BURNS McDONNELL

COMPOSTING FACILITY TECHNICAL EVALUATION

MCCOMMAS BLUFF SITING STUDY

Project No. 164099

SUBMITTED TO
City of Dallas

March 2025

CONTENTS

FIGURES

TABLES

List of Abbreviations

Abbreviation	Term/Phrase/Name
2024 USD	2024 United States Dollars
ASPs	Aerated Static Piles
Burns & McDonnell	Burns & McDonnell Engineering Company, Inc.
C:N	Carbon-to-Nitrogen
CECAP	Comprehensive Environmental and Climate Action Plan
City	City of Dallas, Texas
CY	Cubic Yard
DBB	Design-Bid-Build
DBO	Design-Build-Operate
DWU	Dallas Water Utilities
EA	Each
EJScreen	EPA's Environmental Justice Screening and Mapping Tool
EPA	United States Environmental Protection Agency
Evaluation	Composting Facility Technical Evaluation
FEMA	Federal Emergency Management Agency
FOG	Fats, Oils and Grease
FY	fiscal year
GIS	Geographic Information System
HEOs	Heavy Equipment Operators
HDPE	high density polyethylene
Landfill	McCommas Bluff Landfill at 5100 Youngblood Road
LS	Lump Sum
LSWMP	Local Solid Waste Management Plan
LVS	load volume scanning
MO	Months
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
NCTCOG	North Central Texas Council of Governments
NTMWD	North Texas Municipal Water District
NWI	National Wetlands Inventory

O&M	Operating and Maintenance
OPCC	Opinion of Probable Construction Costs
PAYT	Pay-as-You-Throw
PFAS	Per- and Polyfluoroalkyl Substances
Project Team	Burns & McDonnell Engineering Company, Inc. in partnership with Risa Weinberger & Associates, Inc.
pH	Potential of Hydrogen
Qty	Quantity
RFCSP	Request for Competitive Sealed Proposals
RFP	Request for Proposal
SF	Square Foot
SS WWTP	Southside Wastewater Treatment Plant
SSO	source separated organics
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TPDES	Texas Pollutant Discharge Elimination System
TRA	Trinity River Authority
US	United States
USFWS	United States Fish and Wildlife Service
WWTF	Wastewater Treatment Facility

Executive Summary

The City of Dallas, Texas (City) has received funding through the Fiscal Year (FY) 2024-2025 North Central Texas Council of Governments (NCTCOG) Solid Waste Grant program from the Texas Commission on environmental Quality (TCEQ) to conduct a technical evaluation study for a regionally accessible composting facility located at the City's McCommas Bluff Landfill at 5100 Youngblood Road (Landfill). Organic wastes managed within the City, which are currently being landfilled, include yard waste, brush, wood waste, food waste, and biosolids.

When landfilled, this material consumes valuable airspace and contributes considerably to the facility's greenhouse gas emissions. If this waste is composted instead, the finished product can reduce reliance on synthetic fertilizers, improve soil water retention, and minimize erosion. Composting can serve as an important portion of a municipal circular economy.

The City has demonstrated a historical interest in the diversion of organic waste. The 2020 *Dallas Comprehensive Environmental and Climate Action Plan* (CECAP) presented goals to actively promote source reduction, recycling and composting to the Dallas community and to adopt an ordinance to implement a City-wide organics management program. Similarly, the 2022 *City of Dallas Local Solid Waste Management Plan Update* (LSWMP) proposed goals to recycle 35 percent of single-family organic waste by 2030 and achieve 80 percent recycling of single-family organic waste by 2050.

In 2012, the City obtained a permit modification to develop a composting facility at the Landfill that was never constructed. This evaluation assesses the feasibility of the permitted site compared to alternatives within the Landfill property boundaries. To conduct this Composting Facility Technical Evaluation (Evaluation), Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell), in partnership with Risa Weinberger & Associates, Inc. (Project Team), has organized the project as summarized below in Table E-1.

Table E-1: Evaluation Organization and Purpose

Section	Title	Purpose
1.0	Introduction	Communicates the project background, overview, and organization.
2.0	Stakeholder Engagement Interviews	Engage with key stakeholders to develop an understanding of the current system, challenges, opportunities, and service needs. Stakeholders interviewed include generators and haulers of organic waste, existing regional organic waste processors, and community partners who may share an interest in developing a composting facility.
3.0	Organic Feedstock and Market Analysis	Evaluate the potential types and quantities of materials to be processed as well as potential markets for the finished products. This evaluation included review of previous studies, analysis of Landfill scale data, and visual audits.
4.0	Location and GIS Analysis	Analyze the Landfill property's ability to support a composting facility in the context of the regional solid waste system.
5.0	Processing Technology Evaluation	Collaborate with the City to identify a preferred composting technology that best aligns with their needs, restrictions, and goals for the program. Technologies considered include turned windrows, aerated static piles (ASPs), and in-vessel systems.

6.0	Traffic Volume Analysis	Estimate the number of vehicles expected to serve this diversion effort and their impact on the traffic volume already experienced at the Landfill property.
7.0	Site Evaluation and Facility Concept	Identify the preferred site location on the Landfill property through desktop analysis of relevant available data and City input. With an annual feedstock, composting technology, and site location identified, develop a conceptual layout and opinion of probable costs for this facility.
8.0	Financial Evaluation	Estimate the impact of the proposed composting facility on the City's overall solid waste management program costs.
9.0	Implementation Strategy and Timeline	Discuss the implementation strategy and schedule for developing a composting facility.
Appendix	**Title**	**Purpose**
A	Stakeholder Interviews	Provides data and results of the stakeholder engagement efforts.
B	Feedstock Calculations	Provides assumptions and calculations used to evaluate the organic feedstock diversion possible in the City.
C	Financial Evaluation	Provides calculation details for annualized capital and operating costs, costs per ton, impacts on Landfill costs and revenue, and recommended pricing as described in Section 8.0.
D	Facility Sizing Calculations	Provides assumptions and calculations used to estimate the proposed composting facility footprint and maximum annual processing rates described in Section 5.4.2.

Stakeholder Engagement Interviews

Burns & McDonnell facilitated stakeholder engagement interviews to develop an understanding of the current marketplace, alternative sources of organic waste, and potential partners in composting facility development. Key stakeholder groups interviewed included haulers, organic waste processors, and community partners. A summary of stakeholder engagement methodology and results is provided in Section 2.0 and Appendix A.

Interviewed stakeholders are supportive of the City's efforts and believe that the project could improve the City's image and be well supported by the public. If the City initiates a competitive procurement process for a composting facility, Burns & McDonnell anticipates a strong response based on feedback received. Stakeholders stressed the importance of feedstock quality standards to their success.

Stakeholders are open to a variety of partnership structures, but most expressed a preference for a facility designed, constructed and operated by the contractor with capital financing by the City. Available options for structuring public-private partnerships are discussed in Section 9.0. Stakeholders were interested in bringing third party tonnage to the composting facility and requested clarification of tonnages to be provided by the City so the facility can be designed and sized appropriately.

Stakeholders are open to processing a variety of feedstock materials. Some expressed reservations about accepting biosolids as a feedstock prior to the anticipated release of new regulations for Per- and Polyfluoroalkyl Substances (PFAS) and recommended pilot-scale or phased-in operation. Stakeholders stressed the importance of enforcing feedstock quality standards on the overall success of the program, especially if post-consumer food waste is accepted.

Organic Feedstock and Market Analysis

The Project Team estimated existing and future quantities of local organic feedstock to support future development of a composting facility. For this Evaluation, organic feedstock is limited to green waste (clean wood waste, yard trimmings, brush, shrubs), food waste, and biosolids. Approximately 217,720 tons of this organic waste was landfilled at the McCommas Bluff Landfill in Fiscal Year (FY) 2023. Through both voluntary participation and the targeting of cleaner brush loads at the Landfill, it was estimated that the City could divert 2,500 to 15,800 tons per year of this feedstock without further policy.

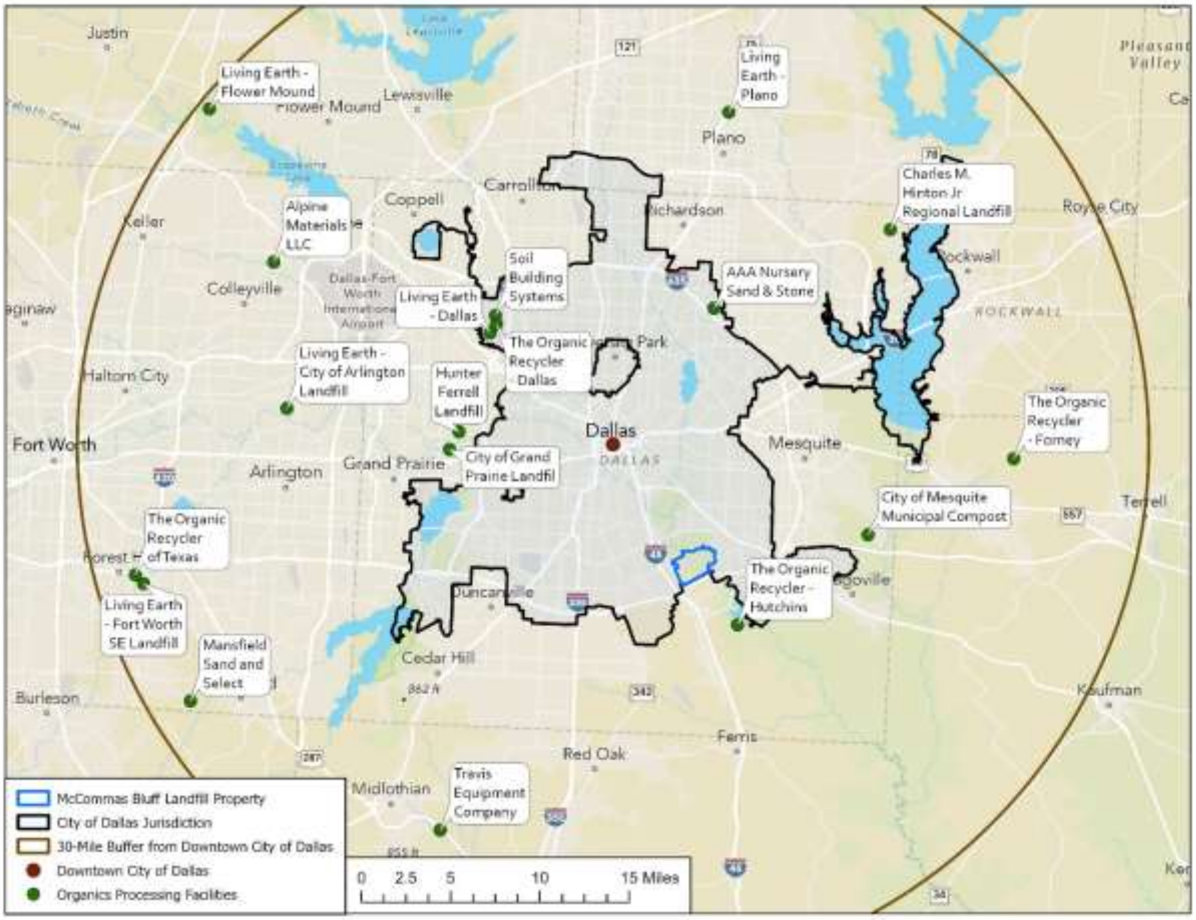
The possible implications of common organics diversion strategies and policies were then analyzed. Two policy strategies were identified as possibilities by the City in the next 10 years: The preferential pricing of both green waste and food waste at the composting facility, and the curbside collection of residential green waste. If the City were to initially implement only preferential pricing strategies, they could divert 6,700 to 31,600 tons of feedstock per year. For the purpose of this Evaluation, Phase 1 represents the high end of this range (31,600 tons per year). If curbside collection of green waste is implemented in addition to the preferential pricing, the City could see 55,600 to 117,400 tons per year of diverted organic feedstock. For the purpose of this Evaluation, Phase 2 represents the high end of this range (117,400 tons per year).

Finally, the Project Team estimated the quantity of finished compost that could be generated by a City facility and potential local markets for the finished product. Because the City has a large supply of green waste, this Evaluation assumes that half of this material will be marketed as mulch with the other half supplying the compost feedstock. Under these assumptions, the maximum compost output for the facility is about 162,700 cubic yards with a maximum mulch output of about 207,700 cubic yards. This product could be utilized internally and/or marketed and sold to the public through the value market, the volume market, or a combination of the two.

Location and GIS Analysis

The feasibility of locating a composting facility at the Landfill property was evaluated by the Project Team. The analysis considered proximity to other regional composting facilities (see Figure E-1) and generators of targeted feedstocks, environmental justice areas, and impacts to threatened and endangered species. It was determined that the Landfill property is in a location that could feasibly attract the targeted organic feedstock based on proximity to substantial generators and distance from competing organic waste processors.

Figure E-1: Proximity to Regional Compost Facilities



The communities near the Landfill property rank nationally in the 92nd percentile for low income, the 84th percentile for limited English proficiency, and the 96th percentile for population of people of color. The potential impact of the composting operation on the local community is not expected to differ substantially from the impact of current waste disposal operations at the Landfill.

Data from the United States Fish and Wildlife Service identifies nine threatened or endangered species in Dallas County. The Landfill has operated under a TCEQ permit since 1981 and was issued a permit for a composting facility in 2012 with no identified concerns related to threatened or endangered species. It is assumed that an active composting facility located on the permitted landfill property would be required to meet the same or similar permit conditions and would not have a significant impact on threatened or endangered species.

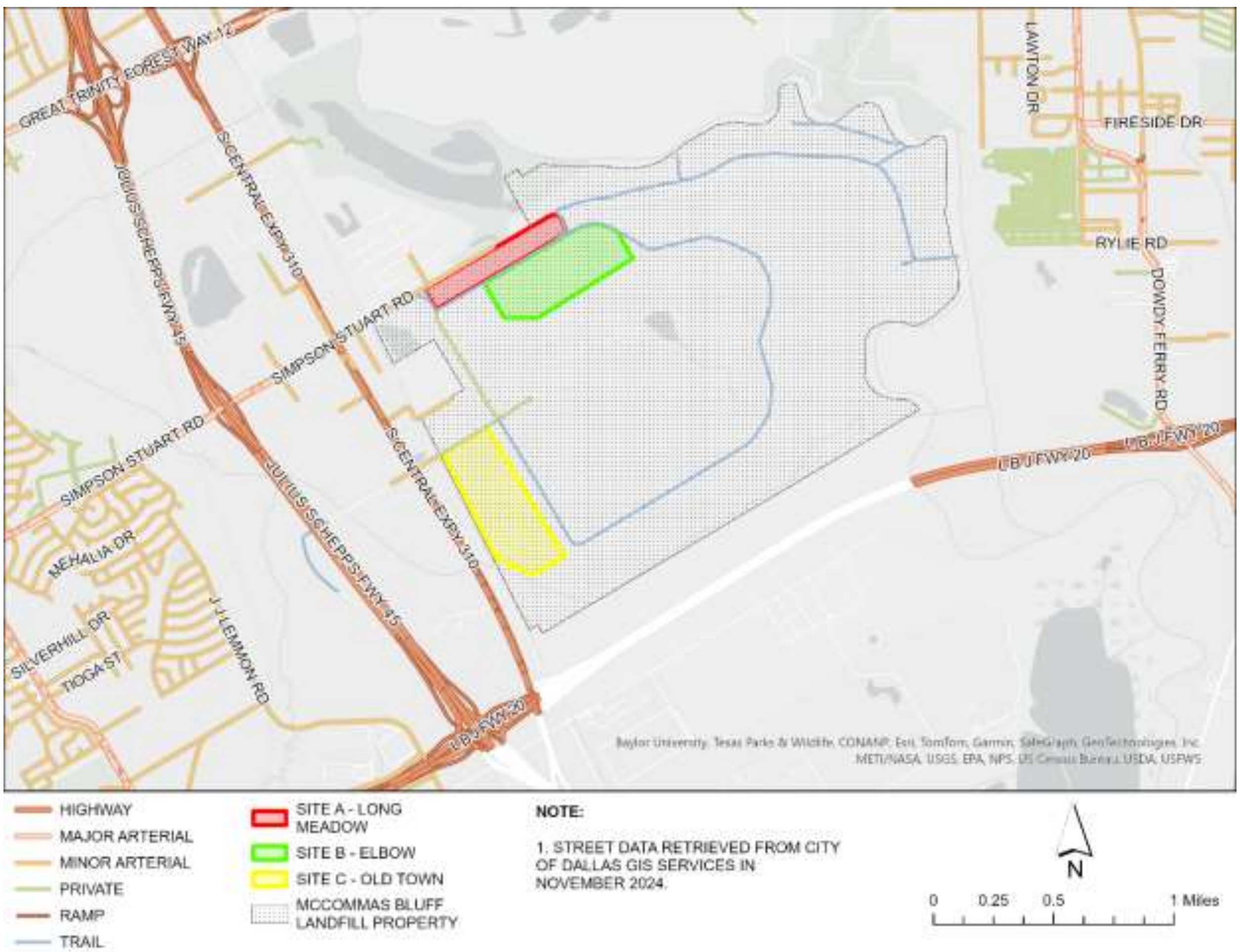
Processing Technology Evaluation

Three primary composting technology alternatives – turned windrows, aerated static piles (ASP), and in-vessel – were evaluated according to the City's priorities and goals for a potential future composting operation. First, the three primary composting technologies were preliminarily screened for feedstock compatibility, equipment needs, operations, Landfill impact, spatial needs, scalability, nuisance issues, compliance, relative capital costs, relative operating and maintenance (O&M) costs, product marketability, and implementation timelines. The preliminary screening analysis indicated that turned windrow composting may best meet the City's needs, though ASP composting could be a feasible alternative if space were a concern.

