Tarrant County	NULL	NULL
LLANO ESTACADO WINERY, INC.	Wineries	Colleyville	Tarrant County	NULL	NULL
Tyson Foods, Inc.	Meat Processed from Carcasses	Fort Worth	Tarrant County	NULL	NULL
Bunge Oils, Inc.	Fats and Oils Refining and Blending	Fort Worth	Tarrant County	NULL	NULL
Millercoors LLC	Breweries	Fort Worth	Tarrant County	NULL	NULL
Farmer Bros. Co.	Coffee and Tea Manufacturing	Arlington	Tarrant County	NULL	NULL
Bimbo Bakeries Usa, Inc	Retail Bakeries	Fort Worth	Tarrant County	NULL	NULL
Tyson Foods, Inc.	Poultry Processing	Fort Worth	Tarrant County	NULL	NULL
Farmer Bros. Co.	Coffee and Tea Manufacturing	Arlington	Tarrant County	NULL	NULL
NV Cupcakes	Commercial Bakeries	Fort Worth	Tarrant County	NULL	NULL
The Kroger Co	Fluid Milk Manufacturing	Fort Worth	Tarrant County	NULL	NULL
Frito-Lay North America, Inc.	Other Snack Food Manufacturing	Arlington	Tarrant County	NULL	NULL
Mrs Baird's Bakeries Business Trust	Commercial Bakeries	Fort Worth	Tarrant County	6065.000000	19453.900000
SFG Management Limited Liability Company	Fluid Milk Manufacturing	Dallas	Dallas County	3669.500000	11770.200000
Pioneer Frozen Foods, Inc.	Commercial Bakeries	Duncanville	Dallas County	2803.200000	8991.500000
Vasari, LLC	Ice Cream and Frozen Dessert Manufacturing	Irving	Dallas County	2772.900000	8894.100000
Rudy's Food Products, Inc.	Other Snack Food Manufacturing	Carrollton	Dallas County	1855.000000	5950.000000
Dalton's Best Maid Products, Incorporated	Fruit and Vegetable Canning	Fort Worth	Tarrant County	1761.800000	5651.000000
CTI Arlington, LLC	Specialty Canning	Saginaw	Tarrant County	1588.900000	5096.600000
Austin Coca-Cola Bottling Company	Soft Drink Manufacturing	Dallas	Dallas County	1415.100000	4539.000000
Dr Pepper Snapple Group Employee Relief Fund	Soft Drink Manufacturing	Plano	Collin County	1302.300000	4177.200000
Dannon Company, Inc.	Fluid Milk Manufacturing	Fort Worth	Tarrant County	1256.100000	4029.000000
Standard Meat Company, L.P.	Meat Processed from Carcasses	Dallas	Dallas County	1066.400000	3420.700000
Cott Beverages Inc.	Breweries	Dallas	Dallas County	1012.500000	3247.700000
Dallas U.S.A. Foods, Inc.	Poultry Processing	Dallas	Dallas County	795.000000	2550.000000
Prime Deli Corporation	Perishable Prepared Food Manufacturing	Lewisville	Denton County	710.400000	2278.800000
Coca-Cola Enterprises Bottling	Soft Drink Manufacturing	Dallas	Dallas County	666.800000	2138.700000
Lobo Tortilla Factory, Inc.	Tortilla Manufacturing	Dallas	Dallas County	620.500000	1990.200000
Buzzballz, LLC	Distilleries	Carrollton	Dallas County	604.200000	1938.000000
Van Oriental Food, Inc.	All Other Miscellaneous Food Manufacturing	Dallas	Dallas County	598.800000	1920.600000
Bakery Express of Central Texas, LP	Commercial Bakeries	Lewisville	Denton County	553.400000	1775.100000
CTI Saginaw I, LLC	Specialty Canning	Saginaw	Tarrant County	544.900000	1747.800000
Nutribiotech Usa, Inc.	Dry, Condensed, and Evaporated Dairy Product Manufacturing	Garland	Dallas County	530.000000	1700.000000
Jus-Made, LP	Flavoring Syrup and Concentrate Manufacturing	Dallas	Dallas County	509.200000	1633.300000
Pepsi Bottling Group	Soft Drink Manufacturing	Mesquite	Dallas County	495.600000	1589.600000
The Paper Plate Incorporated	All Other Miscellaneous Food Manufacturing	Dallas	Dallas County	493.100000	1581.800000
La Mexicana Tortilla Factory, Inc.	Tortilla Manufacturing	Duncanville	Dallas County	493.100000	1581.700000
Mibo Fresh Foods, LLC	Frozen Fruit, Juice, and Vegetable Manufacturing	Fort Worth	Tarrant County	464.200000	1489.000000
Blue Ribbon Products Inc.	All Other Miscellaneous Food Manufacturing	Dallas	Dallas County	460.100000	1475.700000
McCormick & Company Incorporated	Spice and Extract Manufacturing	Irving	Dallas County	436.800000	1401.200000
Precise Food Ingredients, Inc.	Spice and Extract Manufacturing	Carrollton	Denton County	406.800000	1304.900000
Rio Star Foods, Inc.	Poultry Processing	Dallas	Dallas County	396.000000	1270.100000
John Hogan Interests, Inc.	All Other Miscellaneous Food Manufacturing	Dallas	Dallas County	379.300000	1216.600000
Quality Star Products, Ltd.	Frozen Specialty Food Manufacturing	Garland	Dallas County	371.000000	1189.900000
Precision Formulations, LLC	Frozen Fruit, Juice, and Vegetable Manufacturing	Dallas	Dallas County	367.700000	1179.300000
Bartush-Schnitzius Foods Co.	Mayonnaise, Dressing, and Other Prepared Sauce Manufacturing	Lewisville	Denton County	359.000000	1151.500000
Deen Wholesale Meat Co.	All Other Miscellaneous Food Manufacturing	Fort Worth	Tarrant County	344.500000	1105.000000
Fortis Foods International, LP	Meat Processed from Carcasses	Frisco	Denton County	305.500000	980.000000

Heritage Family Specialty Foods, Inc.	Mayonnaise, Dressing, and Other Prepared Sauce Manufacturing	Grand Prairie	Dallas County	303.000000	972.000000
Lopez Tortilla Foods, Inc.	Other Snack Food Manufacturing	Dallas	Dallas County	294.900000	945.700000
M & M Italian Style Foods, Inc.	Meat Processed from Carcasses	Roanoke	Denton County	289.000000	927.000000
Wholesome Group, LLC	Frozen Specialty Food Manufacturing	Plano	Collin County	283.500000	909.300000
Usplabs, LLC	Dry, Condensed, and Evaporated Dairy Product Manufacturing	Dallas	Dallas County	275.500000	883.700000
Formulife, Inc.	Dry, Condensed, and Evaporated Dairy Product Manufacturing	Allen	Collin County	268.400000	860.800000
The Pickle Juice Company	Soft Drink Manufacturing	Mesquite	Dallas County	265.000000	850.000000
Pretzels, Inc	Other Snack Food Manufacturing	Carrollton	Dallas County	252.600000	810.400000
Renfro Foods, Inc.	Fruit and Vegetable Canning	Fort Worth	Tarrant County	242.500000	777.800000
Gourmet Cuisine, Inc.	Frozen Specialty Food Manufacturing	Mesquite	Dallas County	241.400000	774.200000
Garland Ventures, Ltd.	Frozen Specialty Food Manufacturing	Garland	Dallas County	216.900000	695.700000
Premark Health Science, Inc.	Dry, Condensed, and Evaporated Dairy Product Manufacturing	Irving	Dallas County	209.500000	672.000000
Georgia Sandwich Company, Inc.	Perishable Prepared Food Manufacturing	Southlake	Tarrant County	208.300000	668.000000
Bimbo Bakeries Usa, Inc	Commercial Bakeries	Rockwall	Rockwall County	204.800000	656.800000
Xochitl Inc.	Spice and Extract Manufacturing	Irving	Dallas County	202.700000	650.100000
ABF Packing, Inc.	Animal (except Poultry) Slaughtering	Dublin	Erath County	201.300000	645.700000
Epi Breads LLC	Commercial Bakeries	Dallas	Dallas County	198.300000	636.100000
Bcw Food Products Inc.	Dry Pasta, Dough, and Flour Mixes Manufacturing from Purchased Flour	Dallas	Dallas County	196.900000	631.600000
Circle U Foods, Inc.	Spice and Extract Manufacturing	Fort Worth	Tarrant County	195.000000	625.400000
National Food and Beverage Incorporated	Spice and Extract Manufacturing	Dallas	Dallas County	190.200000	610.100000
Jgr Enterprises LLC	Dry Pasta, Dough, and Flour Mixes Manufacturing from Purchased Flour	Fort Worth	Tarrant County	186.400000	597.900000
R. Ibarra's, Inc.	Flour Milling	Fort Worth	Tarrant County	184.600000	592.100000
First Place Foods, LLC	Fruit and Vegetable Canning	Garland	Dallas County	174.000000	558.100000
DUBLIN BOTTLING WORKS, INC.	Soft Drink Manufacturing	Dublin	Erath County	171.200000	549.200000
Clements Nut Co, Inc	Roasted Nuts and Peanut Butter Manufacturing	Lewisville	Denton County	168.800000	541.500000
Cain Food Industries, Inc.	All Other Miscellaneous Food Manufacturing	Dallas	Dallas County	168.300000	539.800000
Miller Brewing	Breweries	Fort Worth	Tarrant County	153.700000	493.100000
Bridgford Food Processing of Texas L.P.	Dry Pasta, Dough, and Flour Mixes Manufacturing from Purchased Flour	Dallas	Dallas County	152.800000	490.000000
Dazzlepie Partners, Ltd.	All Other Miscellaneous Food Manufacturing	Dallas	Dallas County	149.900000	481.000000
BALLY UNITED PRODUCE, LTD.	Poultry Processing	Garland	Dallas County	145.300000	466.100000
Figueroa Brothers, Inc.	Spice and Extract Manufacturing	Irving	Dallas County	141.300000	453.300000
Maui Foods International, Inc.	Dry Pasta, Dough, and Flour Mixes Manufacturing from Purchased Flour	Dallas	Dallas County	140.400000	450.200000
Rolling Frito-Lay Sales, LP	Other Snack Food Manufacturing	Plano	Collin County	140.200000	449.600000
Lwc Brands, Inc.	Cookie and Cracker Manufacturing	Dallas	Dallas County	133.900000	429.600000
Texas Ingredient Corporation	Breweries	Cleburne	Johnson County	132.500000	425.000000
Rodriguez Foods, Ltd.	Specialty Canning	Fort Worth	Tarrant County	132.500000	425.100000
CTI Foods Acquisition LLC	Specialty Canning	Saginaw	Tarrant County	132.500000	425.000000
Kracker Enterprises, LLC	Cookie and Cracker Manufacturing	Plano	Collin County	131.100000	420.700000
La Hacienda Mexican Food Products, Inc.	All Other Miscellaneous Food Manufacturing	Dallas	Dallas County	126.200000	404.600000
T. W. BURLESON & SON, INC.	All Other Miscellaneous Food Manufacturing	Waxahachie	Ellis County	118.400000	379.800000
Richard E. Colgin I. Ltd.	Mayonnaise, Dressing, and Other Prepared Sauce Manufacturing	Dallas	Dallas County	115.500000	370.300000
Hillary's Sweet Temptations, Inc.	Commercial Bakeries	Garland	Dallas County	111.300000	357.000000
Paciugo Supply Co. LP	Ice Cream and Frozen Dessert Manufacturing	Dallas	Dallas County	107.700000	345.300000
Classic Foods, L.P.	Spice and Extract Manufacturing	Fort Worth	Tarrant County	105.900000	339.600000
The Van Tone Creative Flavors Inc	Spice and Extract Manufacturing	Terrell	Kaufman County	100.800000	323.400000