Turned windrow composting was then analyzed in greater detail for compliance and facility sizing. In general, feedstock and not technology dictates the regulatory requirements of a composting facility. However, the Landfill already has TCEQ approval for a turned windrow composting facility onsite. The development of a turned windrow composting facility could thus benefit from the lowest permitting efforts.

The Project Team estimated maximum throughputs of a turned windrow composting facility located at each of the three candidate sites under consideration in this Evaluation: Site A (The Long Meadow), Site B (The Elbow), and Site C (Old Town). Site A could process approximately 80,000 tons per year, Site B was estimated at 170,000 tons per year, and Site C was about 180,000 tons per year. Locations for the three candidate sites are shown below in Figure E-2.

Figure E-2: Candidate Site Locations



If the City partners with a third-party contractor for operations only, they should solicit feedback from any potential operating partners prior to making a final decision on their choice of processing technology. If the City decides to develop a composting facility in partnership with a private company through a Design-Build-Operate (DBO) procurement, it may be advantageous for the City to give respondents flexibility to propose turned windrow or aerated static pile technology based on the types and quantities of feedstock that they intend to process.

Traffic Volume Analysis

Burns and McDonnell analyzed potential changes to the number of vehicles accessing the Landfill property based on the estimated Phase 1, Phase 2, and maximum Site B throughput tonnages.

A total of 35.7 daily inbound vehicle trips, including 2.2 rerouted vehicles from the Landfill tipping face and 33.5 additional vehicles, are estimated for a composting facility handling 162,500 cubic yards of feedstock per year (Phase 1). This facility could anticipate about 10.3 daily outbound trips. With the implementation of a composting facility handling the Phase 1 throughput, the Landfill could experience about a 3.9% increase in daily traffic volumes.

A total of 88.8 daily inbound vehicle trips, including 26.7 rerouted vehicles from the Landfill tipping face and 62.2 additional vehicles, are estimated for a composting facility handling 693,200 cubic yards of feedstock per year (Phase 2). This facility could anticipate about 31.8 daily outbound trips. With the implementation of a composting facility handling the Phase 2 throughput, the Landfill could experience about an 8.6 percent increase in daily traffic volumes.

A total of 149.8 daily inbound vehicle trips, including 26.7 rerouted vehicles from the Landfill tipping face and 123.1 additional vehicles, are estimated for a composting facility handling 1,004,200 cubic yards of feedstock per year (Maximum Throughput). This facility could anticipate about 44.7 daily outbound trips. With the implementation of a composting facility handling the Phase 2 throughput, the Landfill could experience about a 15.8 percent increase in daily traffic volumes.

The City should consider separating composting traffic from Landfill traffic, as feasible, to mitigate negative impacts this new operation could have on existing traffic flow. This can be achieved by utilizing a quicker alternative, like load volume scanning (LVS), to track incoming composting feedstock.

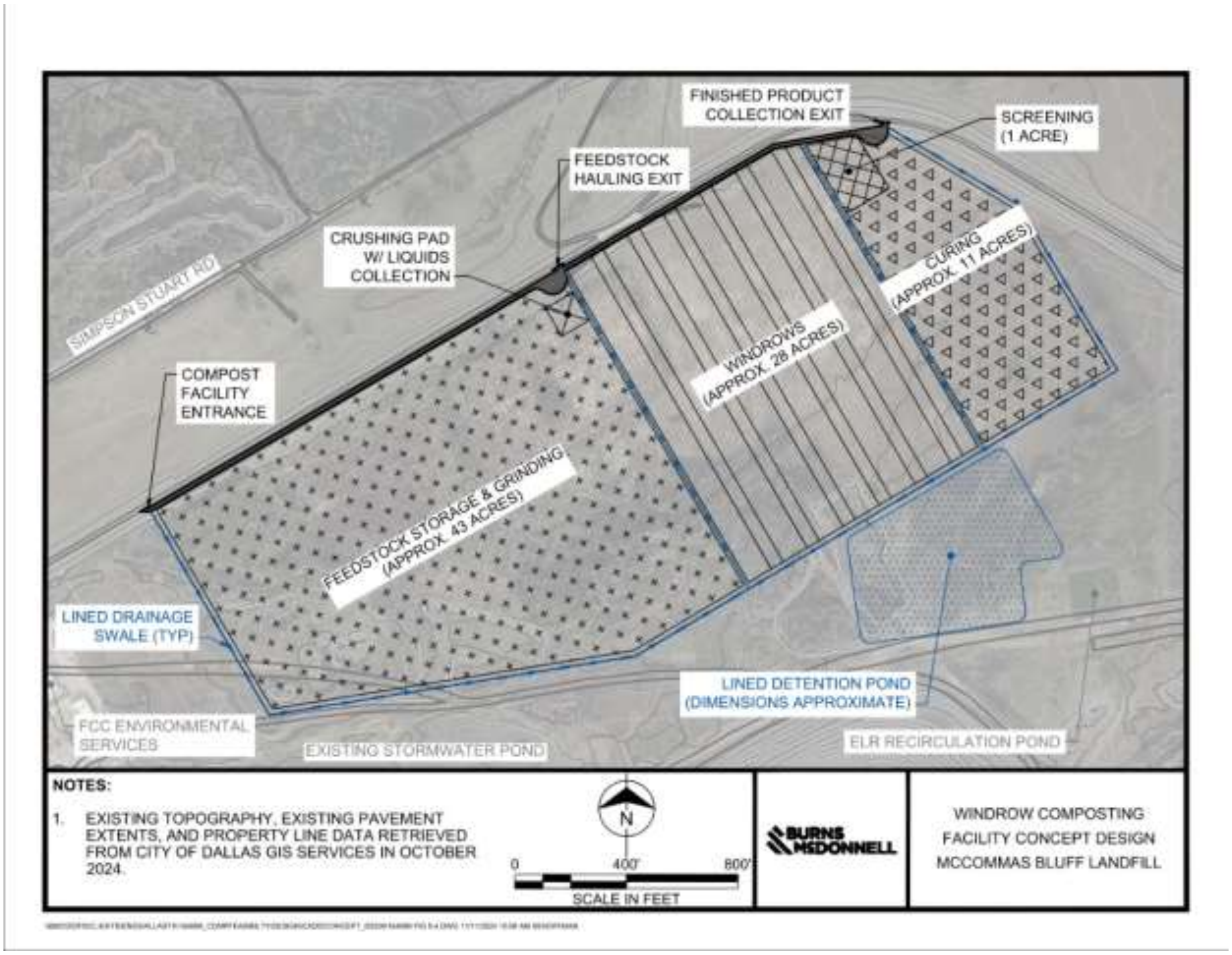
Site Evaluation and Facility Concept

The City has identified three potential locations for a new composting facility at the Landfill property. While evaluating the three candidate site locations, considerations were made including physical constraints and infrastructure, regulatory requirements, environmental restrictions, and transportation needs.

Site B (The Elbow) was identified as the preferred location for a windrow composting facility due to its size, existing grades, permitted status, lack of floodplain status, and ability to route traffic away from the Landfill’s scale house. One major disadvantage of Site B lies in its position within the future footprint of the Landfill. The City anticipates that much of Site B’s area could be claimed by a horizontal Landfill cell expansion in as little as 10 years.

The Project Team designed a conceptual turned windrow composting facility within the originally permitted footprint on Site B. It was estimated that this facility (Figure E-1) could process up to 170,000 tons of feedstock per year at maximum capacity. Key considerations made while arranging the facility include existing permit conditions, surface water management, existing topography, material flow through the composting process, future Landfill encroachment, safety and accessibility, and footprint minimization.

Figure E-1: Windrow Composting Facility Concept Design



Burns & McDonnell then developed a planning-level opinion of probable capital and operating cost for maximum throughput of the facility shown in Figure E-1 (170,000 tons per year). This facility would require an estimated initial capital investment of approximately $21.2 million in 2024 USD including facility construction and equipment purchase and an annual operating investment of approximately $3.1 million in 2024 USD. The facility construction cost estimate includes conservative assumptions including development of the full 82-acre permitted area, construction of a low permeability liner in the windrow area to permit the processing of biosolids, construction of a permanent, fully serviced, metal framed building for management and operations staff and maintenance activities, and contingencies that reflect the preliminary conceptual nature of the assumed design. These assumptions may be revisited and refined during detailed design.

The City should solicit feedback from any potential operating partners prior to detailed facility design, permitting, and construction to facilitate early collaboration. During detailed facility design, they should look for synchronization with the future planned Landfill cell to maximize efficiency in construction costs.

Financial Evaluation

The analysis in Section 8.0 builds from the financial pro forma that was developed for Site B at the Landfill, utilizing the opinion of probable capital and operating costs described in Section 7.5. There are several factors, particularly policy decisions, that can influence the amount of material brought into the composting facility. The City has initially expressed interest in establishing preferential pricing for green and food waste at the composting facility, which could yield up to 31,600 tons of annual feedstock (Phase 1). They have also indicated the possibility of later establishing curbside collection of green waste within this 10-year planning period, potentially raising the feedstock to 117,400 tons per year (Phase 2). The maximum throughput of the facility, as discussed in Section 7.0, is estimated at 170,000 tons per year, accommodating approximately 52,600 additional tons of feedstock beyond the Phase 2 estimate. Given the range of potential material that could be processed at the composting facility, Burns & McDonnell developed the financial analysis for the three scenarios based on 31,000, 117,400 and 170,000 tons per year.

Tipping fees for the composting facility can be competitive with the cost of landfill disposal, provided that the composting facility has enough incoming material. The lowest tonnage scenario (Phase 1) of 31,000 tons per year results in a break-even cost $76.77 per ton, while Phase 2 at 117,000 and the Maximum Tonnage at 170,000 tons per year result in costs per ton of $25.15 and $17.65, respectively. The cost per ton of a composting facility will generally decrease as tonnage throughput increases. Feedstock may be sourced via a combination of City policies and programs, as well as through the efforts of a private operator.

Several variables, mainly inbound tonnage, may vary year-to-year at the composting facility. If the City proceeds with the RFP process for a private operator, pricing should be developed in collaboration with a private operator based on their knowledge of regional markets and available feedstock. The price for disposal needs to be competitive with other regional facilities, but it should also consider the City's location advantage due to reduced hauling time. Additionally, the pricing must be less expensive than landfill disposal to encourage the use of the composting facility.

Diverting material away from the City’s Landfill has positive and negative short- and long-term financial benefits. In the short-term, material that is diverted from the Landfill means less revenue from landfill tipping fees. While less revenue is partially offset from deferred costs for landfill development, closure-post closure and TCEQ fees, there is a negative cash flow impact on the Landfill that increases as the tonnages grow. The City can either fill this airspace with additional revenue tons or preserve the airspace for additional Landfill life in the future. Over time the value of the preserved Landfill airspace space will continue to appreciate in value. Over the long-term, the City should recover the deferred revenue.

Implementation Strategy and Timeline

Burns & McDonnell developed possible implementation steps and identified key issues for the development of the potential future composting facility described in the sections above.

Private facility operation allows the contractor to leverage their operating experience and existing equipment, customer and supplier networks to the benefit of the City. Allowing the contractor to process third party feedstock at the City’s facility spreads facility capital costs over more tonnage and increases access to different types of feedstock to balance carbon, nitrogen, moisture and nutrient requirements. The City should also take a non-prescriptive approach to technology requirements, allowing vendors maximum flexibility to optimize the facility to match their business and operational strategies.

Through a Request for Competitive Sealed Proposals (RFCSP), the City can request separate pricing for facility operation by the contractor and facility operation by the City and evaluate both options before making a final decision. Public financing of infrastructure can reduce costs by leveraging the City’s lower borrowing costs and remove the need for the contractor to make a return on facility capital.

The proposed composting facility location lies within the ultimate footprint of Landfill development and is expected to be available for composting operations for approximately 10 years. If the City decides to implement a project, the procurement process should begin as early as possible to maximize the facility’s useful life and the City's investment in capital. The City should also consider Design-Build-Operate (DBO) facility procurement to accelerate development timelines and provide opportunities for optimal facility design through collaboration between the designer, constructor, and operator.

Stakeholder engagement with City Council, interest groups, the southeast Dallas community, and the general public should be integrated into project procurement and implementation to provide an open and transparent process that solicits stakeholder input as appropriate.

The information in this Evaluation is presented for planning purposes only to assess the feasibility of siting a composting facility at the McCommas Bluff Landfill in Dallas, Texas. Burns and McDonnell's estimates, analyses, and recommendations presented in this Evaluation are based on our professional experience and judgment, as well as external sources and assumptions. While we believe the information presented herein is reasonably accurate, the Project Team does not guarantee that actual values or scenarios will not differ from those presented upon implementation. While the Project Team collaborated with the City to develop the information included in the Evaluation, they are not obligated to implement the recommendations included therein as there is a need for further technical, financial and policy decisions to be made prior to any final actions.

1.0 Introduction

The City of Dallas, Texas (City) provides solid waste management to approximately 1.3 million residents through its Sanitation Department. The City disposes of most of its waste at the McCommas Bluff Landfill located at 5100 Youngblood Rd (Landfill). Organic materials such as yard waste, brush, wood waste, food waste, and biosolids make up a sizable portion of the material landfilled by the City and third-party customers, consuming valuable airspace. Diversion of organic waste represents a significant opportunity for the City to conserve landfill capacity to meet future demand.

The diversion of organic material can also reduce greenhouse gas emissions, with food waste being responsible for as much as 60 percent of the methane generated at landfill sites[1] which rank third in national fugitive methane emissions.[2] Composting is a popular strategy for the diversion and recycling of organic waste. Finished compost, when properly applied, improves soil water retention, minimizes erosion and reduces reliance on synthetic fertilizers. Composting can play a key role in developing a municipal circular economy.