NAME	NAICS_CODE_DESCRIPTION	CITY	COUNTY	EXCESSFOOD_TC	EXCESSFOOD_TONYEAR_HIGHEST
504 North O'Conner, Inc.	Supermarkets and Other Grocery (except Convenience) Stores	Irving	Dallas County	114.6	418
The Kroger Co	Supermarkets and Other Grocery (except Convenience) Stores	Rockwall	Rockwall County	114.6	696
Wisconsin's Finest, Inc.	Dairy Product (except Dried or Canned) Merchant Wholesalers	Plano	Collin County	94.4	147
ISA Solutions, LLC	Meat and Meat Product Merchant Wholesalers	Plano	Collin County	94.4	147
Echo Food Group, L.L.C.	General Line Grocery Merchant Wholesalers	Dallas	Dallas County	94.4	147
Lipman-Texas, LLC	Fresh Fruit and Vegetable Merchant Wholesalers	Dallas	Dallas County	94.4	147
International Food Associates, Inc.	Other Grocery and Related Products Merchant Wholesalers	Irving	Dallas County	94.4	150
Fast-Pak Supply Corp.	Meat and Meat Product Merchant Wholesalers	Dallas	Dallas County	94.4	147
Sakom Investment, Ltd.	Confectionery Merchant Wholesalers	Dallas	Dallas County	94.4	156
Dallas Meat Distributors, LLC	Meat and Meat Product Merchant Wholesalers	Dallas	Dallas County	94.4	150
Redstone Foods, Inc.	Confectionery Merchant Wholesalers	Carrollton	Denton County	94.4	147
Lipotec Usa, Inc.	Other Grocery and Related Products Merchant Wholesalers	Lewisville	Denton County	94.4	160
Dorado Chemical	Fresh Fruit and Vegetable Merchant Wholesalers	Rockwall	Rockwall County	94.4	147
Bwjw, Inc.	Meat and Meat Product Merchant Wholesalers	Fort Worth	Tarrant County	94.4	160
West Trading Company	Meat and Meat Product Merchant Wholesalers	Fort Worth	Tarrant County	94.4	147
Texas Wholesale 2	General Line Grocery Merchant Wholesalers	Fort Worth	Tarrant County	94.4	147
Southstar LLC	Other Grocery and Related Products Merchant Wholesalers	Fort Worth	Tarrant County	94.4	147
The Kroger Co	Supermarkets and Other Grocery (except Convenience) Stores	Cedar Hill	Dallas County	86.499995	418
Premier Produce Services, L.L.C.	Fruit and Vegetable Markets	Fort Worth	Tarrant County	85	155
Intermex Products Usa, Ltd.	Other Grocery and Related Products Merchant Wholesalers	Grand Prairie	Dallas County	81.4709	147
Prime Produce, Inc.	Fresh Fruit and Vegetable Merchant Wholesalers	Dallas	Dallas County	80	147
Winn Meat Company, L.P.	Meat and Meat Product Merchant Wholesalers	Dallas	Dallas County	78.261895	147
Gilmore, R R & C Produce Inc	Fresh Fruit and Vegetable Merchant Wholesalers	Dallas	Dallas County	77.717065	147
J.K. Paty Meat Co. Inc.	Meat and Meat Product Merchant Wholesalers	Dallas	Dallas County	77.70303	147
Fresh One, LLC	Other Grocery and Related Products Merchant Wholesalers	Dallas	Dallas County	68.50518	147
Interex Corp.	Other Grocery and Related Products Merchant Wholesalers	Fort Worth	Tarrant County	66.240065	147
Sam's West, Inc.	Warehouse Clubs and Supercenters	Westworth Village	Tarrant County	63.45	118
Sam's West, Inc.	Warehouse Clubs and Supercenters	Dallas	Dallas County	60.75	112
Kroger Texas L.P.	Supermarkets and Other Grocery (except Convenience) Stores	Cleburne	Johnson County	60	290
Dallas Direct Distributing LLC	Fresh Fruit and Vegetable Merchant Wholesalers	Crandall	Kaufman County	60	147
Brothers Produce of Dallas, Inc.	Fruit and Vegetable Markets	Garland	Dallas County	59.89824	117
Correctional Food Services Gp, Incorporated	General Line Grocery Merchant Wholesalers	Dallas	Dallas County	57.58245	147
Vending Nut Co., Inc.	Confectionery Merchant Wholesalers	Fort Worth	Tarrant County	57.5	147
Sam's West, Inc.	Warehouse Clubs and Supercenters	Fort Worth	Tarrant County	55.89	104
Sam's West, Inc.	Warehouse Clubs and Supercenters	Plano	Collin County	54	100
Costco Wholesale Corporation	Warehouse Clubs and Supercenters	Frisco	Denton County	53.46	99
Costco Wholesale Corporation	Warehouse Clubs and Supercenters	Greenville	Hunt County	53.19	98
Costco Wholesale Corporation	Warehouse Clubs and Supercenters	Rockwall	Rockwall County	53.19	98
Costco Wholesale Corporation	Warehouse Clubs and Supercenters	Dallas	Dallas County	52.92	98
Costco Wholesale Corporation	Warehouse Clubs and Supercenters	Lewisville	Denton County	52.92	98
Costco Wholesale Corporation	Warehouse Clubs and Supercenters	Frisco	Denton County	52.92	98
Coosemans Dallas Inc	Fresh Fruit and Vegetable Merchant Wholesalers	Dallas	Dallas County	52.5	147
Costco Wholesale Corporation	Warehouse Clubs and Supercenters	Plano	Collin County	51.3	95
Sam's West, Inc.	Warehouse Clubs and Supercenters	Dallas	Dallas County	51.03	94
Loh's Corporation	Supermarkets and Other Grocery (except Convenience) Stores	Grand Prairie	Dallas County	50	209
C & L Foods Inc	Poultry and Poultry Product Merchant Wholesalers	Dallas	Dallas County	50	147
Frankie V'S Kitchen, LLC	Other Grocery and Related Products Merchant Wholesalers	Dallas	Dallas County	50	147
Andrew Robbins Holdings, LLC	Confectionery Merchant Wholesalers	Frisco	Denton County	50	147
Processing Partners, Ltd.	Meat and Meat Product Merchant Wholesalers	Dallas	Dallas County	49.291435	147

Name	Service	City	County	EXCESSFOOD TONYEAR LOWEST	EXCESSFOOD TONYEAR HIGHEST
				-	-
Gmri, Inc.	Full-Service Restaurants	Mesquite	Dallas Cou	166	204
Gmri, Inc.	Full-Service Restaurants	Addison	Dallas Cou	166	204
Cracker Barrel Old Country Store, Inc.	Full-Service Restaurants	Denton	Denton Co	166	204
Gmri, Inc.	Full-Service Restaurants	Frisco	Denton Co	166	204
Cheddar's Casual Cafe, Inc.	Full-Service Restaurants	Arlington	Tarrant Co	166	204
Joe's Crab Shack - Texas, Inc.	Full-Service Restaurants	Grapevine	Tarrant Co	166	204
Pappas Restaurants, Inc.	Full-Service Restaurants	Fort Worth	Tarrant Co	165.6	203.52
Red Lobster Hospitality LLC	Full-Service Restaurants	Arlington	Tarrant Co	165.6	203.52
Otb Acquisition LLC	Full-Service Restaurants	Irving	Dallas Cou	164.22	201.82
Flying Food Group, Inc.	Caterers	Grapevine	Tarrant Co	163	200
Terry's Supermarket Management L.L.C.	Full-Service Restaurants	Lewisville	Denton Co	158.7	195.04
Food Concepts International, Inc.	Full-Service Restaurants	Hurst	Tarrant Co	155	190
Cracker Barrel Old Country Store, Inc.	Full-Service Restaurants	Allen	Collin Cour	152	187
Cheddar's Casual Cafe, Inc.	Full-Service Restaurants	Irving	Dallas Cou	152	187
Gmri, Inc.	Full-Service Restaurants	Duncanville	Dallas Cou	152	187
Uncle Julio's of Texas, Inc.	Full-Service Restaurants	Allen	Collin Cour	152	187
Romano's Macaroni Grill, Inc.	Limited-Service Restaurants	Dallas	Dallas Cou	150	180
Cheddar's Casual Cafe, Inc.	Full-Service Restaurants	Allen	Collin Cour	149	183
Cheddar's Casual Cafe, Inc.	Full-Service Restaurants	Irving	Dallas Cou	149	183
Bravo Brio Restaurant Group, Inc.	Limited-Service Restaurants	Southlake	Tarrant Co	148	179
Pappas Restaurants, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	148	181
Pappas Restaurants, Inc.	Full-Service Restaurants	Arlington	Tarrant Co	148	181
Uncle Julio's of Texas, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	145	178
Uncle Julio's Corporation	Full-Service Restaurants	Grapevine	Tarrant Co	144	176
Razzoo's, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	142	175
FSI Restaurant Development Limited	Full-Service Restaurants	Plano	Collin Cour	138	170
Gmri, Inc.	Full-Service Restaurants	Mckinney	Collin Cour	138	170
Bloomin' Brands, Inc.	Full-Service Restaurants	Irving	Dallas Cou	138	170

Cheddar's Casual Cafe, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	138	170
Cheddar's Casual Cafe, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	138	170
Chili's, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	138	170
Gmri, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	138	170
Gmri, Inc.	Full-Service Restaurants	Irving	Dallas Cou	138	170
Gmri, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	138	170
Hillstone Restaurant Group, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	138	170
Hillstone Restaurant Group, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	138	170
Chili's, Inc.	Full-Service Restaurants	Denton	Denton Co	138	170
Chili's, Inc.	Full-Service Restaurants	Fort Worth	Tarrant Co	138	170
Chili's, Inc.	Full-Service Restaurants	Arlington	Tarrant Co	138	170
Gmri, Inc.	Full-Service Restaurants	Arlington	Tarrant Co	138	170
Gmri, Inc.	Full-Service Restaurants	Fort Worth	Tarrant Co	138	170
Gmri, Inc.	Full-Service Restaurants	Fort Worth	Tarrant Co	138	170
TGI Friday's, Inc.	Full-Service Restaurants	Plano	Collin Cour	138	170
Red Lobster Hospitality LLC	Full-Service Restaurants	Mesquite	Dallas Cou	138	170
Sky Chefs, Inc.	Caterers	Irving	Dallas Cou	138	170
TGI Friday's, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	138	170
Texas Roadhouse Holdings, LLC	Full-Service Restaurants	Mesquite	Dallas Cou	138	170
Texas Roadhouse Holdings, LLC	Full-Service Restaurants	Grand Prai	Dallas Cou	138	170
Texas Wings, Incorporated	Full-Service Restaurants	Dallas	Dallas Cou	138	170
Outback Steakhouse of Florida, LLC	Full-Service Restaurants	Lewisville	Denton Co	138	170
Red Lobster Hospitality LLC	Full-Service Restaurants	Lewisville	Denton Co	138	170
On The Border Corporation	Full-Service Restaurants	Burleson	Johnson Co	138	170
Pappas Restaurants, Inc.	Full-Service Restaurants	Fort Worth	Tarrant Co	138	170
Razzoo's, Inc.	Full-Service Restaurants	Arlington	Tarrant Co	138	170
Razzoo's, Inc.	Full-Service Restaurants	Fort Worth	Tarrant Co	138	170
Stemnones Compadres Ltd	Caterers	Colleyville	Tarrant Co	138	170
Texas Wings, Incorporated	Full-Service Restaurants	Arlington	Tarrant Co	138	170
Julios Uncle Corporation	Full-Service Restaurants	Dallas	Dallas Cou	137	168
Gmri, Inc.	Full-Service Restaurants	Arlington	Tarrant Co	135	166
Razzoo's, Inc.	Full-Service Restaurants	Mesquite	Dallas Cou	134	165

Razzoo's, Inc.	Full-Service Restaurants	Lewisville	Denton Co	134	165
Razzoo's, Inc.	Full-Service Restaurants	Fort Worth	Tarrant Co	134	165
Gmri, Inc.	Full-Service Restaurants	Garland	Dallas Cou	132	163
Gmri, Inc.	Full-Service Restaurants	Denton	Denton Co	132	163
Gmri, Inc.	Full-Service Restaurants	Burleson	Johnson C	132	163
Red Lobster Hospitality LLC	Full-Service Restaurants	Plano	Collin Cour	132.5	162.8
Red Lobster Hospitality LLC	Full-Service Restaurants	Irving	Dallas Cou	132.5	162.8
TGI Friday's, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	132.5	162.8
Red Lobster Hospitality LLC	Full-Service Restaurants	Denton	Denton Co	132.5	162.8
Bravo Brio Restaurant Group, Inc.	Limited-Service Restaurants	Allen	Collin Cour	132	159
Applebee's International, Inc.	Full-Service Restaurants	Duncanvill	Dallas Cou	131	161
FSI Restaurant Development Limited	Full-Service Restaurants	Fort Worth	Tarrant Co	131	161
Texas Roadhouse, Inc.	Full-Service Restaurants	Mansfield	Tarrant Co	128	158
P.F. Chang's China Bistro, Inc.	Full-Service Restaurants	Arlington	Tarrant Co	127	156
Texas Roadhouse, Inc.	Full-Service Restaurants	Fort Worth	Tarrant Co	127	156
Mac Parent LLC	Limited-Service Restaurants	Fort Worth	Tarrant Co	125	150
Mac Parent LLC	Limited-Service Restaurants	Arlington	Tarrant Co	125	150
Mac Parent LLC	Limited-Service Restaurants	Grapevine	Tarrant Co	125	150
Chili's, Inc.	Full-Service Restaurants	Richardson	Dallas Cou	124	153
Gmri, Inc.	Full-Service Restaurants	Grapevine	Tarrant Co	124	153
Maggiano's, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	124	153
Red Lobster Hospitality LLC	Full-Service Restaurants	Dallas	Dallas Cou	124	153
Brinker International, Inc.	Full-Service Restaurants	Wylie	Collin Cour	123	151
Brinker International, Inc.	Full-Service Restaurants	Mckinney	Collin Cour	123	151
Brinker International, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	123	151
Brinker International, Inc.	Full-Service Restaurants	Frisco	Denton Co	123	151
Brinker International, Inc.	Full-Service Restaurants	Euless	Tarrant Co	123	151
Brinker International, Inc.	Full-Service Restaurants	Fort Worth	Tarrant Co	123	151
Gmri, Inc.	Limited-Service Restaurants	Plano	Collin Cour	122	147
Humperdink's Texas, L.L.c	Limited-Service Restaurants	Dallas	Dallas Cou	121	146
Eureka Restaurant Group, LLC	Limited-Service Restaurants	Dallas	Dallas Cou	120	144
Luby's Restaurants Limited Partnership	Cafeterias, Grill Buffets, and Buf	De Soto	Dallas Cou	117	144

Red Lobster Hospitality LLC	Full-Service Restaurants	Duncanvill	Dallas Cou	117	144
Saltgrass, Inc.	Full-Service Restaurants	Cedar Hill	Dallas Cou	117	144
Rita Restaurant Corp.	Full-Service Restaurants	North Rich	Tarrant Co	117	144
Cracker Barrel Old Country Store, Inc.	Full-Service Restaurants	Weatherfo	Parker Cou	116	142
Cracker Barrel Old Country Store, Inc.	Full-Service Restaurants	Grapevine	Tarrant Co	116	142
On The Border Corporation	Full-Service Restaurants	Garland	Dallas Cou	115.92	142.46
Apple Texas Restaurants, Inc.	Full-Service Restaurants	Grand Prai	Dallas Cou	115	141
Razzoo's, Inc.	Full-Service Restaurants	Garland	Dallas Cou	114.54	140.77
Razzoo's, Inc.	Full-Service Restaurants	Mckinney	Collin Cour	113.16	139.07
Cec Entertainment, Inc.	Limited-Service Restaurants	Dallas	Dallas Cou	112	135
Zoe's Kitchen, Inc.	Limited-Service Restaurants	Fort Worth	Tarrant Co	112.23	135
Brinker International, Inc.	Limited-Service Restaurants	Corsicana	Navarro Co	111	134
Chili's, Inc.	Full-Service Restaurants	Allen	Collin Cour	110	136
Joe's Crab Shack - Texas, Inc.	Full-Service Restaurants	Plano	Collin Cour	110	136
Last Call Operating Co I., Inc.	Full-Service Restaurants	Dallas	Collin Cour	110	136
Chili's, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	110	136
Chili's, Inc.	Full-Service Restaurants	Carrollton	Denton Co	110	136
Chili's, Inc.	Full-Service Restaurants	Frisco	Denton Co	110	136
Dos Gringos, Inc.	Full-Service Restaurants	Arlington	Tarrant Co	110	136
FSI Restaurant Development Limited	Full-Service Restaurants	Fort Worth	Tarrant Co	110	136
L C 2rt	Full-Service Restaurants	Hurst	Tarrant Co	110	136
Luby's Restaurants Limited Partnership	Cafeterias, Grill Buffets, and Buf	Mesquite	Dallas Cou	110.4	135.68
Outback Steakhouse of Florida, LLC	Full-Service Restaurants	Addison	Dallas Cou	110.4	135.68
On The Border Corporation	Full-Service Restaurants	Bedford	Tarrant Co	110.4	135.68
Outback Steakhouse of Florida, LLC	Full-Service Restaurants	Fort Worth	Tarrant Co	110.4	135.68
Outback Steakhouse of Florida, LLC	Full-Service Restaurants	Hurst	Tarrant Co	110.4	135.68
Consolidated Restaurant Operations, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	109	134
El Chico Restaurants, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	109	134
FSI Restaurant Development Limited	Full-Service Restaurants	Dallas	Dallas Cou	108	132
Mac Parent LLC	Limited-Service Restaurants	Plano	Collin Cour	106	127.5
Pluckers Wing Factory, A Limited Partnersh	Limited-Service Restaurants	Dallas	Dallas Cou	106	127.5
Pluckers Wing Factory, A Limited Partnersh	Limited-Service Restaurants	Grapevine	Tarrant Co	106	127.5

Pluckers Wing Factory, A Limited Partnersh	Limited-Service Restaurants	Arlington	Tarrant Co	106	127.5
Houlihan's Restaurants, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	105	129
Bl Restaurant Operations, LLC	Full-Service Restaurants	Dallas	Dallas Cou	104	127
Cracker Barrel Old Country Store, Inc.	Full-Service Restaurants	Mesquite	Dallas Cou	104	127
Enchilada's Corporation	Full-Service Restaurants	Dallas	Dallas Cou	104	127
Fogo De Chao Churrascaria (austin) LLC	Full-Service Restaurants	Addison	Dallas Cou	104	127
Aramark Services, Inc.	Full-Service Restaurants	Denton	Denton Co	104	127
Chili's, Inc.	Full-Service Restaurants	Roanoke	Denton Co	104	127
Charleston's Enterprises Inc	Full-Service Restaurants	Fort Worth	Tarrant Co	104	127
Cheddar's Casual Cafe, Inc.	Full-Service Restaurants	Arlington	Tarrant Co	104	127
Chili's, Inc.	Full-Service Restaurants	Grapevine	Tarrant Co	104	127
FSI Restaurant Development Limited	Full-Service Restaurants	Arlington	Tarrant Co	104	127
Joe's Crab Shack - Texas, Inc.	Full-Service Restaurants	Grapevine	Tarrant Co	104	127
Red Lobster Hospitality LLC	Full-Service Restaurants	Burleson	Johnson C	104	127
Outback Steakhouse of Florida, LLC	Full-Service Restaurants	Arlington	Tarrant Co	104	127
Red Robin International, Inc.	Full-Service Restaurants	Grapevine	Tarrant Co	104	127
Aramark Services, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	102	126
Hoffworth Partnership, Ltd	Full-Service Restaurants	Fort Worth	Tarrant Co	102	126
Houlihan's Restaurants, Inc.	Full-Service Restaurants	Fort Worth	Tarrant Co	101	124
Home Group	Limited-Service Restaurants	Saginaw	Tarrant Co	100	120
McDonald's Restaurants of Texas, Inc.	Limited-Service Restaurants	Irving	Dallas Cou	100	120
McMahan Enterprises Inc	Limited-Service Restaurants	Colleyville	Tarrant Co	100	120
El Chico Restaurants, Inc.	Full-Service Restaurants	Flower Mo	Denton Co	99	122
Montana Restaurant Inc	Full-Service Restaurants	Granbury	Hood Cour	99	122
TGI Friday's, Inc.	Full-Service Restaurants	Hurst	Tarrant Co	99	122
Chili's, Inc.	Full-Service Restaurants	Lancaster	Dallas Cou	98	120
Chili's, Inc.	Full-Service Restaurants	Garland	Dallas Cou	98	120
Chili's, Inc.	Full-Service Restaurants	Hickory Cr	Denton Co	98	120
Chili's, Inc.	Full-Service Restaurants	Fort Worth	Tarrant Co	98	120
BJ's Restaurants, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	97	119
Chili's, Inc.	Full-Service Restaurants	Mesquite	Dallas Cou	97	119
Chili's, Inc.	Full-Service Restaurants	Grand Prai	Dallas Cou	97	119