1.1 Project Overview

Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell), in partnership with Risa Weinberger & Associates, Inc. has undertaken a comprehensive technical evaluation on behalf of the City for siting a regionally accessible composting facility at the Landfill. This initiative is supported by the Fiscal Year (FY) 2024-2025 North Central Texas Council of Governments (NCTCOG) Solid Waste Grant and serves as a continuation of several previous efforts including:

- The *Dallas Comprehensive Environmental and Climate Action Plan* (CECAP)[3]
- The *City of Dallas Local Solid Waste Management Plan Update* (LSWMP)[4]
- The North Central Texas *Regional Solid Waste Management Plan*[5]
- The *North Central Texas Organic Waste to Fuel Feasibility Study*[6]
- The *North Central Texas Organic Waste Gap Analysis Technical Study*[7]

CECAP emphasized the importance of organic waste diversion through the following goals:

1. Actively promote source reduction, recycling and composting to the Dallas community.

[1] US EPA, "Quantifying Methane Emissions from Landfilled Food Waste", US EPA, October 2023, https://www.epa.gov/system/files/documents/2023-10/food-waste-landfill-methane-10-8-23-final_508-compliant.pdf
[2] US EPA, "2022 US Methane Emissions, by Source", Basic Information about Landfill Gas, US EPA, September 20, 2024, https://www.epa.gov/lmop/basic-information-about-landfill-gas
[3] AECOM, *Dallas Comprehensive Environmental and Climate Action Plan*, (City of Dallas, Texas, 2020), https://www.dallasclimateaction.com/.
[4] Burns & McDonnell, *Local Solid Waste Management Plan Update*, (City of Dallas, Texas, 2022), https://dallascityhall.com/departments/sanitation/lswmp/Pages/default.aspx.
[5] Burns & McDonnell, *Regional Solid Waste Management Plan*, (NCTCOG, 2022), https://www.nctcog.org/envir/materials-management/materials-management-plan
[6] Burns & McDonnell, *North Central Texas Organic Waste to Fuel Feasibility Study*, (NCTCOG, 2022), https://www.nctcog.org/envir/materials-management/nct-organic-waste-to-fuel-feasibility-study.
[7] Risa Weinberger & Associates, Inc., *North Central Texas Organic Waste Gap Analysis Technical Study*, (NCTCOG, 2023), https://www.nctcog.org/envir/materials-management/organic-waste-gap-analysis-study.

2. Adopt an ordinance to implement a City-wide organics management program.

In support of CECAP goals, the LSWMP identified goals encouraging the diversion of organic waste as well:

1. Recycle 35 percent of single-family organic waste by 2030
2. Recycle 80 percent of single-family organic waste by 2050

The proposed composting operation is significant not only for the City but also for regional organic waste diversion objectives. In 2012, the City obtained a permit modification to develop a composting facility at the Landfill that was never constructed. This evaluation assesses the feasibility of the permitted site compared to alternatives within the Landfill property boundaries.

1.2 Project Organization

To conduct this Composting Facility Technical Evaluation (Evaluation), Burns & McDonnell has organized the project as summarized in Table 1-1.

Table 1-1: Evaluation Organization and Purpose

Section	Title	Purpose
1.0	Introduction	Communicates the project background, overview, and organization.
2.0	Stakeholder Engagement Interviews	Engage with key stakeholders to develop an understanding of the current system, challenges, opportunities, and service needs. Stakeholders interviewed include generators and haulers of organic waste, existing regional organic waste processors, and community partners who may share an interest in developing a composting facility.
3.0	Organic Feedstock and Market Analysis	Evaluate the potential types and quantities of materials to be processed as well as potential markets for the finished products. This evaluation included review of previous studies, analysis of Landfill scale data, and visual audits.
4.0	Location and GIS Analysis	Analyze the Landfill property's ability to support a composting facility in the context of the regional solid waste system.
5.0	Processing Technology Evaluation	Collaborate with the City to identify a preferred composting technology that best aligns with their needs, restrictions, and goals for the program. Technologies considered include turned windrows, aerated static piles (ASPs), and in-vessel systems.
6.0	Traffic Volume Analysis	Estimate the number of vehicles expected to serve this diversion effort and their impact on the traffic volume already experienced at the Landfill property.
7.0	Site Evaluation and Facility Concept	Identify the preferred site location on the Landfill property through desktop analysis of relevant available data and City input. With an annual feedstock, composting technology, and site location identified, develop a conceptual layout and opinion of probable costs for this facility.
8.0	Financial Evaluation	Estimate financial costs and revenue of the proposed composting facility and financial impacts on the City's overall solid waste management program costs.
9.0	Implementation Strategy and Timeline	Discuss the implementation strategy and schedule for developing a composting facility.

Appendix	Title	Purpose
A	Stakeholder Interviews	Provides data and results of the stakeholder engagement efforts.
B	Feedstock Calculations	Provides assumptions and calculations used to evaluate the organic feedstock diversion possible in the City.
C	Financial Evaluation	Provides calculation details for annualized capital and operating costs, costs per ton, impacts on Landfill costs and revenue, and recommended pricing as described in Section 8.0.
D	Facility Sizing Calculations	Provides assumptions and calculations used to estimate the proposed composting facility footprint and maximum annual processing rates described in Section 5.4.2.

2.0 Stakeholder Engagement Interviews

Burns & McDonnell facilitated stakeholder engagement interviews to develop an understanding of the current marketplace, alternative sources of organic waste, and potential partners in composting facility development. These interviews targeted the following three sectors:

- Organic waste processors including private sector companies currently operating commercial-scale composting facilities in the Texas market.
- Large quantity generators such as food manufacturers, grocery stores, restaurants, or haulers operating subscription-based organic waste collection programs.
- Community partners including City departments and governmental agencies such as Public Works, Parks and Recreation, Forestry, and wastewater treatment authorities.

Organic waste diversion in the City is currently provided by private haulers and processing facilities. The City is developing a pilot program to collect and recycle commercial organic waste that will target special events and food service establishments. The quality and quantity of organic waste to be generated by this new City program during the initial years is unknown at present.

The City may decide to implement a curbside collection program for green waste in the future but does not intend to collect or haul food waste or other organic wastes. The City will rely on private haulers for delivery of these materials to the proposed composting facility. The City anticipates pursuing a public private partnership for facility development and operations, or potentially for facility operations only.

2.1 Interview Methodology

Burns & McDonnell worked with the City to develop a list of 11 large quantity generators and haulers, seven organic waste processors, and seven community partners that were invited to participate in interviews as summarized in Table 2-1.

Table 2-1: Stakeholder Interview Invited Participants

Large Quantity Generators and Haulers	Organic Waste Processors	Community Partners
Large Quantity Generators • Pioneer Frozen Foods • Oak Farms Dairy • Walmart • Kroger • Consolidated Restaurant Operations • Baylor University Medical Center • Lew Sterrett Justice Center • Southern Glazer's Wine & Spirits of Texas • Dean Holding Company **Haulers** • Turn Compost • Moonshot Compost	• Living Earth • The Organic Recycler • Organics by Gosh • Synagro • New Earth • Silver Creek Materials • Champion Waste & Recycling Services	• Dallas Public Works • Dallas Parks and Recreation • Dallas Department of Aviation • Dallas Convention and Event Services • Dallas Water Utilities • Trinity River Authority • North Texas Municipal Water District (NTMWD)

Invitees received a list of questions to be covered during the interview process. Copies of the interview questions are included in Appendix A. Burns & McDonnell received responses and scheduled interviews with eight stakeholders as summarized in Table 2-2. Burns & McDonnell followed up with the remaining invited stakeholders but did not receive responses.

Table 2-2: Stakeholder Interview Participants

Large Quantity Generators and Haulers	Organic Waste Processors	Community Partners
• Turn Compost (hauler) • Moonshot Compost (hauler) • No responses received from large quantity generators	• Living Earth • The Organic Recycler • Organics by Gosh • Synagro	• Trinity River Authority • North Texas Municipal Water District (NTMWD) • Dallas Water Utilities

Burns & McDonnell conducted one-hour virtual interviews with each stakeholder in January 2024. Question responses are presented in aggregate format to protect the confidentiality of interview participants. Results are grouped by stakeholder category and topic in the following sections.

2.2 Organic Waste Processors

Burns & McDonnell's interviews with organic waste processors confirm that there is significant interest in partnering with the City to develop a composting facility at the Landfill. A summary of organic waste processors' feedback on key issues is provided below.

2.2.1 Partnership Structure

All organic waste processors interviewed confirmed that they are interested in partnering with the City on development of a composting facility at the Landfill. All firms indicated that they would be likely to pursue the opportunity whether the facility was designed, built, and operated by the contractor or if the facility was designed and built by the City with a contract for operations only. Most expressed a preference for a design-build-operate contract. All agreed that it would be beneficial for the operator to have input during the design phase. There was a general preference for construction to be financed by the City, although contractor financing was also viewed as a viable option.

2.2.2 Facility Location

Processors were asked about their preference among the following facility location options:

- Existing privately owned facility
- New facility at the Landfill
- New facility at a different location

Processors agreed that no single existing facility currently has sufficient capacity to manage the tonnage that is likely to be generated by a City organics program. All agreed that the Landfill property location offers several advantages over other locations including the following:

- The site is City-owned, and centrally located
- The site is zoned, permitted, and in active use as a waste management site
- The site has existing infrastructure that could potentially be shared between the Landfill and composting facility (e.g. scales, roads, utilities, office and maintenance facilities, fuel tanks, etc.).

- The Landfill is a convenient location for disposal of non-processable contaminants
- Brush delivered to the Landfill could potentially be segregated and redirected to the composting facility

One processor noted that they have been looking at other locations within the Dallas area but would consider locating at the Landfill if the opportunity was presented.

2.2.3 Advantages and Disadvantages of City Operation

Processors were asked to describe potential advantages and disadvantages of a City-owned and operated facility compared to the City partnering with a private company. The processors all agreed that the City would benefit from the experience of a private operator, especially for marketing finished products. Product marketing requires detailed understanding of customer needs. Strong customer networks can take years to build, and customizing products to meet customer needs can affect the entire composting process. One processor noted that a publicly funded entity is less incentivized to prioritize product marketing.

Several processors noted that the biggest challenge in public-private partnerships is maintaining alignment of goals and objectives between the public and private partners. Processors emphasized the importance of clear communications and maintaining a commitment to cooperation and partnership while working together to solve problems.

2.2.4 Third Party Tonnage

Processors agreed that it would be beneficial to allow the contractor to process additional tons from other customers. In addition to creating economies of scale, bringing tonnage from a variety of sources allows the contractor to maintain an optimal balance of carbon, nitrogen, moisture, and other parameters in their compost mix. Processors agreed that the contractor should have flexibility to set pricing on third-party tons to allow them to compete in the marketplace and attract tonnage to the facility.

2.2.5 Agreement Terms

Processors expressed an overall willingness to be flexible and consider alternative agreement structures provided that all terms are clearly communicated at the start to allow the contractor to account for all costs in their pricing. In addition to expressing a general preference for the facility to be designed, built, and operated by the contractor with construction financing by the City, processors provided the following feedback on contract terms.

- The contractor needs a contract term of at least five years to recover their start-up cost and investment in rolling stock and other equipment.
- The City could pay a per-ton fee for each City ton processed that could be set through a Request for Competitive Sealed Proposals (RFCSP) or expressed as a discount to market-based fees charged by the contractor on third-party tons. The fee structure for City tons could include price tiers with variable pricing based on the total quantity delivered if the City needs flexibility on tonnage.
- As noted previously, the processors requested flexibility to set prices on third-party tons independently of the City's set rates to allow them to compete in the marketplace and recover true costs for different material types.
- The contractor can potentially make rent payments to the City for use of the site and/or pay the City a royalty on third-party tonnage, but this structure will generally result in higher per-ton fees on City tonnage.

- Although the City can create some flexibility in its tonnage commitment by using a tiered pricing structure as noted above, stakeholders expressed a preference for a contract that includes specified minimum and maximum city tonnages so the facility can be properly planned and designed.
- Some stakeholders suggested that the contract should allow for use of alternative composting facilities in the event of a service disruption at the City's facility.

2.2.6 Material Types

Processors were asked about their experience with processing the potential feedstock types listed below and their willingness to accept these materials at a composting facility located at the Landfill.

- Brush and yard trimmings
- Pre-consumer food waste
- Post-consumer food waste
- Wood waste
- Fats, oil and grease (FOG)
- Agricultural waste
- Construction and demolition debris
- Biosolids

Most processors had experience with the listed feedstock types and noted that the City's decisions about feedstocks could affect technology selection and price. The following are notes from discussions about individual feedstock types.

- Half of the processors were not experienced or had little experience with biosolids. All processors noted that clarity is needed on future regulation of Per- and Polyfluoroalkyl Substances (PFAS) before accepting biosolids as feedstock. Some believed that use of biosolids could be beneficial as a source of nitrogen and moisture-rich feedstock that is readily available and inexpensive to collect, while others believed that risks related to processing this material can increase without the correct mass balance. All expressed willingness to consider a process where biosolids are included with some recommending that the City start without it and consider adding it after the facility is established.
- Half of the interviewed processors were experienced with post-consumer food waste while the others were not. Some processors said that more space and equipment is needed to process this material and that the product is less marketable because of plastic and glass contaminants in the end product.
- One processor had experience with FOG, but it was processed in an anaerobic digester to create biofuel rather than composted.

2.2.7 Processing Technology

Processors were asked about their processing technology experience and preferences. The technology discussion was focused on windrow composting, ASPs, and in-vessel composting technologies. A common initial response was that technology selection could be influenced by the amount of space available as well as the type of feedstock. Many processors were familiar with using windrows and aerated static piles, but not as experienced with in-vessel processing. The following are additional points made about each technology.

- Processors were all experienced with windrow technology and liked its simplicity, flexibility, and lower cost. Most believed it was a logical choice for high volume feedstocks with lower odor potential like brush and yard waste provided that sufficient space is available.
- Many processors liked aerated static piles as a secondary option as it would provide faster degradation, increased odor protection, and reduced space requirements, but noted that this

technology would be more expensive. Some processors noted the possibility of a hybrid approach where an aerated static pile is used to stabilize certain wastes before incorporating them into windrows for finishing.

- Some processors were experienced with in-vessel technologies and others were not. All agreed that an in-vessel approach was not recommended if most of the material processed is yard waste and brush since in-vessel technology would introduce unnecessary expense and complexity.

2.2.8 Product Marketing

Processors described their approaches to marketing finished compost material. The following is a summary of key observations and comments that processors provided on compost marketing.

- Processors stressed the importance of producing quality products designed to meet customer needs.
- Processors currently produce a variety of blends and market bagged products to residential consumers and bulk products to a variety of markets including residential customers, agriculture, landscapers, construction companies, and reclamation projects.
- Most employ a dedicated sales team.
- Education and demonstrations can help customers understand the benefits and proper use of compost and mulch. With the correct use of soil amendment products, soil health gradually improves rather than depletes.
- The City could consider an ordinance that requires use of compost on development and landscaping projects in the City to realize the benefits of compost use such as carbon sequestration, improved soil water retention and health, and reduced runoff, flooding, and reliance on chemical fertilizers.
- A facility located at the Landfill has the potential for a diverse market portfolio.

2.3 Large Quantity Generators and Haulers

The large quantity generators and haulers that responded to Burns & McDonnell’s interview request were commercial haulers offering subscription-based organic waste collection services. The full list of invited participants is provided in Table 2-1. The following are key observations and comments provided during the interviews.

- Both haulers interviewed do not provide their own processing services but deliver to privately-owned processing facilities such as the ones interviewed in the previous section.
- Both haulers stated that they would deliver material to a composting facility located at the Landfill if it was priced competitively.
- Both haulers operate in the Dallas area. One also operates in Houston and Austin.
- One hauler reported over 100,000 pounds (50 tons) collected since commencement of Dallas operations in March 2023. The other hauler has reportedly exceeded 1,000,000 pounds in less than six years of operations.
- Both haulers stated that they collect all types of food waste and some yard waste and accept both pre-consumer and post-consumer waste. One hauler expressed a preference to collect pre-consumer food waste from clients first and then progress to post-consumer waste if the client shows willingness and ability to comply with rules for acceptable and unacceptable material. This creates a smaller stream of collection, but one that is less contaminated and easier to process.
- One hauler does not collect any packaged materials but acknowledged that potential customers may have a need for de-packaging at the composting facility.

- One hauler collects packaged material from a single commercial customer and noted that they are currently hauling this material to a processor outside of the Dallas area.
- Haulers would not disclose their pricing at specific processing facilities, but one hauler estimated a general range of $40 to $50 per cubic yard (CY).
- Both haulers were optimistic about their growth plans but expressed a need to carefully consider variables contributing to their business success when making decisions about expansion.
- Turn Compost, one of the two firms interviewed, ceased operations on July 19, 2024.

2.4 Community Partners

Burns & McDonnell contacted Dallas Water Utilities (DWU), Trinity River Authority (TRA) and the North Texas Municipal Water District (NTMWD) to discuss the possibility of composting biosolids at the Landfill. DWU currently manages biosolids using dedicated on-site monofils and was not interested in pursuing composting as an alternative biosolids management option. TRA land applies biosolids from the Central Regional Wastewater System but landfills biosolids generated by its other wastewater treatment plants. All biosolids tonnages generated by NTMWD are currently landfilled at their own landfill (RDF 121) with the exception of tonnage generated by the South Mesquite Regional Wastewater Treatment Plant, which is currently sent to Skyline Landfill for disposal. The following are key observations and comments provided through Burns & McDonnel's discussions with TRA and NTMWD.

- TRA and NTMWD each expressed interest in composting at the Landfill as an alternative for biosolids that are currently landfilled depending on price and proximity to their wastewater treatment plants.
- The combined annual biosolids quantity landfilled by TRA and NTMWD in 2023 was approximately 228,000 wet tons.
- TRA and NTMWD each expressed reservations about composting biosolids prior to release of new regulations on PFAS.
- One wastewater authority has been approached by an external wastewater treatment plant about biosolids processing, but their permit would not allow it.
- One wastewater authority had been approached by a large quantity food waste generator about processing in their digestors, but their permit would not allow it.

2.5 Additional Discussion

At the end of each interview, Burns & McDonnell invited participants to discuss additional topics not covered in the interview questions. The following is a summary of these additional comments.

- Brush and yard waste material would be a good starting point to establish the program before adding other materials.
- The City might consider a pilot scale project before full-scale implementation.
- Data collection will be key to future success of a City-owned facility. The City should gather as much information as possible about feedstock quantities and quality.
- Strict enforcement of feedstock quality standards is important.
- Processors are very supportive of the City's effort to pursue this kind of project. They believe that it could improve the City's image and be well supported by the public.
- The City should partner with an experienced and reputable processor that is familiar with the market area and has the necessary resources to succeed.
- Some processors encouraged the City to establish the program with brush and yard waste before implementing biosolids.

- Some processors expressed concerns about accepting biosolids prior to the anticipated establishment of additional regulations for PFAS.
- Take time to decide the best plan of action to achieve the City's goals. Create relationships with key stakeholders before developing a site.

2.6 Key Findings

The following key findings summarize feedback received from stakeholders during the interviews:

1. Multiple companies expressed interest in a compost facility partnership. The companies interviewed for this project expressed an interest in and are qualified to provide the compost processing services requested by the City.
2. Stakeholders believe that additional processing capacity is needed to implement a City organics program and respondents are supportive of a facility located at the Landfill.
3. Organic waste processors are open to a variety of partnership structures, but most expressed a preference for a facility designed, constructed and operated by the contractor with capital financing by the City.
4. Stakeholders recommend that a minimum and maximum City tonnage commitment be included in the contract to facilitate planning and design of the facility.
5. Stakeholders request flexibility to bring third-party tonnage to the site and to set prices to compete in the market.
6. Processors are open to a variety of feedstocks but some expressed reservations about including biosolids and post-consumer food waste without appropriate contractual terms.
7. Anticipated release of additional PFAS regulations could affect a City composting facility, especially if biosolids are accepted as feedstock.
8. Subscription-based organic waste haulers are currently operating in the City and represent a potential source of food waste. These haulers expressed interest in bringing materials collected to a City-owned composting facility at the Landfill
9. TRA and NTMWD currently landfill approximately 228,000 combined wet tons of biosolids annually. Both expressed interest in composting as an alternative to landfilling.
10. Stakeholders emphasized the importance of enforcing feedstock quality standards to the success of a City composting program.
11. Interviewed participants are supportive of the City's effort to pursue this project. They believe that it could improve the City's image and be well supported by the public.

2.7 Recommendations

1. Organic waste processors interviewed were well qualified and should be invited to participate in any future competitive procurement process. The opportunity should also be open to other qualified respondents.
2. If the City issues an RFP, it will be important for the documents to clearly articulate the status of and responsibilities for site infrastructure.
3. The City should carefully consider feedback provided by stakeholders to help maximize participation in any future procurement process.

3.0 Organic Feedstock and Market Analysis

This section estimates existing and future quantities of local organic feedstock to support future development of a composting facility. Securing a sufficient supply of organic feedstock is critical to the development of an optimized compost facility. Strategies and policies to enable efficient collection and diversion of organic feedstock generated in the City are considered below. This section also considers the quantity of finished compost that could be generated by a City facility and potential local markets for the finished product which is another key factor for a successful composting operation.

3.1 Solid Waste Source Material Categories

Most of the organic material to be processed at a future composting facility is expected to come from material streams that are currently landfilled at the Landfill today. To assess organic waste quantities that may be available to support future development of a composting facility, Burns & McDonnell obtained a full year of scale transaction records for FY 2023 from the Landfill and each of the City's three transfer stations. The scale records, which comprised over 400,000 transactions, indicate that the Landfill received 1,458,040 tons of solid waste during FY 2023 including material from the transfer stations. After filtering out material types that are considered unlikely to contain significant quantities of recoverable organic materials (construction and demolition materials, roofing materials, concrete, asphalt, and soil), Burns & McDonnell identified 1,086,569 tons of material considered likely to contain recoverable organics as shown in Table 3-1. These material categories are further broken down by source into materials collected by the City through its curbside collection program and departmental operations, and materials collected "by others", which include both cash customers and customers with accounts at the Landfill.

Table 3-1: Solid Waste Tonnages by Category and Source (2023)

Source Material Category	City Collected	Collected by Others	Total
Mixed Bulk and Brush	190,189	13,185	**203,374**
Green Materials	5,112	47	**5,159**
Pallets	–	1,630	**1,630**
Biosolids	2,163	1,219	**3,382**
Garbage, Compacted	232,379	121,444	**353,823**
Garbage, Uncompacted	29,775	489,426	**519,201**
Total	**459,618**	**626,951**	**1,086,569**

3.2 Organic Waste Categories

The mixed waste streams shown in Table 3-1 contain organic waste that could potentially be source-separated and diverted for use as feedstock at a composting facility. These organic wastes may be further divided into subcategories based on physical properties that affect composting operations as shown in Table 3-2.

Table 3-2: Organic Waste Categories

Organic Waste Category	Examples	Material Physical Properties
Green Waste (GW)	Clean wood waste, yard trimmings, brush, shrubs	High carbon to nitrogen (C:N) ratio, low moisture content
Food Waste (FW)	Pre-consumer and post-consumer food waste	Lower C:N ratio (higher nitrogen), higher moisture content, increased contamination risk
Biosolids	Treated and untreated sludge and septage from wastewater treatment processes	Lowest C:N ratio (highest nitrogen), highest moisture content

Burns & McDonnell estimated maximum recoverable organics tonnages at a capture rate of 100% for each organic waste category based on the composition percentages in Table 3-3. These composition percentages are based on a combination of previous City of Dallas composition audits, audit studies for other Texas cities, field observations, and assumptions as summarized in Appendix B.

Table 3-3: Estimated Organic Waste Composition Percentage by Material Stream

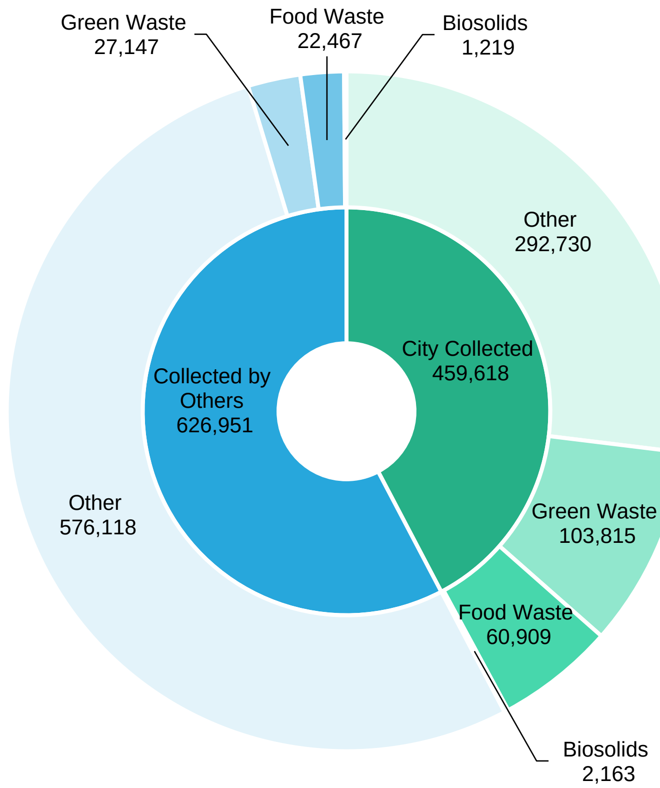
Source Material Category	Composition Percentage					
	City Collected			Collected by Others		
	Green Waste	Food Waste	Biosolids	Green Waste	Food Waste	Biosolids
Mixed Bulk and Brush	45.0%	0.0%	0.0%	45.0%	0.0%	0.0%
Green Materials	75.0%	0.0%	0.0%	75.0%	0.0%	0.0%
Pallets	–	–	–	100.0%	0.0%	0.0%
Biosolids	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
Garbage, Compacted	5.8%	26.2%	0.0%	3.2%	18.5%	0.0%
Garbage, Uncompacted	3.2%	0.0%	0.0%	3.2%	0.0%	0.0%

Applying the composition percentages in Table 3-3 to the total source material quantities in Table 3-1 results in a maximum estimate of 217,720 organic waste tons available for recovery in FY 2023 as summarized in Table 3-4 and Figure 3-1. These represent theoretical maximum tonnages assuming that the facility is able to capture 100 percent of available tonnage. Estimated actual capture rates for various City policy scenarios are discussed in Section 3.5.

Table 3-4: Estimated Maximum Recoverable Organic Tonnage at 100 Percent Capture

Source Material Category	Maximum Recoverable Tons		
	City Collected	Collected by Others	Total
Green Waste	103,815	27,147	130,962
Food Waste	60,909	22,467	83,376
Biosolids	2,163	1,219	3,382
Total	**166,887**	**50,833**	**217,720**

Figure 3-1: FY 2023 Disposed Tonnages by Hauler and Organic Fraction



The biosolids tonnages in Table 3-4 and Figure 3-1 represent biosolids currently received at the Landfill. Use of biosolids from external sources as feedstock is discussed in Sections 3.7.3 and 4.2.

3.3 Fieldwork

On July 25, 2024, Burns & McDonnell visited the Landfill site to observe receipt, recording, and processing of mixed organic waste loads. The site visit included conversations with City staff at the scale house and landfill working face and observation of operations over a period of approximately one hour. The purpose of the visit was to gain a better understanding of existing site operations and serve as a secondary check against the audit-based composition percentages in Table 3-3 and other assumptions underlying the tonnage estimates.

Prior to visiting the site, Burns and McDonnell had considered using higher assumed green waste composition percentages for loads from selected customer categories such as City Parks and Recreation that may contain higher percentages of green waste. However, based on the field observations and conversations with landfill staff, it was decided to use 45 percent as an assumed average green waste content for mixed bulk and brush loads from all customers. Through these field observations, Burns & McDonnell also identified a customer that regularly brings large, segregated loads of pallets to the site, and included loads from this customer totaling 1,630 tons per year in our annual green waste tonnage estimates.

3.4 Policy Options

The actual organic waste capture rate achieved by the City's program will depend on multiple factors including the City's policy decisions, public education programs, enforcement efforts, program convenience, and cost. The City could use various policy options to increase capture of organic waste such as implementing a separate City-operated curbside collection program for green waste and/or food waste, establishing preferential pricing for segregated green waste and/or food waste delivered to the landfill by non-city vehicles, or a landfill ban on green waste and/or food waste as summarized in the following sections. For each policy option, Burns & McDonnell applied an assumed capture rate based on typical results for similar programs as summarized in Section 3.5.

3.4.1 Green Waste Curbside Collection

The City's curbside collection program currently collects green waste commingled with other bulky wastes that are too large for carts such as furniture, carpet, mattresses, and appliances. Burns & McDonnell's tonnage estimates assume that a separate City-operated curbside collection program for green waste (Collect GW), if implemented, would capture 35 percent to 65 percent of the green waste currently managed through the City's mixed brush and bulky waste collection program and 15 to 40 percent of the green waste in the City's compacted and uncompacted waste streams. The City would require additional haul routes and collections vehicles to accommodate this new waste stream

The preferential price and landfill ban options for green waste discussed in Sections 3.4.3 and 3.4.5 are assumed to have minimal impact on City collection tonnages and are intended to increase capture of green waste currently hauled in non-city vehicles from sources such as commercial landscapers, construction contractors, or residents self-hauling mixed loads to the landfill.

Residential organics diversion programs often begin with curbside collection of green waste which is relatively easy to implement. If green waste is no longer accepted in the bulk waste stream, then the green waste collection program becomes the next-easiest and least expensive option for residents to use. If the City does not implement a curbside collection program, then it is estimated that the composting facility will capture one to five percent of green waste currently transported in City vehicles through voluntary citizen drop-off and the City's ongoing efforts to separate organics at the landfill working face.

3.4.2 Food Waste Curbside Collection

Residential food waste is currently managed through the City's curbside trash collection vehicles commingled with other household wastes. Although the City currently has no plans to implement source-separated collection, Burns & McDonnell estimates that a separate City-operated curbside collection program for food waste (Collect FW), if implemented, would capture 35 to 65 percent of the food waste tonnage in the City's compacted waste stream. The City would require additional haul routes and collections vehicles to accommodate this new waste stream. If the City decides to implement curbside collection for both food waste and green waste, then the two materials could potentially be co-collected in the same vehicle.

The preferential price and landfill ban policy options for food waste discussed in Sections 3.4.4 and 3.4.6 are assumed to have minimal impact on curbside collection tonnages and are intended to increase capture of food waste tonnages currently hauled in non-city vehicles from sources such as private commingled commercial collection, subscription programs, voluntary drop-off programs or self-hauled loads from residents.

Residential food waste collection programs may provide both an in-house food scraps bin and an outdoor collection container to residents. Frequently reported barriers to residential food waste diversion include odors, pests, spills, and overall cleanliness. Compostable bags to line in-house bins are a popular solution to these obstacles; however, they create operational challenges for composters as the bags often decompose slower than other organic wastes. If compostable liner bags are permitted, the City will need to decide if the City will sell approved bags to residents, give them away, or require residents to purchase them from third parties. For each of these options, the City will need to employ a combination of education, outreach, and enforcement to minimize use of unapproved bags. Another approach is a collection container replacement approach where containers are removed, cleaned, and returned to customers.

Regardless of the collection approach, educational outreach is an important component in reducing the contamination of organic feedstock. Overall, the successful implementation of a residential food waste diversion program requires a thoughtful and intentional strategy to reduce potential contamination and encourage participation by residents.

If the City does not implement a curbside collection program, then it is estimated that the composting facility could capture one to five percent of food waste in the City's compacted waste stream through voluntary participation via subscription programs, self-hauling, drop-off centers, and the City's ongoing efforts to separate organics at the landfill working face.

3.4.3 Green Waste Preferential Price

By offering a discounted tipping fee for source separated green waste, the City may encourage private haulers to voluntarily separate and haul material to the composting facility themselves. Enforcement measures would be required to monitor for contamination in these preferentially priced loads.

Burns & McDonnell estimates that a green waste preferential price (GW Price), if implemented, could capture 10 to 40 percent of available non-City green waste from all streams. If neither the green waste preferential price nor the green waste ban (Section 3.4.5) are implemented, then it is estimated that the composting facility could capture two to 10 percent of available green waste in all non-City streams due to convenience of location, voluntary participation and the City's ongoing efforts to separate organics at the landfill working face.

3.4.4 Food Waste Preferential Price

The City may also encourage diversion of food waste through discounted tipping fees for source separated material. Enforcement measures would be required to monitor for contamination in these preferentially priced loads, which could become more difficult if the City chooses to accept post-consumer food waste or compostable packaging and compostable food service ware in this organic waste stream.

Burns & McDonnell estimates that a food waste preferential price (FW Price), if implemented, could capture 10 to 40 percent of available non-City food waste from all streams. If neither the food waste preferential price nor the food waste ban (Section 3.4.6) are implemented, then it is estimated that the composting facility could capture two to 10 percent of available food waste in the non-City stream through voluntary participation or by redirecting large segregated loads of food waste from commercial and industrial sources to the composting facility rather than the Landfill working face.