El Fenix Corporation	Full-Service Restaurants	Dallas	Dallas Cou	97	119
El Fenix Corporation	Full-Service Restaurants	Dallas	Dallas Cou	97	119
Applebee's International, Inc.	Full-Service Restaurants	Little Elm	Denton Co	97	119
Chili's, Inc.	Full-Service Restaurants	Flower Mo	Denton Co	97	119
Chili's, Inc.	Full-Service Restaurants	Ennis	Ellis Count	97	119
Chili's, Inc.	Full-Service Restaurants	Forney	Kaufman C	97	119
Applebee's International, Inc.	Full-Service Restaurants	Weatherfo	Parker Cou	97	119
El Chico Restaurants, Inc.	Full-Service Restaurants	Rockwall	Rockwall C	97	119
FSI Restaurant Development Limited	Full-Service Restaurants	Rockwall	Rockwall C	97	119
Bone Daddy's, Inc.	Full-Service Restaurants	Grapevine	Tarrant Co	97	119
Chili's, Inc.	Full-Service Restaurants	Arlington	Tarrant Co	97	119
Outback Steakhouse of Florida, Inc.	Full-Service Restaurants	Frisco	Collin Cour	97	119
Texas Wings, Incorporated	Full-Service Restaurants	Plano	Collin Cour	97	119
On The Border Corporation	Full-Service Restaurants	Dallas	Dallas Cou	97	119
Outback Steakhouse of Florida, LLC	Full-Service Restaurants	Mesquite	Dallas Cou	97	119
Rita Restaurant Corp.	Full-Service Restaurants	Grand Prai	Dallas Cou	97	119
Swh Mimi's Cafe, LLC	Full-Service Restaurants	Dallas	Dallas Cou	97	119
TGI Friday's, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	97	119
Texas Wings, Incorporated	Full-Service Restaurants	Irving	Dallas Cou	97	119
Outback Steakhouse of Florida, LLC	Full-Service Restaurants	Burleson	Johnson Co	97	119
Red Lobster Hospitality LLC	Full-Service Restaurants	Fort Worth	Tarrant Co	97	119
Great Texas Food Corporation	Full-Service Restaurants	Allen	Collin Cour	95	117
Bone Daddy's, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	95	117
Great Texas Food Corporation	Full-Service Restaurants	Mesquite	Dallas Cou	95	117
Hasslocher Enterprises, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	95	117
Swh Mimi's Cafe, LLC	Full-Service Restaurants	Dallas	Dallas Cou	95.2	117.0
Red Robin Gourmet Burgers, Inc.	Full-Service Restaurants	Fort Worth	Tarrant Co	93.8	115.3
Humperdink's Texas, L.L.c	Limited-Service Restaurants	Arlington	Tarrant Co	93.5	112.5
S P H C Inc	Limited-Service Restaurants	Grand Prai	Dallas Cou	93.5	112.5
Wadsworth Old Chicago, Inc.	Limited-Service Restaurants	Dallas	Dallas Cou	93.5	112.5
Joe's Crab Shack - Texas, Inc.	Full-Service Restaurants	Mesquite	Dallas Cou	92.5	113.6
Joe's Crab Shack - Texas, Inc.	Full-Service Restaurants	Cedar Hill	Dallas Cou	92.5	113.6

Aramark Services, Inc.	Caterers	Denton	Denton Co	92.5	113.6
Joe's Crab Shack - Texas, Inc.	Full-Service Restaurants	Fort Worth	Tarrant Co	92.5	113.6
Sky Chefs, Inc.	Caterers	Dallas	Dallas Cou	92.5	113.6
S P H C Inc	Limited-Service Restaurants	Carrollton	Dallas Cou	92.3	111.0
S P H C Inc	Limited-Service Restaurants	Duncanvill	Dallas Cou	92.3	111.0
Facility Concession Services, Inc.	Caterers	Carrollton	Dallas Cou	91.1	111.9
PANDA POWER GENERATION INFRASTRUC	Full-Service Restaurants	Dallas	Dallas Cou	91.1	111.9
Mac Parent LLC	Limited-Service Restaurants	Lewisville	Denton Co	89.8	108.0
Gmri, Inc.	Full-Service Restaurants	Plano	Collin Cour	90	110
Chili's, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	90	110
Chili's, Inc.	Full-Service Restaurants	Irving	Dallas Cou	90	110
El Chico Restaurants, Inc.	Full-Service Restaurants	Desoto	Dallas Cou	90	110
Applebee's International, Inc.	Full-Service Restaurants	Waxahach	Ellis Count	90	110
Applebee's International, Inc.	Full-Service Restaurants	Greenville	Hunt Coun	90	110
Carrabba's Italian Grill, Inc.	Full-Service Restaurants	Hurst	Tarrant Co	90	110
Outback Steakhouse of Florida, LLC	Full-Service Restaurants	Denton	Denton Co	90	110
El Chico Restaurants, Inc.	Full-Service Restaurants	Richland H	Tarrant Co	88	109
California Pizza Kitchen, Inc.	Limited-Service Restaurants	Dallas	Dallas Cou	87	105
S W Mesa Restaurants Inc	Limited-Service Restaurants	Dallas	Dallas Cou	87	105
S W Mesa Restaurants Inc	Limited-Service Restaurants	Dallas	Dallas Cou	87	105
El Fenix Corporation	Full-Service Restaurants	Mesquite	Dallas Cou	86	105
Texas Wings, Incorporated	Full-Service Restaurants	Mesquite	Dallas Cou	86	105
On The Border Corporation	Full-Service Restaurants	Mansfield	Tarrant Co	86	105
Incredible Pizza Co., Inc.	Limited-Service Restaurants	Euless	Tarrant Co	85	102
El Chico Restaurants, Inc.	Full-Service Restaurants	Frisco	Denton Co	84	103
Aramark Services, Inc.	Limited-Service Restaurants	Dallas	Dallas Cou	84	101
Chili's, Inc.	Full-Service Restaurants	Irving	Dallas Cou	83	102
Chili's, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	83	102
Chili's, Inc.	Full-Service Restaurants	Garland	Dallas Cou	83	102
Chili's, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	83	102
Chili's, Inc.	Full-Service Restaurants	Dallas	Dallas Cou	83	102
FSI Restaurant Development Limited	Full-Service Restaurants	Dallas	Dallas Cou	83	102

Firebird Restaurant Group, LLC	Full-Service Restaurants	Dallas	Dallas Cou	83	102
Chili's, Inc.	Full-Service Restaurants	Flower Mo	Denton Co	83	102
Chili's, Inc.	Full-Service Restaurants	Lewisville	Denton Co	83	102
Chili's, Inc.	Full-Service Restaurants	Stephenvil	Erath Cour	83	102
Chili's, Inc.	Full-Service Restaurants	Greenville	Hunt Coun	83	102
Applebee's International, Inc.	Full-Service Restaurants	Cleburne	Johnson C	83	102
Chili's, Inc.	Full-Service Restaurants	Mansfield	Tarrant Co	83	102
Chili's, Inc.	Full-Service Restaurants	Grapevine	Tarrant Co	83	102
Chili's, Inc.	Full-Service Restaurants	Arlington	Tarrant Co	83	102
Dos Gringos, Inc.	Full-Service Restaurants	Fort Worth	Tarrant Co	83	102
El Chico Restaurants, Inc.	Full-Service Restaurants	Pantego	Tarrant Co	83	102
FSI Restaurant Development Limited	Full-Service Restaurants	Grapevine	Tarrant Co	83	102
FSI Restaurant Development Limited	Full-Service Restaurants	Arlington	Tarrant Co	83	102
On The Border Corporation	Full-Service Restaurants	Dallas	Dallas Cou	83	102
Outback Steakhouse of Florida, LLC	Full-Service Restaurants	De Soto	Dallas Cou	83	102
Outback Steakhouse of Florida, LLC	Full-Service Restaurants	Dallas	Dallas Cou	83	102
Razzoo's, Inc.	Full-Service Restaurants	Irving	Dallas Cou	83	102
Red Lobster Hospitality LLC	Full-Service Restaurants	Dallas	Dallas Cou	83	102
Rockfish Seafood Grill, Inc	Full-Service Restaurants	Dallas	Dallas Cou	83	102
On The Border Corporation	Full-Service Restaurants	Arlington	Tarrant Co	83	102
Rita Restaurant Corp.	Full-Service Restaurants	Fort Worth	Tarrant Co	83	102
Tarrant County Texas (inc)	Full-Service Restaurants	Fort Worth	Tarrant Co	83	102
Hooters of America, LLC	Full-Service Restaurants	Mckinney	Collin Cou	81	100
Cotton Patch Caf, LLC	Full-Service Restaurants	Stephenvil	Erath Cour	81	100
BJ's Restaurants, Inc.	Full-Service Restaurants	Fort Worth	Tarrant Co	81	100
ROYCE ALSOP	Limited-Service Restaurants	Keller	Tarrant Co	81	98
LONE STAR STEAKHOUSE & SALOON OF CO	Full-Service Restaurants	Plano	Collin Cou	80	98
Genghis Grill, Inc.	Limited-Service Restaurants	Mckinney	Collin Cou	80	96
S L I ENTERPRISES	Limited-Service Restaurants	Ennis	Ellis Count	80	96