3.4.5 Green Waste Ban

Green waste landfill disposal bans have seen a national increase in popularity since the early 1990's. Today, 27 states have banned green waste from landfills.[8] Should the City implement a ban, not all green waste currently landfilled at McCommas Bluff would be expected to reroute to the compost facility. Private haulers may choose an alternative means of disposal that proves more cost effective.

[8] US EPA, "Yard Trimmings: Material-Specific Data", Facts and Figures about Materials, Waste and Recycling, US EPA, November 22, 2023, https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/yard-trimmings-material-specific-data

Burns & McDonnell estimates that a green waste ban (GW Ban), if implemented could capture 35 to 65 percent of available green waste in the non-City tonnage stream. If neither the green waste ban nor the green waste preferential price (Section 3.4.3) is implemented, then it is estimated that the composting facility could capture two to 10 percent of available green waste in the non-City stream through voluntary participation and the City's ongoing efforts to separate organics at the landfill working face.

3.4.6 Food Waste Ban

Food waste landfill disposal bans are a newer development in the US – nine states currently enforce some form of food waste ban.[9] These bans usually target compliance for larger generators first with smaller generators phased in sequentially. The legislation often includes a proximity clause requiring compliance only within a specified distance from an existing processing facility. An option to donate edible food for human or animal consumption is also a feature of some food waste bans.

Burns & McDonnell estimates that a food waste ban (FW Ban), if implemented could capture 35 to 65 percent of available food waste in the non-City tonnage stream. If neither the food waste ban nor the food waste preferential price (Section 3.4.4) is implemented, then it is estimated that the composting facility could capture two to 10 percent of available food waste in the non-City stream through voluntary participation or by redirecting large segregated loads of food waste from commercial and industrial sources to the composting facility rather than the Landfill working face.

3.4.7 Biosolids Diversion

The Landfill received 3,382 tons of biosolids in FY 2023 from City and non-City sources. It is assumed that 100 percent of this material is redirected to the composting facility in scenarios where the City elects to include biosolids.

Although the existing quantity of biosolids at the Landfill is relatively small, the City could consider accepting biosolids from offsite sources as further discussed in Section 3.7.3. Biosolids are a good source of nitrogen and moisture and bulk transportation of biosolids from wastewater treatment plants is inexpensive compared to implementing curbside collection of food waste. Biosolids can accelerate degradation of other organic feedstocks, reducing residence time and increasing facility throughput. However, biosolids introduce unique requirements that should be taken into consideration including stricter permitting, construction of a low permeability processing pad, demonstration of pathogen destruction, additional testing for heavy metals and other contaminants, and potential for increased public opposition. Public concerns about biosolids can be reduced through educational outreach and transparent stakeholder discussions prior to implementation.

3.5 Capture Rates

For each policy option in Section 3.4, Burns & McDonnell estimated "conservative" and "best case" capture rates as summarized in Table 3-5 and Table 3-6 . These capture rates were applied to the maximum tonnages in Table 3-4 to obtain conservative and best-case green waste, food waste, and biosolids tonnage estimates. The estimated annual tonnages for each policy scenario are presented and discussed in Section 3.7.

[9] Zero Waste Food Coalition, "Achieving Zero Food Waste – a State Policy Toolkit", State Toolkit, May 2023, https://cdn.sanity.io/files/34qvzoil/production/a517a31a81c38d76e897dd539bde3207affa164d.pdf

Table 3-5: Policy Measures and Capture Rates – City Collected Tons

Policy Measure	Policy Measure Short Name	City Waste Stream	Capture Rate (%)			
			Status Quo (No Program)		City Collection Program	
			Conservative	Best Case	Conservative	Best Case
Green Waste Curbside Collection	Collect GW	Brush/Bulk and Green Materials	1%	5%	35%	65%
Green Waste Curbside Collection	Collect GW	Compacted / Uncompacted Waste	1%	5%	15%	40%
Food Waste Collection	Collect FW	Compacted Garbage Only	1%	5%	35%	65%
Include Biosolids	Biosolids	Biosolids Only	0%	0%	100%	100%

Table 3-6: Policy Measures and Capture Rates – Tons Collected by Others

Policy Measure	Short Name	Capture Rate (%)			
		Status Quo (No Program)		With Preferential Price or Landfill Ban	
		Conservative	Best Case	Conservative	Best Case
Green Waste Preferential Price	GW Price	2%	10%	10%	40%
Green Waste Ban	GW Ban	2%	10%	35%	65%
Food Waste Preferential Price	FW Price	2%	10%	10%	40%
Food Waste Ban	FW Ban	2%	10%	35%	65%
Include Biosolids	Biosolids	0%	0%	100%	100%

3.6 Feedstock Mass Balance

The success and speed of composting operations are affected by the following key feedstock attributes:

- Moisture content
- Carbon-to-nitrogen (C:N) ratio
- Particle size
- Porosity
- Bulk density
- Potential of hydrogen (pH)

Although composting is a relatively forgiving process, it is necessary to maintain a proper balance between feedstocks with differing carbon, nitrogen, and moisture levels. Ideally, the blend of feedstocks processed by a facility should result in an aggregate C:N ratio between 25:1 and 35:1 and a moisture content between 50 and 60 percent. Although it is possible to operate outside of these ranges, it may be necessary to supplement with other feedstocks, add water, produce mulch from excess green waste, or make other process adjustments if the composition of materials normally received does not naturally result in a balanced ratio.

As discussed in Section 3.2, the organic waste streams anticipated at the site contain varying percentages of green waste, food waste, and biosolids, which vary significantly in their carbon, nitrogen, and moisture contents. The mix of materials received at the site can be further influenced by the City's policy decisions which may alter the balance of materials received.

Burns & McDonnell estimated the C:N ratio for each City policy scenario presented in Sections 3.7.1 and 3.7.2 to account for any additional material from external sources that might be needed to balance the ratio. These C:N ratio calculations were based on assumed aggregate properties for each organic waste category as summarized in Table 3-7.

Table 3-7: Assumed Aggregate Feedstock Properties

Organic Waste Category	Mass Percentage			
	Solids	Moisture	Carbon (dry)	Nitrogen (dry)
Green Waste (GW)	85.0%	15.0%	50.0%	1.0%
Food Waste (FW)	31.0%	69.0%	34.8%	2.4%
Biosolids	16.0%	84.0	30.0%	5.0%

For each scenario, the amount of additional green waste or food waste (if any) required to maintain a minimum C:N ratio of 25:1 or a maximum C:N ratio of 35:1 was estimated and included in the total tonnage for the policy scenario. For the purposes of these calculations, it was assumed that 50 percent of inbound green waste will be ground and marketed as mulch instead of using it to make compost to reduce potential requirements for additional food waste. While it is possible to operate outside this ideal range of C:N ratios, accounting for additional feedstock requirements is a conservative approach to help ensure that the facility is adequately sized.

Use of biosolids instead of food waste to balance high-carbon C:N ratios is discussed in Section 3.7.3.

3.7 Results

Burns & McDonnell calculated conservative and best-case annual tonnages for a total of 14 policy option scenarios grouped in order of ascending annual tonnage. Additional calculation details are provided in Appendix B. All tonnages presented in this section include an allowance for annual growth through 2034 at a rate equivalent to the 10-year average population growth rate for the City as published by the NCTCOG.[10]

3.7.1 Phase 1 Options – No Curbside Collection Program

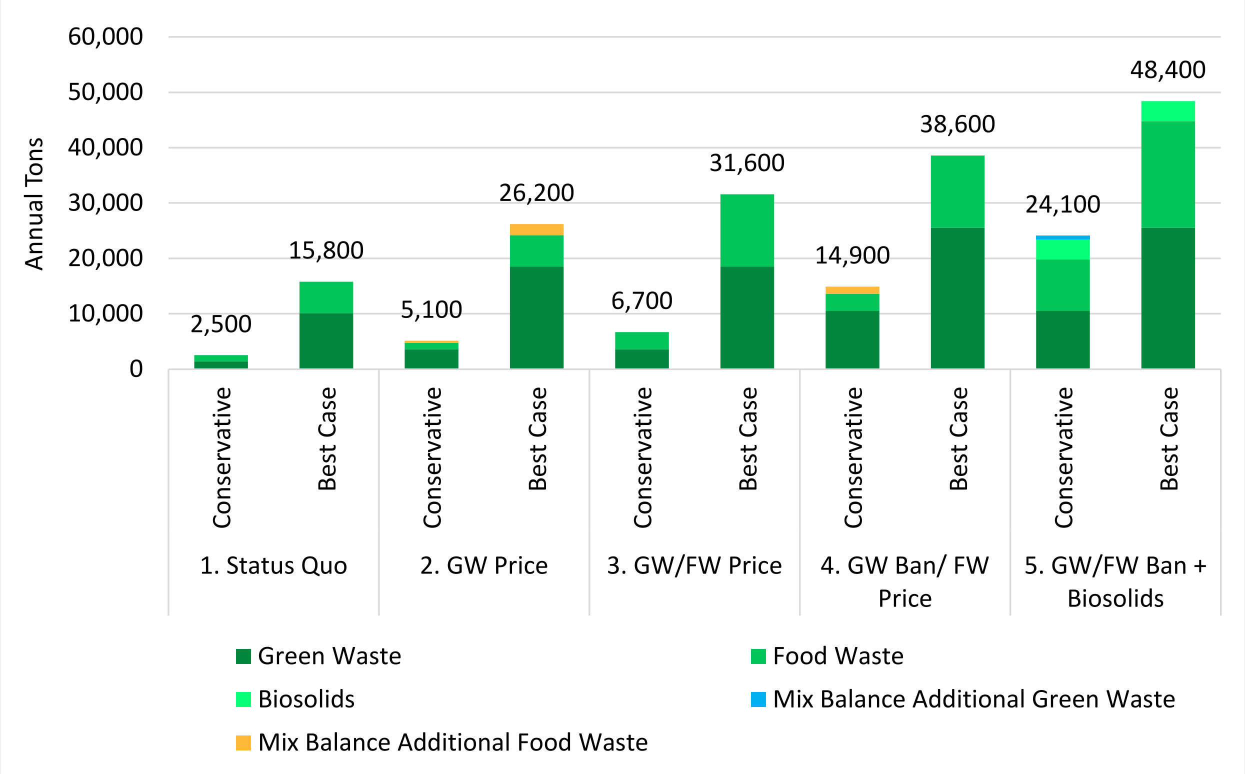
The City has indicated that it may implement its composting program in phases by offering preferential pricing or implementing a ban on green waste or food waste from commercial sources as shown in Figure 3-2. Since commercial green waste and food waste are collected by private haulers, the City can

[10] North Central Texas Council of Governments, "2045 NCTCOG Demographic Forecast (City)", Regional Data Center NCTCOG, February 25, 2022, https://data-nctcoggis.opendata.arcgis.com/datasets/e572c5b67c68444e90b5abc083118f53_2/explore

implement these policy options without incurring any new collection costs, providing time for the City to consider its options for implementing a residential curbside collection program.

Estimated tonnages under these scenarios are modest, ranging from 2,500 tons per year for the conservative status quo scenario up to 48,400 tons per year for a landfill ban on green waste, food waste, and biosolids under the best-case scenario. If the City implements preferential pricing or a ban on green waste without corresponding incentives for food waste, it may be necessary to secure additional food waste or biosolids from outside sources to balance the mix. The estimated phase 1 tonnages are low enough that they could potentially be managed at any of the candidate sites discussed in Section 7.0.

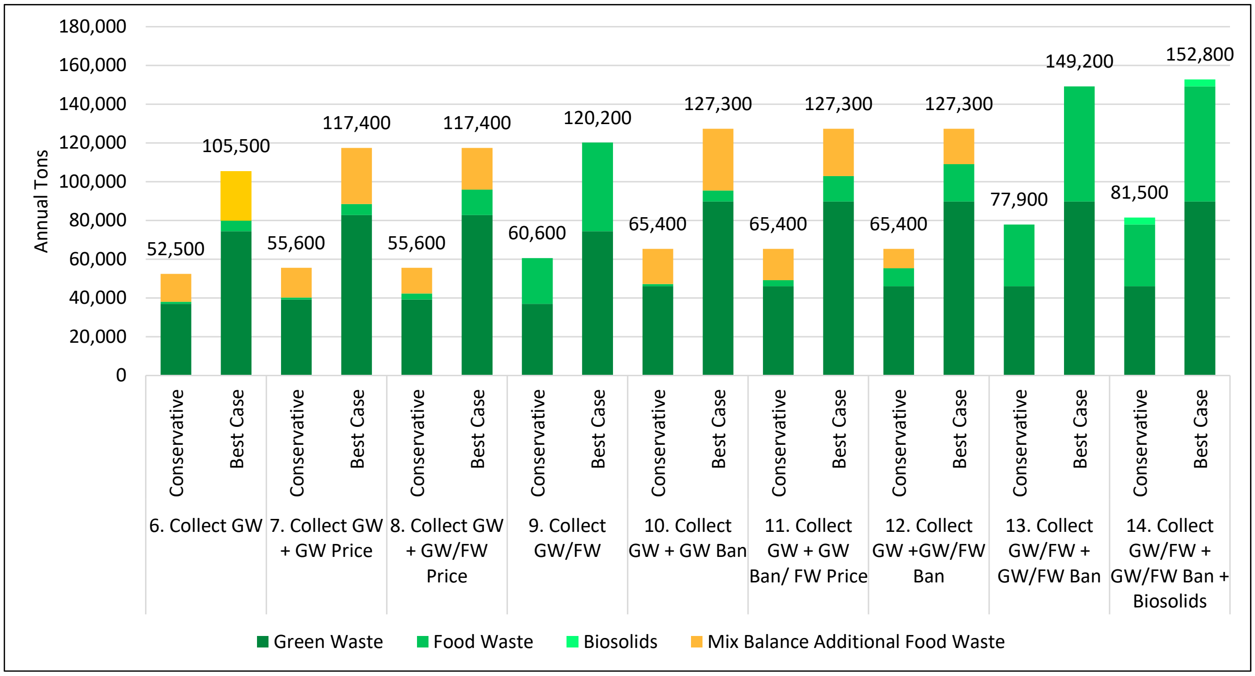
Figure 3-2: Policy Option Scenarios with no Curbside Collection Program



3.7.2 Phase 2 Options – Implementation of Curbside Collection

Phase 2 of the policy option scenarios includes progressive implementation of residential curbside collection programs for green waste and/or food waste plus preferential pricing and/or tonnage bans on non-City materials as shown in Figure 3-3.

Figure 3-3: Policy Option Scenarios with Curbside Collection



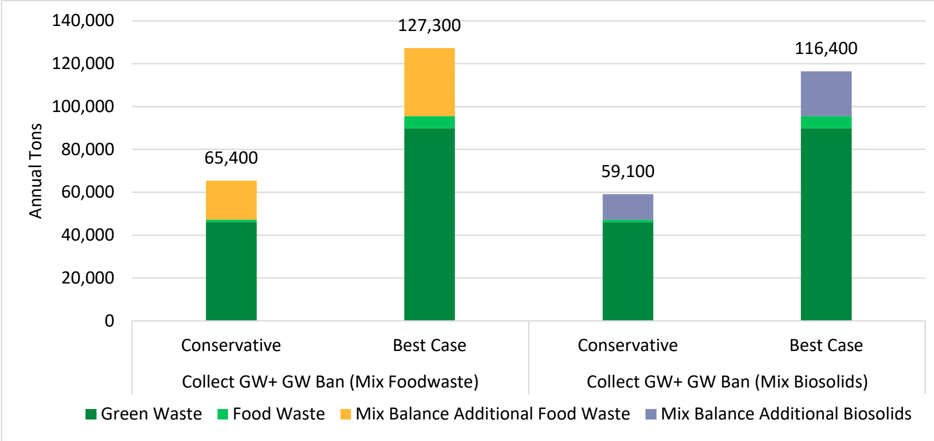
Implementation of curbside collection programs increases estimated annual tonnages significantly. Under the Phase 2 scenarios, annual tonnages are likely to exceed the capacity of Site A but remain within the annual capacity of a windrow composting site located in Sites B or C as further described in Section 7.0.