Costco Wholesale Corporation	Warehouse Clubs and Supercenters	Fort Worth	Tarrant County	49.14	91
Sam's West, Inc.	Warehouse Clubs and Supercenters	Dallas	Dallas County	48.6	90
Sam's West, Inc.	Warehouse Clubs and Supercenters	Grand Prairie	Dallas County	48.6	90
Sam's West, Inc.	Warehouse Clubs and Supercenters	Dallas	Dallas County	48.6	90
Sam's West, Inc.	Warehouse Clubs and Supercenters	Irving	Dallas County	48.6	90
Sam's West, Inc.	Warehouse Clubs and Supercenters	Burleson	Johnson County	48.6	90
Sam's West, Inc.	Warehouse Clubs and Supercenters	Fort Worth	Tarrant County	48.6	90
Costco Wholesale Corporation	Warehouse Clubs and Supercenters	Southlake	Tarrant County	48.6	90
The Kroger Co	Supermarkets and Other Grocery (except Convenience) Stores	Irving	Dallas County	48.499999	290
Freedman Food Service of Dallas, Inc	Supermarkets and Other Grocery (except Convenience) Stores	Dallas	Dallas County	47.153907	117
Sam's West, Inc.	Warehouse Clubs and Supercenters	Mckinney	Collin County	46.98	87
Sam's West, Inc.	Warehouse Clubs and Supercenters	Garland	Dallas County	46.98	87
Costco Wholesale Corporation	Warehouse Clubs and Supercenters	Arlington	Tarrant County	45.9	85
Green Valley Food Corp.	Fresh Fruit and Vegetable Merchant Wholesalers	Dallas	Dallas County	45.316015	147
Sam's West, Inc.	Warehouse Clubs and Supercenters	Dallas	Dallas County	44.82	83
Diamond Onions, Inc.	Fresh Fruit and Vegetable Merchant Wholesalers	Dallas	Dallas County	43.984794	147
Sam's West, Inc.	Warehouse Clubs and Supercenters	Fort Worth	Tarrant County	43.74	81
Midland Foods Distribution, Inc.	Packaged Frozen Food Merchant Wholesalers	Dallas	Dallas County	43.465671	147
Buds Salads Inc	Fresh Fruit and Vegetable Merchant Wholesalers	Dallas	Dallas County	43.178358	147
The Kroger Co	Supermarkets and Other Grocery (except Convenience) Stores	Mckinney	Collin County	42.5	206
Sam's West, Inc.	Warehouse Clubs and Supercenters	Lewisville	Denton County	42.39	78
Southern Bay Seafood Corporation	Fish and Seafood Merchant Wholesalers	Arlington	Tarrant County	41.58288	147
Consolidated Food Concept Inc	General Line Grocery Merchant Wholesalers	Dallas	Dallas County	40.930118	147
The Kroger Co	Supermarkets and Other Grocery (except Convenience) Stores	Grand Prairie	Dallas County	40.816469	464
Dm Shivtex, Inc.	Poultry and Poultry Product Merchant Wholesalers	Dallas	Dallas County	40.500002	147
Costco Wholesale Corporation	Warehouse Clubs and Supercenters	Duncanville	Dallas County	40.5	75

NAME	SCHOOL_TYPE	CITY	COUNTY	EXCESSFOOD TONYEAR LOWEST	EXCESSFOOD TONYEAR HIGHEST
Tarrant County College District	Postsecondary	Stephenville	Tarrant County	564.85	3427.86925
The University of Texas at Arlington	Postsecondary	Martin	Tarrant County	498.102	3022.79991
University of North Texas	Postsecondary	Dahlonega	Denton County	419.595	2546.369475
Collin County Community College District	Postsecondary	Phoenix	Collin County	326.733	1982.823765
The University of Texas at Dallas	Postsecondary	Austin	Dallas County	294.723	1788.566715
Richland College	Postsecondary	South Prince George	Dallas County	199.166	1208.66603
Texas Woman's University	Postsecondary	Fort Worth	Denton County	172.205	1045.049525
Eastfield College	Postsecondary	Torrington	Dallas County	165.319	1003.260895
Texas A & M University-Commerce	Postsecondary	College Station	Hunt County	148.654	902.12707
Tarleton State University	Postsecondary	Philadelphia	Erath County	143.539	871.085995
Brookhaven College	Postsecondary	Lincroft	Dallas County	140.525	852.795125
Southern Methodist University	Postsecondary	South Portland	Dallas County	129.129	783.636945
North Lake College	Postsecondary	Mason City	Dallas County	119.658	726.16089
El Centro College	Postsecondary	Torrance	Dallas County	118.25	717.61625
Texas Christian University	Postsecondary	Pasadena	Tarrant County	114.334	693.85147
Mountain View College	Postsecondary	Charleston	Dallas County	106.172	644.31926
Navarro College	Postsecondary	Monterey	Navarro County	101.53	616.14865
Cedar Valley College	Postsecondary	Allentown	Dallas County	78.364	475.56262
Weatherford College	Postsecondary	Waynesville	Parker County	61.809	375.096345
Dallas Baptist University	Postsecondary	Mitchell	Dallas County	56.716	344.18878
ALLEN H S	Public Elementary & Secondary	ALLEN	Collin County	42.714	201.13548
SKYLINE H S	Public Elementary & Secondary	DALLAS	Dallas County	42.561	200.41502
LEWISVILLE H S	Public Elementary & Secondary	LEWISVILLE	Denton County	39.393	185.49726
DUNCANVILLE H S	Public Elementary & Secondary	DUNCANVILLE	Dallas County	37.368	175.96176
University of North Texas at Dallas	Postsecondary	Denton	Dallas County	33.33	202.26765
SAM HOUSTON H S	Public Elementary & Secondary	ARLINGTON	Tarrant County	32.67	153.8394
MARTIN H S	Public Elementary & Secondary	ARLINGTON	Tarrant County	30.159	142.01538
SOUTH GRAND PRAIRIE H S	Public Elementary & Secondary	GRAND PRAIRIE	Dallas County	30.033	141.42206
RESPONSIVE EDUCATION VIRTUAL LEARN	Public Elementary & Secondary	LEWISVILLE	Denton County	29.916	140.87112
COPPELL H S	Public Elementary & Secondary	COPPELL	Dallas County	29.385	138.3707
TIMBER CREEK H S	Public Elementary & Secondary	FORT WORTH	Tarrant County	27.684	130.36088
DESOTO H S & ISTEAM3D	Public Elementary & Secondary	DESOTO	Dallas County	27.315	128.6233
BOWIE H S	Public Elementary & Secondary	ARLINGTON	Tarrant County	27.288	128.49616
PLANO EAST SR H S	Public Elementary & Secondary	PLANO	Collin County	26.595	125.2329
University of North Texas Health Science	Postsecondary	Dallas	Tarrant County	26.191	158.943655
LAMAR H S	Public Elementary & Secondary	ARLINGTON	Tarrant County	26.154	123.15628

Texas Wesleyan University	Postsecondary	Lubbock	Tarrant County	26.103	158.409615
MESQUITE H S	Public Elementary & Secondary	MESQUITE	Dallas County	26.028	122.56296
Dallas Theological Seminary	Postsecondary	Dallas	Dallas County	25.971	157.608555
University of Dallas	Postsecondary	Waterbury	Dallas County	25.927	157.341535
PLANO SR H S	Public Elementary & Secondary	PLANO	Collin County	25.722	121.12204
MCKINNEY BOYD H S	Public Elementary & Secondary	MCKINNEY	Collin County	25.605	120.5711
NORTH MESQUITE H S	Public Elementary & Secondary	MESQUITE	Dallas County	25.587	120.48634
University of Texas Southwestern Medica	Postsecondary	Tyler	Dallas County	25.476	154.60458

NAME	NAICS_CODE_DESCRIPTION	CITY	COUNTY	EXCESSFOOD_T	EXCESSFOOD_TONYEAR_
RENAISSANCE HOSPITAL TERRELL	General Medical and Surgical Hosp	TERRELL	KAUFMAN	NULL	NULL
BAYLOR UNIVERSITY MEDICAL CENTER	General Medical and Surgical Hosp	DALLAS	DALLAS	109.32	586.70
TEXAS HEALTH PRESBYTERIAN HOSPITAL DALLAS	General Medical and Surgical Hosp	DALLAS	DALLAS	103.27	554.25
PARKLAND MEMORIAL HOSPITAL	General Medical and Surgical Hosp	DALLAS	DALLAS	101.18	543.01
MEDICAL CITY DALLAS HOSPITAL	General Medical and Surgical Hosp	DALLAS	DALLAS	92.69	497.45
TEXAS HEALTH HARRIS METHODIST HOSPITAL FORT WORTH	General Medical and Surgical Hosp	FORT WORTH	TARRANT	84.43	453.13
METHODIST DALLAS MEDICAL CENTER	General Medical and Surgical Hosp	DALLAS	DALLAS	68.04	365.13
BAYLOR SCOTT & WHITE ALL SAINTS MEDICAL CENTER FORT WC	General Medical and Surgical Hosp	FORT WORTH	TARRANT	66.52	357.01
JOHN PETER SMITH HOSPITAL	General Medical and Surgical Hosp	FORT WORTH	TARRANT	65.94	353.89
MEDICAL CENTER OF PLANO	General Medical and Surgical Hosp	PLANO	COLLIN	57.3359	307.70595
CHILDREN'S MEDICAL CENTER OF DALLAS	General Medical and Surgical Hosp	DALLAS	DALLAS	56.64	303.96
WILLIAM P. CLEMENTS JR. UNIVERSITY HOSPITAL	Specialty (except Psychiatric and S	DALLAS	DALLAS	53.50	287.11
COOK CHILDREN'S MEDICAL CENTER	General Medical and Surgical Hosp	FORT WORTH	TARRANT	50.01	268.38
TEXAS HEALTH ARLINGTON MEMORIAL HOSPITAL	General Medical and Surgical Hosp	ARLINGTON	TARRANT	42.91	230.31
TEXAS HEALTH PRESBYTERIAN HOSPITAL PLANO	General Medical and Surgical Hosp	PLANO	COLLIN	42.5658	228.4389
TEXAS HEALTH HUGULEY HOSPITAL	General Medical and Surgical Hosp	FORT WORTH	TARRANT	41.40	222.20
MEDICAL CENTER OF ARLINGTON	General Medical and Surgical Hosp	ARLINGTON	TARRANT	39.77	213.46
MEDICAL CITY FORT WORTH	General Medical and Surgical Hosp	FORT WORTH	TARRANT	37.22	199.73
METHODIST CHARLTON MEDICAL CENTER	General Medical and Surgical Hosp	DALLAS	DALLAS	36.87	197.86
TERRELL STATE HOSPITAL	Psychiatric and Substance Abuse H	TERRELL	KAUFMAN	36.75	197.23
BAYLOR SCOTT & WHITE MEDICAL CENTER AT GRAPEVINE	General Medical and Surgical Hosp	GROESBECK	TARRANT	36.52	195.98
BAYLOR SCOTT & WHITE MEDICAL CENTER - IRVING	General Medical and Surgical Hosp	IRVING	DALLAS	34.42	184.75
TEXAS HEALTH PRESBYTERIAN HOSPITAL DENTON	General Medical and Surgical Hosp	DENTON	DENTON	29.66	159.16
METHODIST MANSFIELD MEDICAL CENTER	General Medical and Surgical Hosp	MANSFIELD	TARRANT	29.54	158.53
TEXAS HEALTH HARRIS METHODIST HOSPITAL HURST-EULESS-BE	General Medical and Surgical Hosp	BEDFORD	TARRANT	28.61	153.54
BAYLOR SCOTT & WHITE MEDICAL CENTER - CARROLLTON	General Medical and Surgical Hosp	CARROLLTON	DENTON	27.33	146.68
TEXAS HEALTH HARRIS METHODIST HOSPITAL SOUTHWEST FOR	General Medical and Surgical Hosp	FORT WORTH	TARRANT	25.82	138.56
BAYLOR SCOTT & WHITE MEDICAL CENTER - WHITE ROCK	General Medical and Surgical Hosp	DALLAS	DALLAS	25.35	136.06
METHODIST RICHARDSON MEDICAL CENTER	General Medical and Surgical Hosp	RICHARDSON	DALLAS	24.31	130.45
MEDICAL CITY DENTON	General Medical and Surgical Hosp	DENTON	DENTON	24.19	129.82
DALLAS REGIONAL MEDICAL CENTER	General Medical and Surgical Hosp	MESQUITE	DALLAS	23.49	126.08
MEDICAL CENTER OF LEWISVILLE	General Medical and Surgical Hosp	LEWISVILLE	DENTON	23.49	126.08
HUNT REGIONAL MEDICAL CENTER GREENVILLE	General Medical and Surgical Hosp	GREENVILLE	HUNT	22.33	119.84
METHODIST RICHARDSON MEDICAL CENTER	General Medical and Surgical Hosp	RICHARDSON	COLLIN	21.2829	114.21945
MEDICAL CITY NORTH HILLS	General Medical and Surgical Hosp	NORTH RICHLAND HILLS	TARRANT	20.47	109.85
NAVARRO REGIONAL HOSPITAL	General Medical and Surgical Hosp	CORSICANA	NAVARRO	18.840600	101.112300
BAYLOR SCOTT & WHITE MEDICAL CENTER - PLANO	General Medical and Surgical Hosp	PLANO	COLLIN	18.608	99.864
MEDICAL CITY MCKINNEY	General Medical and Surgical Hosp	MCKINNEY	COLLIN	18.2591	97.99155
DALLAS MEDICAL CENTER	General Medical and Surgical Hosp	DALLAS	DALLAS	18.03	96.74
UNIVERSITY OF TEXAS SOUTHWESTERN MEDICAL CENTER	General Medical and Surgical Hosp	DALLAS	DALLAS	17.21	92.37
TIMBERLAWN MENTAL HEALTH SYSTEM	Psychiatric and Substance Abuse H	DALLAS	DALLAS	16.75	89.88

BAYLOR SCOTT & WHITE MEDICAL CENTER - MCKINNEY	General Medical and Surgical Hosp	MCKINNEY	COLLIN	16.6309	89.25345
TEXAS HEALTH HARRIS METHODIST HOSPITAL CLEBURNE	General Medical and Surgical Hosp	CLEBURNE	JOHNSON	15.93	85.51
MEDICAL CITY GREEN OAKS HOSPITAL	Psychiatric and Substance Abuse H	DALLAS	DALLAS	14.42	77.39
MILLWOOD HOSPITAL	Psychiatric and Substance Abuse H	ARLINGTON	TARRANT	14.19	76.15
BAYLOR SCOTT & WHITE MEDICAL CENTER - CENTENNIAL	General Medical and Surgical Hosp	FRISCO	COLLIN	13.7234	73.6497
THE HEART HOSPITAL BAYLOR PLANO	Specialty (except Psychiatric and S	PLANO	COLLIN	13.4908	72.4014
SUNDANCE HOSPITAL DALLAS	Psychiatric and Substance Abuse H	GARLAND	DALLAS	13.49	72.40
DALLAS BEHAVIORAL HEALTHCARE HOSPITAL LLC	Psychiatric and Substance Abuse H	DE SOTO	DALLAS	13.49	72.40
SUNDANCE HOSPITAL	Psychiatric and Substance Abuse H	ARLINGTON	TARRANT	13.49	72.40
BAYLOR SCOTT & WHITE MEDICAL CENTER - GARLAND	General Medical and Surgical Hosp	GARLAND	DALLAS	13.14	70.53
BAYLOR SCOTT & WHITE MEDICAL CENTER - LAKE POINTE	General Medical and Surgical Hosp	ROWLETT	ROCKWALL	13.03	69.90
UNIVERSITY GENERAL HOSPITAL DALLAS	General Medical and Surgical Hosp	DALLAS	DALLAS	12.91	69.28
KINDRED HOSPITAL - DALLAS	Specialty (except Psychiatric and S	DALLAS	DALLAS	12.79	68.66
UNIVERSITY BEHAVIORAL HEALTH OF DENTON	Psychiatric and Substance Abuse H	DENTON	DENTON	12.10	64.91
BAYLOR SCOTT & WHITE MEDICAL CENTER AT WAXAHACHIE	General Medical and Surgical Hosp	WAXAHACHIE	ELLIS	12.10	64.91
MEDICAL CENTER OF MCKINNEY - WYSONG CAMPUS	Psychiatric and Substance Abuse H	MCKINNEY	COLLIN	11.9789	64.28745
TEXAS HEALTH PRESBYTERIAN HOSPITAL FLOWER MOUND	General Medical and Surgical Hosp	FLOWER MOUND	DENTON	11.98	64.29
MEDICAL CITY LAS COLINAS	General Medical and Surgical Hosp	IRVING	DALLAS	11.63	62.42
WALNUT HILL MEDICAL CENTER	General Medical and Surgical Hosp	DALLAS	DALLAS	11.63	62.42
TEXAS SCOTTISH RITE HOSPITAL FOR CHILDREN	General Medical and Surgical Hosp	DALLAS	DALLAS	11.63	62.42
SELECT SPECIALTY HOSPITAL - SOUTH DALLAS	General Medical and Surgical Hosp	DE SOTO	DALLAS	11.63	62.42
WEATHERFORD REGIONAL MEDICAL CENTER	General Medical and Surgical Hosp	WEATHERFORD	PARKER	11.51	61.79
WISE REGIONAL HEALTH SYSTEM	General Medical and Surgical Hosp	DECATUR	WISE	11.51	61.79
TEXAS HEALTH HARRIS METHODIST HOSPITAL STEPHENVILLE	General Medical and Surgical Hosp	STEPHENVILLE	ERATH	11.40	61.17
BAYLOR INSTITUTE FOR REHABILITATION	Specialty (except Psychiatric and S	DALLAS	DALLAS	10.70	57.42
TEXAS HEALTH PRESBYTERIAN HOSPITAL KAUFMAN	General Medical and Surgical Hosp	KAUFMAN	KAUFMAN	10.58	56.80
HEALTHSOUTH REHABILITATION HOSPITAL OF ARLINGTON	Specialty (except Psychiatric and S	ARLINGTON	TARRANT	9.89	53.05
FOREST PARK MEDICAL CENTER	General Medical and Surgical Hosp	DALLAS	DALLAS	9.77	52.43
HICKORY TRAIL HOSPITAL	Psychiatric and Substance Abuse H	DE SOTO	DALLAS	9.77	52.43
CRESCENT MEDICAL CENTER LANCASTER	General Medical and Surgical Hosp	LANCASTER	DALLAS	9.77	52.43
HEALTHSOUTH PLANO REHABILITATION HOSPITAL	Specialty (except Psychiatric and S	PLANO	COLLIN	9.6529	51.80445
LAKE GRANBURY MEDICAL CENTER	General Medical and Surgical Hosp	GREENVILLE	HOOD	9.652900	51.804450
LIFECARE HOSPITALS OF FORT WORTH	Specialty (except Psychiatric and S	FORT WORTH	TARRANT	9.30	49.93
KINDRED HOSPITAL - TARRANT COUNTY - FORT WORTH SOUTHV	Specialty (except Psychiatric and S	FORT WORTH	TARRANT	9.30	49.93
PALO PINTO GENERAL HOSPITAL	General Medical and Surgical Hosp	MINERAL WELLS	PALO PINTO	8.61	46.19
TEXAS HEALTH HARRIS METHODIST HOSPITAL ALLIANCE	General Medical and Surgical Hosp	FORT WORTH	TARRANT	8.61	46.19
TEXAS HEALTH PRESBYTERIAN HOSPITAL ALLEN	General Medical and Surgical Hosp	ALLEN	COLLIN	8.4899	45.56295
CHILDRENS MEDICAL CENTER PLANO	General Medical and Surgical Hosp	PLANO	COLLIN	8.3736	44.9388
GARLAND BEHAVIORAL HOSPITAL	Psychiatric and Substance Abuse H	GARLAND	DALLAS	8.37	44.94
MESA SPRINGS	Psychiatric and Substance Abuse H	FORT WORTH	TARRANT	8.37	44.94
BAYLOR SCOTT & WHITE MEDICAL CENTER - SUNNYVALE	General Medical and Surgical Hosp	SUNNYVALE	DALLAS	8.14	43.69
TEXAS HEALTH SPRINGWOOD HOSPITAL HURST-EULESS-BEDFOR	Psychiatric and Substance Abuse H	BEDFORD	TARRANT	8.14	43.69

SELECT SPECIALTY HOSPITAL - SOUTH DALLAS	Specialty (except Psychiatric and S	DALLAS	DALLAS	8.02	43.07
BAYLOR MEDICAL CENTER AT WAXAHACHIE	General Medical and Surgical Hosp	WAXAHACHIE	ELLIS	8.02	43.07
BAYLOR SCOTT & WHITE MEDICAL CENTER - FRISCO	General Medical and Surgical Hosp	FRISCO	COLLIN	7.9084	42.4422
BAYLOR SPECIALTY HOSPITAL	Specialty (except Psychiatric and S	DALLAS	DALLAS	7.91	42.44
KINDRED HOSPITAL - TARRANT COUNTY	Specialty (except Psychiatric and S	ARLINGTON	TARRANT	7.91	42.44
KINDRED HOSPITAL - FORT WORTH	Specialty (except Psychiatric and S	FORT WORTH	TARRANT	7.79	41.82
LIFECARE HOSPITALS OF PLANO	Specialty (except Psychiatric and S	PLANO	COLLIN	7.6758	41.1939
PROMISE HOSPITAL OF DALLAS	Specialty (except Psychiatric and S	DALLAS	DALLAS	7.68	41.19
TEXAS REHABILITATION HOSPITAL OF FORT WORTH	Specialty (except Psychiatric and S	FORT WORTH	TARRANT	7.68	41.19