As shown in Figure 3-3, food waste or biosolids from external sources may be necessary to achieve a balanced ratio. Potential sources of food waste and biosolids are discussed further in Section 4.2.

3.7.3 Impact of Biosolids

To conservatively estimate the total external tonnage that may be required to maintain a balanced C:N ratio, Burns & McDonnell's base mass balance calculations assume that food waste will be added to the process as required to reduce the C:N ratio to a maximum value of 35:1. However, biosolids have a higher nitrogen content than food waste and can balance excess carbon with fewer total tons. For example, if the City implements a green waste collection program for City tonnage plus a commercial green waste ban with 50 percent of green waste used as mulch, then it is expected that an additional 31,800 tons of food waste could be needed from external sources to balance the C:N ratio in the best-case scenario. However, if the City uses biosolids as amendment material instead of food waste, then the additional annual tonnage decreases by 10,900 tons to 20,900 tons per year as illustrated in Figure 3-4.

Figure 3-4: Impact of Biosolids on Amendment Material Requirements



Biosolids can also increase the rate of decomposition in an active windrow which reduces residence time in the composting phase and increases throughput. As discussed during the stakeholder interviews, there are significant quantities of biosolids potentially available in the region which are more easily collected and transported to the site than food waste.

Since realizing these operational benefits requires initial capital investment in construction of a low permeability liner, the City should consider in the early planning stages if it is open to this alternative, which becomes more difficult to implement later in the process. Since the City's existing compost facility permit includes biosolids as an acceptable feedstock, Burns & McDonnell's opinion of probable capital cost in Section 7.5.1 assumes that a low-permeability liner will be constructed under the windrow composting pad, stormwater detention pond to provide the City with operational flexibility to compost biosolids if required.

3.8 Preliminary City Preferred Policy Option

Burns & McDonnell reviewed the policy options in Sections 3.4.1 through 3.4.7 and the resulting tonnage estimates in Sections 3.7.1 through 3.7.3 with the City and discussed the preferred policy options to be carried forward into subsequent phases of the Evaluation. The City is considering implementation of its organics program in two phases with implementation of preferential pricing for non-City green waste and food waste in Phase 1 and implementation of a residential green waste curbside collection program in Phase 2 as summarized in Table 3-8. Since the City currently considers this to be the most probable future course of action, Burns & McDonnell used these options as a baseline for development of the preliminary site concept.

Table 3-8: Phases of City Organics Program Implementation

Implementation Phase	City Preferred Policy Option	Estimated Annual Tonnages (Best Case)			
		Green Waste	Food Waste	Additional Food Waste	Total
Phase 1	GW/FW Price	18,500	13,100	--	31,600
Phase 2	Collect GW + GW/FW Price	82,800	13,100	21,500	117,400

To estimate tonnages conservatively, it is assumed that any additional tonnage required to balance the C:N ratio will be food waste. However, biosolids are listed as an acceptable material in the existing permit for the composting facility, and the preliminary facility conceptual design (Section 7.3) includes construction of a low permeability liner under the active windrow composting area, detention pond, and drainage ditches to provide the City with the option of accepting biosolids.

3.9 Market Analysis

The volume of finished compost produced annually can be approximated from the compost recipes described above. A substantial reduction in volume, often between 30 and 90 percent, can be expected as feedstock material is composted. This is mainly due to grinding and compaction as material decomposes, but the release of carbon dioxide and water also contributes. This Evaluation assumes a volume reduction of 40% from incoming feedstock to finished compost.

Below, Table 3-9 demonstrates potential quantities of finished product for Phases 1 and 2 (defined above in Table 3-8) and the estimated maximum throughput for the Site B (The Elbow) location under consideration in this Evaluation (please refer to Section 7.3 for the significance of this scenario). All feedstock scenarios below assume that half of the incoming green waste is finished as mulch while the remaining half contributes to the compost mix.

Table 3-9: Finished Product Estimates

Feedstock Scenario	Finished Compost (CY)	Finished Mulch (CY)	Total Product Output (CY)
Phase 1	29,300	32,300	**61,600**
Phase 2	112,900	143,400	**255,600**
Maximum Throughput	162,700	207,700	**370,400**

Diverting organic waste through composting is only as effective as the marketability of its finished product. The City could use a portion of this finished compost in its internal operations for landscaping and other public works projects. Costs associated with producing the compost would likely be offset by the City's reduced reliance on soil amendments purchased externally.

Additionally, compost may be made available for sale to the public for agricultural, commercial, and residential use. Profits from the City's compost sales could also help offset the program's cost. Agricultural buyers represent the volume market – customers who will purchase a large volume of compost but are not willing to pay a high unit price. Residents and commercial buyers like landscapers, nurseries, and garden centers can be categorized as the value market – customers who are willing to pay a higher unit price but tend to purchase less compost. Targeting the value market can prove more profitable for producers of compost, but this market involves greater competition, demands higher product quality, and requires larger investments in marketing efforts. Bagging compost is an added marketing expense that can yield a higher unit price from the value market due to branding and customer convenience. Conversely, the volume market is advantageous when large volumes of feedstock must be processed, when volume users are located near the composting facility, or when higher product quality cannot be met. Both markets can be targeted, but it is necessary to develop products that are responsive to the needs of different market sectors and advisable to brand the products distinctly to avoid customer confusion. As a conservative estimate of potential revenue from product sales, Burns & McDonnell's Financial Evaluation in Section 8.0 assumes an average price of $26 per cubic yard of compost and $18 per cubic yard of mulch. These prices represent the low end of the market for products purchased in bulk directly from compost producers.

3.10 Key Findings and Recommendations

This section provides key findings and recommendations for the feedstock and market analysis described in the preceding sections.

1. An estimated 217,720 tons of organic waste was landfilled at McCommas Bluff in FY 2023. This material consisted of brush, yard waste, pallets, food waste, and biosolids that could potentially be captured for use as composting feedstock.
2. The City could divert an estimated 2,500 to 15,800 tons of organic waste per year without implementing any new policies through voluntary compliance and continued effort by the City to redirect clean loads of organic waste at the Landfill.
3. The City could divert up to 48,400 tons of organic feedstock annually by 2034 without implementing a curbside collection program through a ban on green waste, food waste, and biosolids currently received at the site.
4. The City could divert up to 152,800 tons of organic waste per year by 2034 through a combination of city residential curbside collection programs for green waste and food waste and bans on green waste, food waste, and biosolids.
5. The estimates in this section assume that 50% of inbound green waste will be ground and marketed as mulch rather than composted to reduce the amount of external food waste or biosolids needed to balance the facility's C:N ratio. Some scenarios could still require up to 31,800 tons of food waste or 20,900 tons of biosolids to balance the C:N ratio after accounting for wood waste used as mulch.
6. The City should continue ongoing efforts to identify and divert clean loads of green waste at the Landfill.
7. The facility planning, design and approvals process should consider the additional requirements for biosolids processing if the City intends to pursue this option as a means of increasing facility throughput.

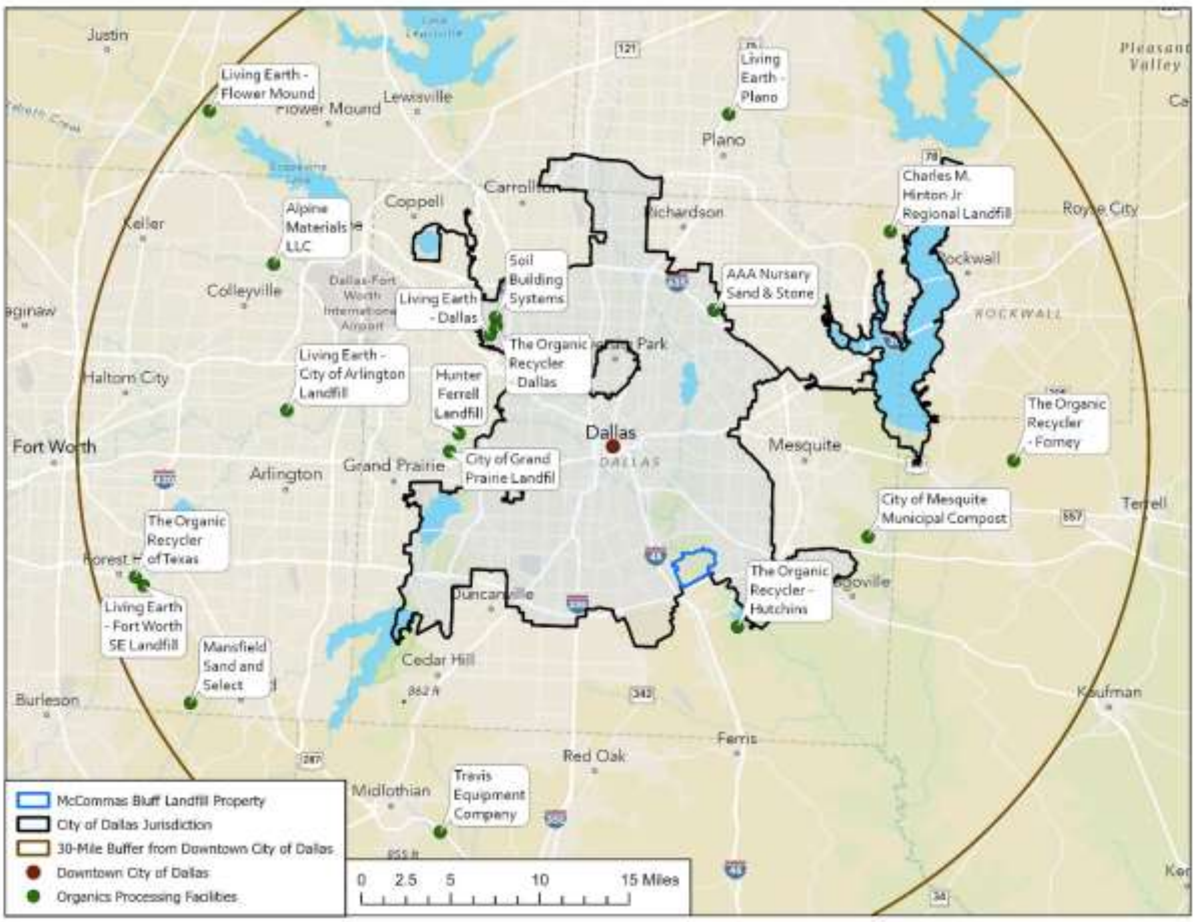
4.0 Location and GIS Analysis

This section evaluates the feasibility of locating a composting facility at the Landfill property. The analysis considers proximity to other regional composting facilities and generators of targeted feedstocks, environmental justice areas, and impacts to threatened and endangered species.

4.1 Proximity to Regional Composting Facilities

Eighteen organics processing facilities have been identified within 30 miles of the City's downtown area as shown in Figure 4-1.[11] The facilities within City boundaries are mostly to the north and west of downtown, presenting an opportunity for the proposed composting facility to serve communities towards the southeast with less competition nearby.

Figure 4-1: Proximity to Regional Compost Facilities

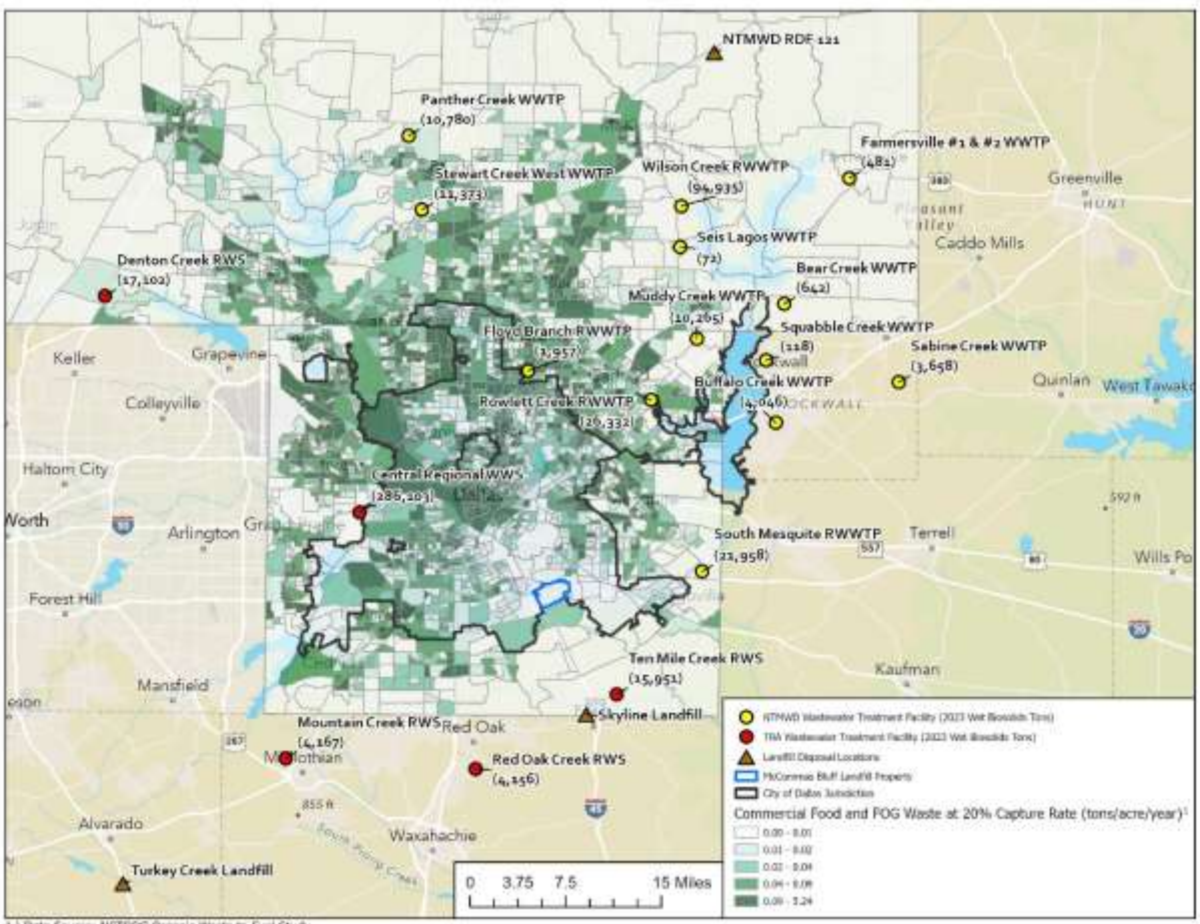


[11] TCEQ, "Municipal Solid Waste Facilities in Texas", 2024, https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.tceq.texas.gov%2Fassets%2Fpublic%2Fpermitting%2Fwaste%2Fmsw%2Fmsw-facilities-texas.xls&wdOrigin=BROWSELINK.

4.2 Proximity to Feedstock Sources

Convenience of location is a key determinant for where generators and haulers choose to dispose of their material. As discussed in Section 3.7.3, the composting facility may require externally sourced biosolids to maintain a balanced C:N ratio after accounting for 50 percent of inbound green waste used as mulch. As illustrated in Figure 4-2, there is abundant food waste available in proximity to the proposed composting facility that could potentially be used to satisfy this requirement. In addition, there are 13 North Texas Municipal Water District (NTMWD) Wastewater Treatment Facilities (WWTF) and five Trinity River Authority (TRA) WWTF located in proximity of the Landfill property. NTMWD and TRA each expressed interest in composting as a method for managing biosolids tonnages that are currently being landfilled at Skyline Landfill, Turkey Creek Landfill, and NTMWD RDF 121. In 2023, South Mesquite Regional WWTP disposed of approximately 21,958 wet tons of biosolids at Skyline Landfill, which is further from the WWTP than McCommas Bluff Landfill. Relocating these tons to the composting facility would reduce transportation costs for NTMWD and would also exceed the estimated maximum biosolids tonnage that may be required to balance the composting facility's C:N ratio.