NAME	NAICS_CODE_DESCRIPTION	CITY	COUNTY	EXCESSFOOD_TONYEAR_	EXCESSFOOD_TONYEAR_HIGHES
County of Dallas	Correctional Institutions	Dallas	Dallas County	312.576875	564.6550
City of Irving	Correctional Institutions	Irving	Dallas County	240.443750	434.3500
CITY OF IRVING	Correctional Institutions	Irving	Dallas County	240.443750	434.3500
Federal Bureau of Prisons	Correctional Institutions	Grand Prairie	Dallas County	240.443750	434.3500
County of Denton	Correctional Institutions	Denton	Denton County	240.443750	434.3500
Federal Bureau of Prisons	Correctional Institutions	Forest Hill	Tarrant County	208.224288	376.1471
Texas Department of Criminal Justice	Correctional Institutions	Dallas	Dallas County	192.355000	347.4800
County of Collin	Correctional Institutions	Mckinney	Collin County	178.890150	323.1564
Dallas County Community Supervision and Corr	Correctional Institutions	Dallas	Dallas County	144.266250	260.6100
Federal Bureau of Prisons	Correctional Institutions	Fort Worth	Tarrant County	117.817437	212.8315
City of Dallas	Correctional Institutions	Dallas	Dallas County	96.177500	173.7400
City of Dallas	Correctional Institutions	Dallas	Dallas County	96.177500	173.7400
City of Dallas	Correctional Institutions	Dallas	Dallas County	96.177500	173.7400
TARRANT COUNTY TEXAS (INC)	Correctional Institutions	Fort Worth	Tarrant County	96.177500	173.7400
Texas Juvenile Justice Department	Correctional Institutions	Fort Worth	Tarrant County	77.903775	140.7294
Federal Bureau of Prisons	Correctional Institutions	Grand Prairie	Dallas County	61.553600	111.1936
Rockwall County Texas	Correctional Institutions	Rockwall	Rockwall County	60.110937	108.5875
CITY OF EULESS	Correctional Institutions	Euless	Tarrant County	57.706500	104.2440
County of Tarrant	Correctional Institutions	Fort Worth	Tarrant County	57.706500	104.2440
City of Mansfield	Correctional Institutions	Mansfield	Tarrant County	51.454963	92.9509
County of Navarro	Correctional Institutions	Corsicana	Navarro County	33.662125	60.8090
County of Dallas	Correctional Institutions	Dallas	Dallas County	25.487037	46.0411
Parole Division, Texas	Correctional Institutions	Fort Worth	Tarrant County	24.044375	43.4350
Parole Division, Texas	Correctional Institutions	Fort Worth	Tarrant County	23.082600	41.6976
Parole Division, Texas	Correctional Institutions	Dallas	Dallas County	21.159050	38.2228
Parole Division, Texas	Correctional Institutions	Benbrook	Tarrant County	21.159050	38.2228
Texas Department of Criminal Justice	Correctional Institutions	Dallas	Dallas County	20.678162	37.3541
Texas Juvenile Justice Dept	Correctional Institutions	Roanoke	Denton County	16.831063	30.4045
Dallas County Commission (inc)	Correctional Institutions	Selma	Dallas County	12.022187	21.7175
Parole Division, Texas	Correctional Institutions	Arlington	Tarrant County	10.579525	19.1114
COUNTY OF ERATH	Correctional Institutions	Stephenville	Erath County	7.694200	13.8992
Tdcj Windham Hutchins UNI	Correctional Institutions	Dallas	Dallas County	6.251538	11.2931
Department of Corrections Alabama	Correctional Institutions	Selma	Dallas County	6.251538	11.2931
County of Palo Pinto	Correctional Institutions	Palo Pinto	Palo Pinto County	4.808875	8.6870
Garland City Jail	Correctional Institutions	Garland	Dallas County	3.847100	6.9496
Texas Department of Criminal Justice	Correctional Institutions	Venus	Johnson County	3.847100	6.9496
Texas Youth Athletics Association	Correctional Institutions	Fort Worth	Tarrant County	3.847100	6.9496
Kenneth Lamere	Correctional Institutions	Arlington	Tarrant County	3.847100	6.9496
Federal Bureau of Prisons	Correctional Institutions	Fort Worth	Tarrant County	3.847100	6.9496
Texas Department of Criminal Justice	Correctional Institutions	Bridgeport	Wise County	3.847100	6.9496
Global Corrections, LLC	Correctional Institutions	Plano	Collin County	3.366213	6.0809
Dawson State Jail	Correctional Institutions	Dallas	Dallas County	3.366213	6.0809

State Correctional	Correctional Institutions	Irving	Dallas County	3.366213	6.0809
Dallas State Jail	Correctional Institutions	Lancaster	Dallas County	2.885325	5.2122
Corplan Corrections Gp, Inc.	Correctional Institutions	Dallas	Dallas County	2.885325	5.2122
Dawson State Jail	Correctional Institutions	Dallas	Dallas County	2.885325	5.2122
Correction Connection, Inc.	Correctional Institutions	Denton	Denton County	2.885325	5.2122
Rockwall County Texas	Correctional Institutions	Rockwall	Rockwall County	2.885325	5.2122
Texas Department of Criminal Justice	Correctional Institutions	Decatur	Wise County	2.885325	5.2122
TOWN OF ADDISON	Correctional Institutions	Addison	Dallas County	1.442662	2.6061
American Corrections Speci	Correctional Institutions	Frisco	Denton County	1.442662	2.6061
County of Parker	Correctional Institutions	Weatherford	Parker County	0.961775	1.7374

Appendix E

Wastewater Treatment Facility Data

TREATMENT FACILITY OWNER	COUNTY	FACILITY NAME	AVERAGE DESIGN FLOW RATE (MM GALLONS/DAY)	PROCESS METHOD	DRY TONS OF SLUDGE PER YEAR
NORTH TEXAS MUNICIPAL WATER DISTRICT	COLLIN	WILSON CREEK REGIONAL WWTP	56	GRAVITY THICKENING	18,079
NORTH TEXAS MUNICIPAL WATER DISTRICT	COLLIN	ROWLETT CREEK REGIONAL WWTP	24	BIOMONITORING	5,110
CITY OF CELINA	COLLIN	CITY OF CELINA WWTP	0.5	DEWATERING-OTHERS	43
CITY OF BLUE RIDGE	COLLIN	CITY OF BLUE RIDGE WWTF	0.28	PRELIM TREATMENT - BAR SCREEN	14
CITY OF LAVON	COLLIN	BEAR CREEK WWTP	0.25	COMMERCIAL LAND APP (PERMIT)	87
SEIS LAGOS UTILITY DISTRICT; NORTH TEXAS MUNICIPAL WATER DISTRICT	COLLIN	SEIS LAGOS WWTP	0.25	DEWATERING - SLUDGE DRYING B01	12
CITY OF FARMERSVILLE	COLLIN	FARMERSVILLE WWTP 1	0.225	SLUDGE HOLDING TANK	66
CITY OF FARMERSVILLE	COLLIN	CITY OF FARMERSVILLE WWTP NO 3	0.1	CHLORINATION FOR DISINFECTION	25
CITY OF JOSEPHINE	COLLIN	CITY OF JOSEPHINE WWTP	0.07	AERATED LAGOONS	18
CITY OF FARMERSVILLE	COLLIN	FARMERSVILLE WWTP 2	0.754	SLUDGE HOLDING TANK	66
COLLIN COUNTY TOTAL			**82.429**		**23,520**
CITY OF DALLAS	DALLAS	CITY OF DALLAS CENTRAL WWTP	170	SLUDGE HOLDING TANK	26,320
NORTH TEXAS MUNICIPAL WATER DISTRICT	DALLAS	SOUTH MESQUITE CREEK REGIONAL WWTP	33	ULTRA VIOLET LIGHT	7,358
TRINITY RIVER AUTHORITY CENTRAL	DALLAS	CENTRAL REGIONAL WWTP	189		68,769
CITY OF GARLAND	DALLAS	CITY OF GARLAND ROWLETT CREEK	24	DECHLORINATION	1,822

TRINITY RIVER AUTHORITY OF TEXAS	DALLAS	TEN MILE CREEK WWTP	24	ULTRA VIOLET LIGHT	3,245
NORTH TEXAS MUNICIPAL WATER DISTRICT	DALLAS	MUDDY CREEK REGIONAL WWTP	10	SLUDGE HOLDING TANK	1,960
NORTH TEXAS MUNICIPAL WATER DISTRICT	DALLAS	FLOYD BRANCH REGIONAL WWTP	4.75	ACTIVATED SLUDGE - CONVENTIONA	367
DALLAS COUNTY TOTAL			**454.75**		**109,842**
CITY OF DENTON	DENTON	PECAN CREEK WATER RECLAMATION PLANT	21	BIOMONITORING	4,159
CITY OF LEWISVILLE	DENTON	PRAIRIE CREEK WWTP	12	TRICKLING MEDIA - ROCK	18,482
Trinity River Authority Of Texas	DENTON	DENTON CREEK REGIONAL WWTP	11.5	POST AERATION (REARATION)	2,535
CITY OF JUSTIN	DENTON	JUSTIN WWTF	0.6	EMERGENCY HOLDING PONDS	452
CITY OF AUBREY	DENTON	AUBREY WWTP	0.4	GRAVITY THICKENING	23
CITY OF DENTON	DENTON	ROBSON RANCH WWTP	0.375	OTHER TREATMENT	135
TOWN OF PONDER	DENTON	TOWN OF PONDER WWTF	0.36	SECONDARY CLARIFICATION	58
CITY OF KRUM	DENTON	CITY OF KRUM WWTP	0.35	LANDFILL	9
Mustang Sud	DENTON	SANDBROCK WWTP	0.2	COMMERCIAL LAND APP (PERMIT)	5,116
UPPER TRINITY REGIONAL WATER DISTRICT	DENTON	RIVERBEND REGIONAL WATER RECLAMATION PLANT	10	DEWATERING-MECHANICAL-CENTRI	878
NORTH TEXAS MUNICIPAL WATER DISTRICT	DENTON	PANTHER CREEK WWTP	10	BIOMONITORING	1,700
TOWN OF FLOWER MOUND	DENTON	TOWN OF FLOWER MOUND WWTP	10	ULTRA VIOLET LIGHT	1,074
UPPER TRINITY REGIONAL WATER DISTRICT	DENTON	LAKEVIEW REGIONAL WATER RECLAMATION PLANT	5.5	FLOW EQUALIZATION BASINS	1,207
NORTH TEXAS MUNICIPAL WATER DISTRICT	DENTON	STEWART CREEK WEST REGIONAL WWTP	5	SLUDGE HOLDING TANK	948
UPPER TRINITY REGIONAL WATER DISTRICT	DENTON	PENNINSULA REGIONAL WATER RECLAMATION PLANT	4.6	SLUDGE HOLDING TANK	437

CITY OF THE COLONY	DENTON	STEWART CREEK WWTP	4.5	DEWATERING-OTHERS	2,357
TOWN OF LITTLE ELM	DENTON	LITTLE ELM WWTP	3	GRAVITY THICKENING	508
UPPER TRINITY REGIONAL WATER DISTRICT	DENTON	BRANCH REGIONAL WATER RECLAMATION WWTP	2	SLUDGE HOLDING TANK	912
Trophy Club Municipal Utility District 1	DENTON	TROPHY CLUB MUD 1	1.75	IRRIGATION-PUBLIC ACCESS	169
CITY OF SANGER	DENTON	CITY OF SANGER WWTP	0.98	GRAVITY THICKENING	713
CITY OF PILOT POINT	DENTON	CITY OF PILOT POINT WWTP	0.735	ULTRA VIOLET LIGHT	628
DENTON COUNTY TOTAL			**104.85**		**42,499**
TRINITY RIVER AUTHORITY OF TEXAS	ELLIS	MOUNTAIN CREEK REGIONAL WWTP	12	BIOMONITORING	695
CITY OF ITALY	ELLIS	CITY OF ITALY WWTP	0.65	CHLORINATION FOR DISINFECTION	320
CITY OF MAYPEARL	ELLIS	CITY OF MAYPEARL WWTP	0.175	DEWATERING-OTHERS	212
CITY OF MILFORD	ELLIS	CITY OF MILFORD WWTF	0.12	PACKAGE PLANT	3,356
CITY OF BARDWELL	ELLIS	CITY OF BARDWELL WWTP	0.08	DEWATERING - SLUDGE DRYING B01	8
CITY OF WAXAHACHIE	ELLIS	CITY OF WAXAHACHIE WWTP	8	SAND FILTERS	8,865
TRINITY RIVER AUTHORITY OF TEXAS	ELLIS	RED OAK CREEK REGIONAL WWTP	6	AEROBIC DIGESTION-AIR	714
CITY OF ENNIS	ELLIS	OAK GROVE PLANT	3.1	DEWATERING-MECHANICAL-FILTER	2,236
ELLIS COUNTY TOTAL			**30.125**		**16,407**
CITY OF STEPHENVILLE	ERATH	STEPHENVILLE WWTP	3	PRELIM TREATMENT - BAR SCREEN	299
ERATH COUNTY TOTAL			**3**		**299**
CITY OF GRANBURY	HOOD	CITY OF GRANBURY WWTP	2	DEWATERING-OTHERS	289
CITY OF TOLAR	HOOD	CITY OF TOLAR WWTP	0.1	AEROBIC DIGESTION-AIR	6

CITY OF CRESSON	HOOD	CRESSON WWTP	0.05	PRELIM TREATMENT - BAR SCREEN	11
ACTON MUD	HOOD	ACTION MUD WWTP 2 PECAN PLANTATION	0.82	PRELIM TREATMENT - GRIT REMOVL	103
HOOD COUNTY TOTAL			**2.97**		**409**
CITY OF GREENVILLE	HUNT	CITY OF GREENVILLE WWTP	6	COMMERCIAL LAND APP (PERMIT)	1,106
CITY OF CADDO MILLS	HUNT	CITY OF CADDO MILLS WWTF	0.375	SECONDARY CLARIFICATION	31
CITY OF QUINLAN	HUNT	CITY OF QUINLAN WWTP	0.3	DISCHARGE ONLY	28
City of Josephine	HUNT	CITY OF JOSEPHINE WWTP 2	0.155	DEWATERING-OTHERS	17
CITY OF COMMERCE	HUNT	COMMERCE WWTF	2	LANDFILL	559
HUNT COUNTY TOTAL			**8.83**		**1,740**
CITY OF CLEBURNE	JOHNSON	CITY OF CLEBURNE WWTP	9.5	SECONDARY CLARIFICATION	638
Johnson County Special Utility District	JOHNSON	JOHNSON COUNTY SUD WWTP	0.7	SLUDGE HOLDING TANK	79
CITY OF ALVARADO	JOHNSON	CITY OF ALVARADO WWTP	0.6	SLUDGE HOLDING TANK	2
CITY OF GODLEY	JOHNSON	CITY OF GODLEY	0.36	SECONDARY CLARIFICATION	170
CITY OF GRANDVIEW	JOHNSON	GRANDVIEW WWTP	0.3	PUMPING RAW WASTEWATER	6
Alvarado Independent School District	JOHNSON	LILLIAN ELEMENTARY SCHOOL WWTP	0.035	AEROBIC DIGESTION-AIR	2
CITY OF KEENE	JOHNSON	KEENE WWTP	0.83	PUMPING RAW WASTEWATER	485
JOHNSON COUNTY TOTAL			**12.325**		**1382.03**
Las Lomas MUD 4B of Kaufman County	KAUFMAN	LAS LOMAS WWTP	0.5		1,382
CITY OF KEMP	KAUFMAN	CITY OF KEMP WWTP	0.35	PUMPING RAW WASTEWATER	2
CITY OF GARLAND	KAUFMAN	DUCK CREEK WWTP	40	SECONDARY CLARIFICATION	6,768
CITY OF TERRELL	KAUFMAN	KINGS CREEK WWTP	4.5	BIOMONITORING	551

CITY OF KAUFMAN	KAUFMAN	CITY OF KAUFMAN WWTP	1.2	ULTRA VIOLET LIGHT	385
KAUFMAN COUNTY TOTAL			**45.7**		**7,704**
CITY OF FROST	NAVARRO	CITY OF FROST WWTF	0.05	DEWATERING-OTHERS	4
CITY OF CORSICANA	NAVARRO	CITY OF CORSICANA WWTP 2	5.95	OTHER FILTRATIONS	285
NAVARRO COUNTY TOTAL			**5.95**		**289**
PALO PINTO COUNTY	PALO PINTO	PALO PINTO COUNTY WWTP	0.05	AEROBIC DIGESTION-AIR	1
CITY OF MINERAL WELLS	PALO PINTO	POLLARD CREEK WWTP	2.35	DEWATERING - SLUDGE DRYING B01	571
PALO PINTO COUNTY TOTAL			**2.35**		**572**
CITY OF ALEDO	PARKER	ALEDO WWTP	0.6	SLUDGE HOLDING TANK	5
CITY OF WILLOW PARK	PARKER	CITY OF WILLOW PARK WWTP	0.5	SECONDARY CLARIFICATION	641
CITY OF SPRINGTOWN	PARKER	CITY OF SPRINGTOWN WWTP	0.48	PUMPING RAW WASTEWATER	502
Springtown Independent School District	PARKER	RENO ELEMENTARY WWTP NO 1	0.015	EFFLUENT STORAGE PONDS	
AZLE ISD	PARKER	SILVER CREEK ELEMENTARY SCHOOL WWTP	0.009	IRRIGATION-PASTURELAND	20
BROCK ISD	PARKER	BROCK HIGH SCHOOL WWTP	0.0075	EFFLUENT STORAGE PONDS	na
CITY OF WEATHERFORD	PARKER	WEATHERFORD FACILITY	4.5	BIOMONITORING	na
CITY OF MINERAL WELLS	PARKER	WILLOW CREEK WWTP	1.26	BIOMONITORING	17
PARKER COUNTY TOTAL			**5.76**		**1,185**
NORTH TEXAS MUNICIPAL WATER DISTRICT	ROCKWALL	SABINE CREEK REGIONAL WWTP	5	BIOMONITORING	503
NORTH TEXAS MUNICIPAL WATER DISTRICT	ROCKWALL	BUFFALO CREEK WWTP	2.25	BIOMONITORING	1,589
NORTH TEXAS MUNICIPAL WATER DISTRICT	ROCKWALL	SQUABBLE CREEK WWTP	1.2	DEWATERING-MECHANICAL-FILTER	67
ROCKWALL COUNTY TOTAL			**8.45**		**2,159**

Texas Parks And Wildlife Department	SOMERVELL	DINOSAUR VALLEY STATE PARK	0.019	EFFLUENT STORAGE PONDS	
CITY OF GLEN ROSE	SOMERVELL	CITY OF GLEN ROSE WWTP	0.95	CHLORINATION FOR DISINFECTION	48
SOMERVELL COUNTY TOTAL			**0.95**		**48**
CITY OF FORT WORTH	TARRANT	VILLAGE CREEK WATER RECLAMATION FACILITY	166	ACTIVATED SLUDGE - CONVENTIONA	27,500
CITY OF GRAPEVINE	TARRANT	PEACH STREET WWTP	5.75	SLUDGE HOLDING TANK	836
CITY OF AZLE	TARRANT	ASH CREEK WWTP	2.45	SLUDGE HOLDING TANK	2,009
TARRANT COUNTY TOTAL			**174.2**		**30,345**
CITY OF BOYD	WISE	CITY OF BOYD WWTP	0.24	AEROBIC DIGESTION-AIR	273
CITY OF RHOME	WISE	WESTSIDE WWTF	0.15	SECONDARY CLARIFICATION	12
CITY OF CHICO	WISE	CITY OF CHICO	0.15	COMMERCIAL LAND APP (REGISTER)	3
CITY OF NEWARK	WISE	CITY OF NEWARK WWTP	0.15	COMMERCIAL LAND APP (REGISTER)	4
City of Alvord	WISE	CITY OF ALVORD WWTP	0.112	TRANSPORT TO ANOTHER WWTP	4
CITY OF DECATUR	WISE	CITY OF DECATUR	1.2	DEWATERING - SLUDGE DRYING B01	115
CITY OF BRIDGEPORT	WISE	CITY OF BRIDGEPORT WWTP	0.84	SLUDGE HOLDING TANK	6
WISE COUNTY TOTAL			**2.842**		**417.1**