Figure 4-2: Proximity to Feedstock Sources



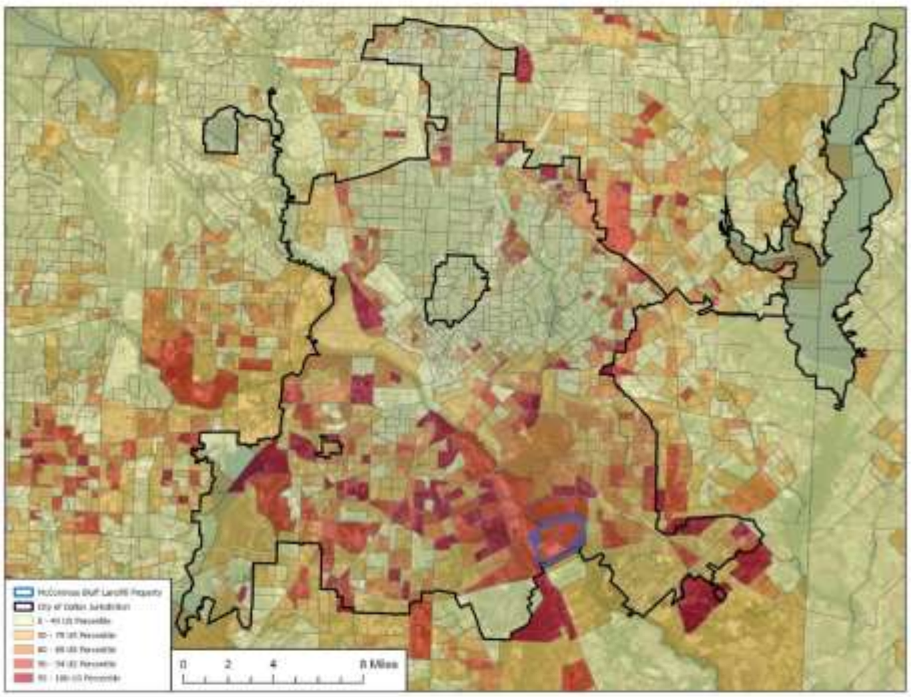
1.) Data Source: NCTCOG Organic Waste to Fuel Study

4.3 Environmental Justice Areas

This section presents a series of environmental justice maps, evaluated using the EPA's Environmental Justice Screening and Mapping Tool (EJScreen).[12] These maps identify, at a city-wide scale, the national percentile ranking of Census block groups based on three key indicators: the percentile of households with income at or below twice the federal poverty level, the percentile of individuals in limited English-speaking households, and the percentile of individuals identifying as a race other than white alone and/or as Hispanic or Latino.

The Landfill property is situated in the southeastern region of the City in an area where these indicators exceed national averages. The low-income population around the property ranks in the 92nd percentile nationally, as shown in Figure 4-3. Development of a composting facility on this property could increase the availability of local jobs to the area.

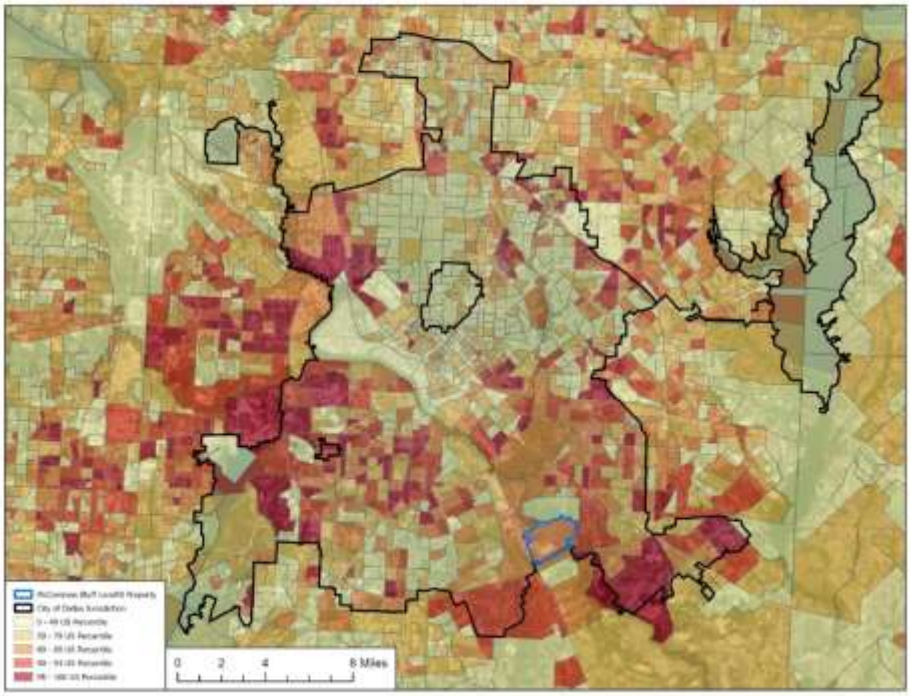
Figure 4-3: Low Income National Percentiles



The Landfill property is located in a block group where the population ranks in the 84th national percentile for limited English proficiency, as shown in Figure 4-4. The City may consider use of multilingual communications for any local outreach efforts.

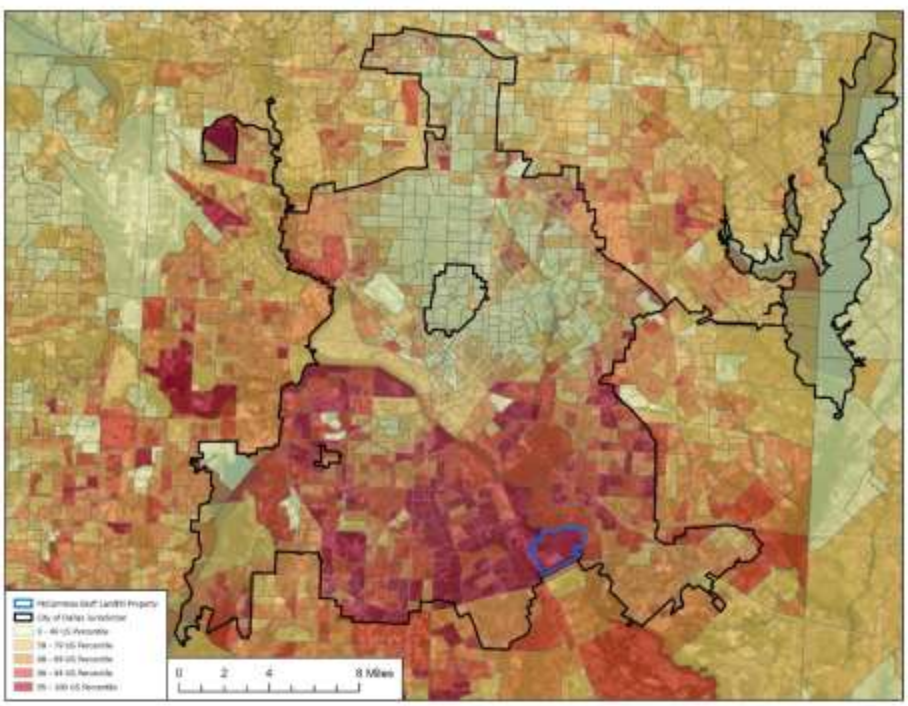
[12] US EPA. 2024. *EJScreen: Environmental Justice Screening and Mapping Tool.* https://ejscreen.epa.gov/mapper/

Figure 4-4: Limited English Proficiency National Percentiles



The Landfill property is located within and adjacent to communities ranking above the 95th percentile for population of people of color. As shown in Figure 4-5, the property itself is situated in an area at the 96th percentile.

Figure 4-5: People of Color National Percentiles



The Landfill is an existing land use that is already permitted for composting. Addition of an active composting operation is not expected to have a significant impact on nearby communities, since much of the feedstock for the composting facility is expected to be diverted from existing disposal operations at the Landfill. The composting facility will also provide additional local employment and waste diversion opportunities.

4.4 Threatened and Endangered Species

Data from the United States Fish and Wildlife Service (USFWS) identifies nine threatened or endangered species in Dallas County, as summarized in Table 4-1.

Table 4-1: Threatened and Endangered Species List

Group	Common Name	Species Name	Habitat	Status
Birds	Golden-cheeked Warbler	Setophaga chrysoparia	Mature juniper-oak woodlands in central Texas, where they breed and find nesting sites	Endangered
Birds	Whooping Crane	Grus americana	Wetlands, coastal marshes, and grasslands for feeding and roosting during migration	Endangered
Clams	Texas Heelsplitter	Potamilus amphichaenus	Rivers and streams with sand or mud substrates, particularly in stable, undisturbed areas	Proposed Endangered
Mammals	Tricolored Bat	Perimyotis subflavus	Caves, abandoned mines, road-associated culverts, forested areas	Proposed Endangered
Birds	Piping plover	Charadrius melodus	Sandy beaches, sandbars, and shores of lakes and rivers during breeding and wintering	Threatened
Birds	Rufa Red Knot	Calidris canutus rufa	Coastal beaches and intertidal areas for foraging, during migration and wintering	Threatened
Clams	Texas Fawnsfoot	Truncilla macrodon	Medium to large rivers with sandy or muddy bottoms	Threatened
Reptiles	Alligator Snapping Turtle	Macrochelys temminckii	Rivers, swamps, and slow-moving water bodies with ample cover and food sources	Proposed Threatened
Insect	Monarch Butterfly	Danaus Plexippus	Open fields, meadows, grasslands, and gardens with milkweed plants	Candidate

The Landfill has operated under a TCEQ permit since 1981 and was issued a permit for a composting facility in 2012 with no identified concerns related to threatened or endangered species. It is assumed that an active composting facility located on the permitted landfill property would be required to meet the same or similar permit conditions and would not have a significant impact on threatened or endangered species.

4.5 Key Findings and Recommendations

This section provides key findings and recommendations for the site evaluation and concept design described in the preceding sections.

1. The Landfill property is in a location that could feasibly attract targeted organic feedstock materials based on proximity to feedstock generators and distance from competing processors.
2. Nearby communities rank in the 84th national percentile for limited English proficiency. The City may consider use of multilingual communications in any local outreach efforts.
3. The Landfill property is located within and adjacent to communities ranking above the 95th percentile for population of people of color and the 92nd percentile for low income nationally.
4. The Landfill is an existing land use that is already permitted for composting. Addition of an active composting operation is not expected to have a significant impact on nearby communities, since much of the feedstock for the composting facility is expected to be diverted from existing disposal operations at the Landfill. The composting facility will also provide additional local employment and waste diversion opportunities.
5. The McCommas Bluff Landfill has operated under a TCEQ permit since 1981 and received a permit for a composting facility in 2012 with no issues related to threatened and endangered species. It is assumed that a composting facility located on the permitted Landfill property would be required to meet the same or similar permit conditions.

5.0 Processing Technology Evaluation

Composting uses the biological activity of aerobic microorganisms to break down organic material under controlled conditions to optimize the rate of decomposition. While composting is not a new concept, technologies are constantly evolving to further improve the process. The key parameters monitored to regulate the composting process are C:N ratio, temperature, moisture content, and oxygen level. Regardless of the method used, the goal of the process is to maintain these parameters in an optimum range long enough to biologically stabilize the material. This section summarizes three composting technology alternatives while highlighting the advantages and disadvantages of each. All three of these technologies are considered a primary step with some form of curing to follow before a finished, stabilized compost product is achieved.

5.1 Processing Technology Alternatives

The primary composting technologies included in this Evaluation are turned windrows, ASPs and in-vessel systems. These composting methods are defined as follows:

5.1.1 Turned Windrow Composting

Turned windrow composting involves placing organic feedstock material into rows of elongated piles, commonly known as windrows. The piles are sized and shaped to maximize surface exposure to oxygen and minimize potential for anaerobic conditions to develop. To manage the temperature, moisture level, and oxygen content of the piles, they are mechanically agitated (turned). This cools, dries and aerates the windrows and ensures that materials remain homogenously mixed as they continue to decompose. Turning can be achieved manually with a shovel in small scale or, more commonly, with a bucket loader, excavator, or specialized windrow turner.

5.1.2 Aerated Static Pile Composting

With ASP composting, organic feedstock is formed into piles with engineered dimensions. Material is either formed into smaller individual piles or a larger extended pile. Ambient air is forced through the compost piles with fans and piping to speed up the degradation process and ensure that the system remains aerobic. The air distribution laterals are commonly either perforated high density polyethylene (HDPE) piping placed on grade, or trenches installed below grade. Air can be pushed through the pile (positive aeration) or drawn through the pile (negative aeration). Systems are also available that utilize a combination of the two to further optimize the process.

5.1.3 In-Vessel Composting

In-vessel composting includes a range of technologies with the commonality of a fully enclosed system. These vessels often employ both forced aeration and mechanical agitation to automate the composting process. Some examples of in-vessel systems that can be found across the country handling organic feedstock on a municipal scale include:

- **Turned Vessels**: Organic feedstock is placed into a fully enclosed vessel fitted with a form of automatic mechanical agitator.
- **Agitated Bays**: Organic feedstock is placed into long channels separated by walls with rails to support an automated mechanical agitator. The channels are contained within an enclosed structure.

- **Aerated Bays**: Organic feedstock is placed into large bays contained within a building. The bays include both forced aeration systems and automated mechanical agitation.
- **Aerated Tunnels**: Organic feedstock is placed into enclosed elongated tunnels fitted with positive aeration floors and exhaust systems where it batch-composts until finished. No agitation occurs.
- **Rotating Drums**: Organic feedstock is placed into one end of horizontally oriented cylinders that slowly rotate. Finished compost is retrieved from the opposite end of the cylinders.

5.2 Preliminary Screening Criteria

Criteria selected to provide a preliminary means of comparison between the three composting methods described above in Section 5.1 are as follows:

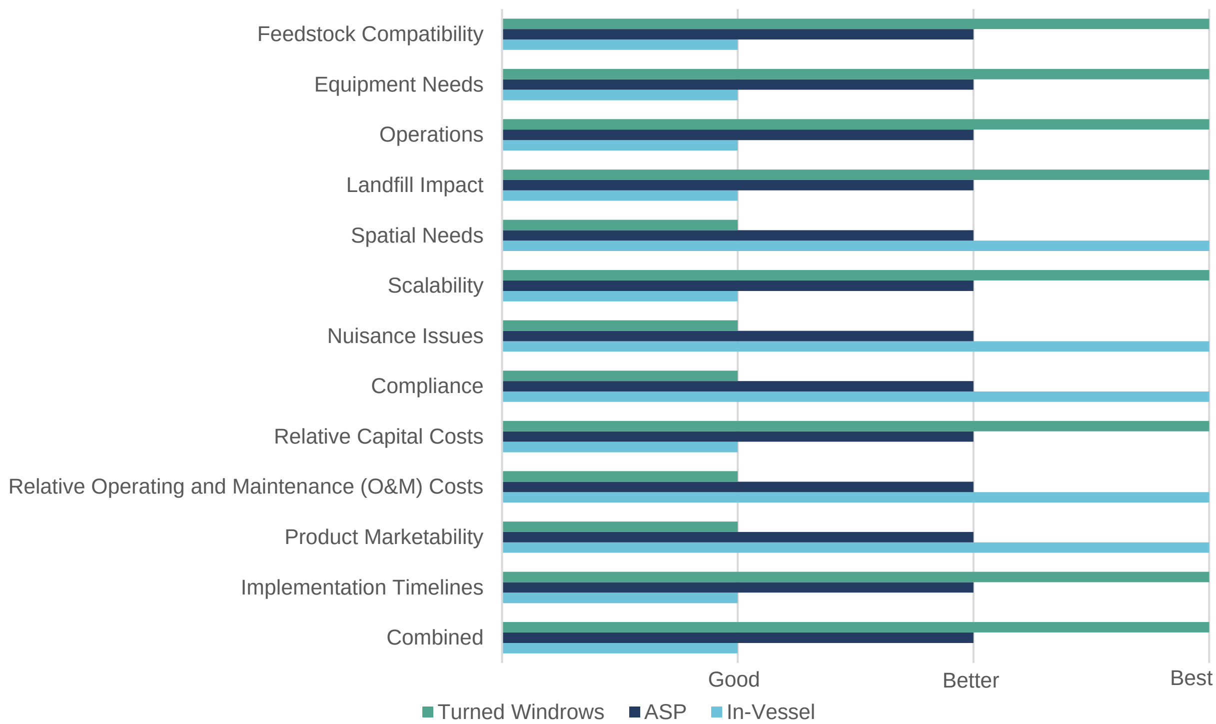
- Feedstock Compatibility
- Equipment Needs
- Operations
- Landfill Impact
- Spatial Needs
- Scalability
- Nuisance Issues
- Compliance
- Relative Capital Costs
- Relative Operating and Maintenance (O&M) Costs
- Product Marketability
- Implementation Timelines

The City's priorities and goals for a potential future composting operation provide the guidance needed to analyze these criteria.

5.3 Preliminary Screening Analysis

The following screening analysis highlights the advantages and disadvantages of each of the three composting methods described in Section 5.1 as they apply to the preliminary screening criteria listed in Section 5.2. Preliminary screening findings are summarized in Figure 5-1.

Figure 5-1: Preliminary Screening Analysis



The individual findings for each of these criteria are detailed in the subsections below.

5.3.1 Feedstock Compatibility

The feedstocks considered in this analysis correspond with those identified in Section 3.2 – green waste, food waste and biosolids. As shown below in Table 5-1, the City's targeted feedstocks are compatible with all three technologies.

Table 5-1: Feedstock Compatibility Screening

Feedstock	Turned Windrows	ASP	In-Vessel
Green Waste			
Food Waste			
Biosolids			

Teal cells indicate optimum compatibility
Blue cells indicate moderate compatibility

Turned windrow composting is a longstanding method that can handle all three of these materials, though newer technologies like ASP and In-Vessel have been invented to improve the composting of more troublesome feedstocks like food waste and biosolids. The frequent agitation of turned windrows allows for more leniency on the initial quality of feedstock mixing.

ASP composting is a newer technology that can process green waste but is especially compatible with food waste and biosolids. Because this is mostly a static system, it is vital to establish a homogenous feedstock mixture with good porosity and structure prior to placing the material into piles. Any feedstock contamination should therefore be removed prior to mixing.

In-vessel composting can manage all three identified feedstock materials as well. The initial quality of feedstock mixing can vary if the system includes mechanical agitation. Though the automation of these systems is convenient, feedstock contamination poses a risk for equipment damage and should be removed before active composting.

5.3.2 Equipment Needs

The equipment considered necessary for each composting technology is summarized in Table 5-2.

Table 5-2: Equipment Screening

Equipment	Examples	Turned Windrows	ASP	In-Vessel
Feedstock Particle Size Reduction	Grinder Chipper Shredder			
Feedstock Mixing	Batch Mixer Pug Mill Front End Loader Excavator			
Material Handling	Front End Loader Bucket Loader Dump Truck Conveyors			
Mechanical Agitation	Windrow Turner Loader Excavator			
Automatic Agitation	Turning Machine Augers Paddles			
Forced Aeration	Controls Fans Manifolds Aeration Floors			
Monitoring Probes	Temperature Moisture Oxygen			
Cover	Microporous Covers Polyethylene Bags Bunkers Hoop Houses			

Equipment	Examples	Turned Windrows	ASP	In-Vessel
Enclosure	Containers Drums Silos Tunnels Buildings	Blue	Blue	Teal
Exhaust	Ventilation Biofilter		Teal	Teal

Teal cells indicate required equipment
Blue cells indicate optional equipment

While teal cells in Table 5-2 demonstrate the required equipment for each of the three composting methods analyzed, some technologies can be further improved by optional equipment. For example, any composting method could benefit from preliminary feedstock mixing equipment – it may even be required for in-vessel composting if a static system is utilized. Forced aeration systems are a popular addition to in-vessel composting for better process control, but again not present in all configurations. Covers can be used to mitigate moisture and/or odors with turned windrows and ASP's but are often an unnecessary expense.

Some form of monitoring equipment is required for all composting, with temperature probes as the most common options across technologies. Oxygen probes can be useful in all three methods, though they're more common to the intricate processes of ASP and in-vessel composting systems to manage aeration rates. Moisture probes are also helpful for ASPs and in-vessel facilities to optimize their intricate conditions.

5.3.1 Operations

Generally, the composting operations transition from more hands-on and flexible with turned windrows to more automated and precise with in-vessel systems. A composter operating a turned windrow facility will spend most of their time mechanically turning the windrows, whereas a composter operating an in-vessel facility will focus primarily on diligent system monitoring. ASP systems fall somewhere between the two. All three systems require some degree of equipment maintenance, simply varying between the upkeep of heavy mobile equipment versus forced aeration systems and/or automated agitation equipment.

One of the greatest operational challenges with turned windrow composting is managing uncovered windrow moisture levels. With ASP composting, a greater initial effort is needed to properly prepare and mix the feedstock material. The static piles can still potentially suffer from over-drying, compaction, short-circuiting of air, and/or inconsistent decomposition during active composting. Besides the expertise required to maintain the automated processes, a common operational challenge with in-vessel systems is maintaining sufficient moisture once the material is loaded into the vessel. If the vessel does not include automated agitation, these systems can also experience similar stagnation problems to ASP composting.

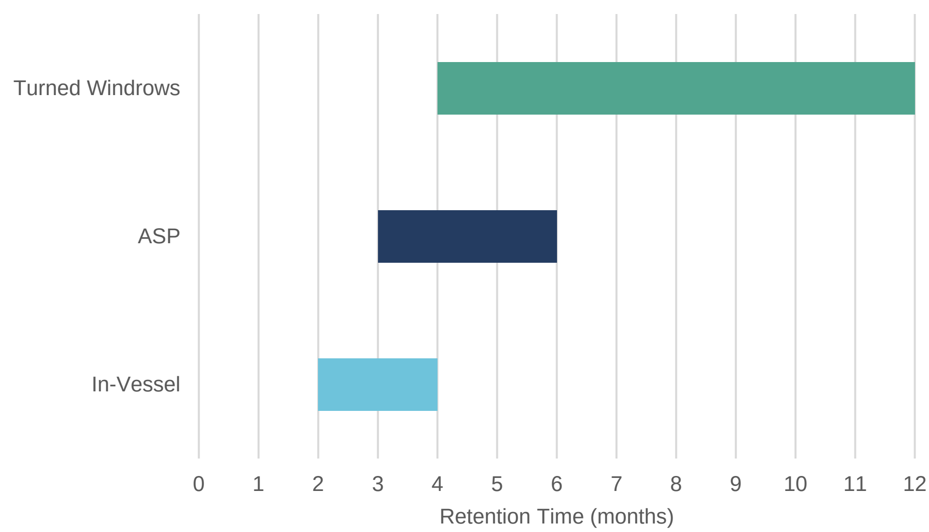
5.3.2 Landfill Impact

With the understanding that one of the three siting locations identified in Section 7.1 includes the footprint of a future horizontal landfill expansion, the magnitude of investment in permanent infrastructure has been compared between the three technology alternatives. Turned windrow composting requires the least amount of permanent infrastructure with nearly all mobile equipment save for an optional paved operating pad and optional connection to a water utility line. ASP composting needs slightly more permanent infrastructure with a site-installed fan system, high voltage power connection requirement, optional water utility connection, optional bunkers, and an optionally paved processing pad with embedded trenching for aeration and contact water drainage. Finally, in-vessel composting poses the greatest investment in permanent infrastructure with vessel foundations, high voltage power connection, likely permanent vessel installation unless a modular system is used, and an optional water utility connection.

5.3.3 Spatial Needs

The choice of composting method used for a new facility is often determined by the availability of space. Spatial needs for various composting technologies are influenced by process retention times, pile geometry, management intensity, and overall material flow through the facility. Primary retention times vary between the three alternatives with turned windrows ready for curing in 4 to 12 months, ASP's in 3 to 6 months, and some in-vessel systems needing as little as 2 to 4 months before moving on to product curing (see Figure 5-2).

Figure 5-2: Primary Composting Retention Times



Turned windrow facilities require aisles between the piles, resulting in significant spacing between windrows. ASP facilities often accommodate larger piles. In-vessel composting facilities may benefit from the most compact footprint of the three alternative systems because they can accomplish active composting relatively quickly. However, in-vessel systems do vary significantly in design and operation with varying spatial requirements. Additional space for product curing is required for any of the three composting methods in this Evaluation.

Considering process retention times, pile geometry, and accessibility needs, turned windrow facilities often have the largest footprints. ASP facilities are comparable in size to turned windrows if not slightly more compact. In-vessel facilities have the smallest spatial requirements.

In addition to space for active processing and curing, all composting methods require space for key functions such as feedstock storage, preprocessing like size reduction and feedstock blending, screening, and product storing and distribution, stormwater management, access, and administrative activities. Additional space may also be required for colorizing mulch or product bagging.

5.3.4 Scalability

The ability to scale a composting operation according to need can be a valuable asset to a new organics diversion program. Scalability of different composting methods depends on the specialty infrastructure involved. Because turned windrow composting only requires a pad, the level of effort to scale a windrow facility is fairly straightforward. Phased scaling is possible for ASP composting as well, though it does require greater foresight. This is because the initial fan system should be oversized according to the maximum anticipated future throughput of material. In-vessel systems are generally not scalable as the addition of new vessels would be required. The operation of multiple independent vessels would drastically reduce the facility's cost efficiency.

5.3.5 Nuisance Issues

Nuisance issues commonly associated with composting include odor, dust, vectors and noise. Regardless of composting method, the greatest potential for odor and vector issues is found in the feedstock receiving operation before the raw materials are intermixed. Once feedstock makes its way into active composting, turned windrows exhibit the greatest potential for odor, dust and vector problems because they are the slowest process with the most frequent agitation and can introduce the most human error with operations. ASP's experience reduced issues with odor, dust and vectors because of the quicker static stabilization process and automation of the system. An exterior layer of stable organic material, often finished compost or mulch, is called a biocover and is an effective means to mitigate these nuisance issues in windrow and ASP facilities. Biofilters are beds of media, typically damp, composted mulch, that remove odors from air – typically from negative aeration in ASPs or in-vessel units. Biofilters may also filter air from enclosed buildings if necessary, particularly indoor windrows or indoor blending operations. The most logical solution to mitigating dust concerns is the proper management of moisture in both feedstocks and compost piles through misters, sprinklers, water trucks, etc. In extreme scenarios, synthetic covers are also available for both windrows and ASP's to mitigate these concerns.

One of the greatest benefits of in-vessel systems is the ability to fully manage odor, dust and vectors with the enclosed operation. Noise levels can be comparable across technologies, though automated aeration and agitation can pose a noise problem for neighbors if they run nonstop. With the intended siting of this composting facility at the existing Landfill, none of the three alternative technologies are expected to perform poorly enough with nuisance issues to cause concern. Nuisance issues can be nearly eradicated through responsible composting operations.

5.3.6 Compliance

Environmental compliance is an important consideration when developing a new composting operation. The primary environmental regulations for composting facilities are Title 30, Part 1, Chapters 328 and 332 of the Texas Administrative Code (TAC). The regulatory tier applied to a composting facility in Texas, pursuant to Chapter 332, is based entirely on the feedstocks accepted. However, a change in composting technology to an already permitted facility is considered a major modification by TCEQ and would require a formal modification to the facility's permit accordingly.

All composting facilities, regardless of regulatory tier, must prohibit nuisance conditions such as noise, dust, vectors and odor affecting neighbors. All must comply with Texas Pollutant Discharge Elimination System (TPDES) stormwater permitting requirements and safety regulations as applicable.

The footprint of an uncovered active composting area will directly impact the amount of contact water that a facility will be responsible for managing under the TPDES Multisector General Permit for Industrial Discharges. Because of this, uncovered turned windrow composting may pose the greatest challenge to maintain regulatory compliance. Compost covers or roof structures over turned windrows or ASPs significantly reduce stormwater management and odor control challenge. Although, handling compost covers presents its own operational challenges. Because in-vessel composting is enclosed within a mechanical system, often indoors, it presents the least regulatory challenges of the three composting methods. All three composting methods – turned windrow, ASP, and in-vessel - require a curing phase, which is typically in open air. The curing operation must comply with stormwater and nuisance regulations.

5.3.7 Relative Capital Costs

In-vessel composting facilities involve a significantly higher capital investment than turned windrows. Notable capital costs include the vessel/structure, possibly aeration equipment and agitation equipment, and monitoring equipment. The capital costs of ASP facilities and turned windrow facilities are relatively comparable. With ASP facilities, significant capital costs can be expected with the aeration equipment and most likely a paved pad. Besides a compost turner, the capital costs associated with turned windrow facilities are mainly the consequences of land development: site clearing, earthwork and possibly a paved pad.

5.3.8 Relative Operating and Maintenance Costs

No matter the method, labor will be the highest operating cost of a composting facility. Other significant operating costs for windrow facilities include fuel, contact water management, and equipment maintenance. For ASP and in-vessel facilities, the other main operating costs that can be expected are utility loads and system monitoring and maintenance. The automated systems associated with these two technologies may also require an ongoing software subscription. Regardless of technology, should the City partner with a third-party operator, the margin needed to cover this party's costs and profits could also be viewed as an operating cost to the City.

5.3.9 Product Marketability

A slight variation in product quality can be expected across the three composting alternatives, mostly due to the frequency of material agitation and the degree of human interference with the process. The frequent agitation of windrows reduces the amount of material removed during screening of the finished compost, often referred to as 'overs'. However, the human involvement throughout the windrow composting process creates the greatest potential for variation in product quality. The bulking material needed to maintain the structure of the ASP's will mostly be screened out as overs, but the nitrogen content of compost is better conserved in these unturned piles, especially when covered. The ongoing agitation of some in-vessel systems can produce a consistent compost texture without the need for screening. The degree of process automation common to these in-vessel systems also generates the most consistent compost quality.

5.3.10 Implementation Timelines

Some key factors affecting the implementation schedule of these composting facilities are the permitting process, level of construction effort, and the procurement process. Permitting a greenfield composting facility in Texas can be extremely time consuming. In-vessel systems involve the most intricate construction, requiring utilities, foundations, possibly buildings, and specialty equipment. Slightly less complicated is the construction of ASP facilities which involve utilities, an aeration floor, and possibly enclosures. Turned windrow composting facilities benefit from the simplest construction demands, though lead times for specialized composting equipment can substantially impact the procurement timeline.

5.4 Planning Level Analysis

Based on preliminary screening, turned windrow or ASP composting may be most compatible with the City's goals and priorities (see Section 5.3). As discussed in Section 5.3.3, turned windrow facilities are often the most spatially demanding. The facility feedstock estimations presented in Section 3.0 indicate that the City is unlikely to be spatially constrained on any of the three sites being considered in this Evaluation (see Section 7.0 below). With this in mind, a turned windrow composting facility was selected to proceed through a more detailed planning level analysis with the understanding that other technologies may also be well-suited for this facility depending on the total tonnage to be processed. Should space become a concern – for example with growing throughput or Landfill encroachment - the City has the option to take advantage of a more compact technology like ASP in the future.

5.4.1 Permitting and Regulatory Compliance

In Texas, composting facilities are authorized by TCEQ using a tiered system. The lowest level of authorization is a Notification of Intent. Facilities that process only yard waste and/or food waste are authorized via a Notification tier or higher. Facilities that process municipal wastewater residuals (biosolids) must be authorized via a Registration or Permit. The highest authorization tier is a Permit, which is required for facilities processing grease trap waste (FOG) and mixed municipal solid waste.

Municipal wastewater residuals (biosolids) must be processed on a low-permeability surface designed to protect groundwater.

5.4.2 Facility Sizing

Several scenarios are identified in Section 3.8.1 and 3.8.2, estimating feedstock blends and quantities. The following is a list of assumptions forming the basis of estimates of acreage required for various composting activities. These assumptions are intentionally conservative, designed to yield areas that allow for the uncertainties inherent in a planning-level analysis without site-specific design data.

1. Basic turned windrow processing will be employed.
2. Allow four months in active windrow processing because C:N is slightly high and the possibility of very high wood (lignin) content slows the process.
3. Curing will not take place in windrows. Time in curing piles will be three months after active composting and before distribution.
4. Windrows will not be combined as they reduce in volume.
5. Assume a self-propelled, straddle-type windrow turner, making piles 18 feet wide and 8 feet high, with 10-foot aisles.
6. Processing areas will be relatively square in shape, to increase space efficiency.
7. Unground green waste may be stored on-site for up to 140 days prior to processing to account for seasonality, excess tonnage generated by major storms, grinding equipment downtime, or a decision by the operator to grind periodically using rented mobile equipment.
8. Green waste will be stored in piles 12 feet high and 24 feet wide, with 20-foot aisles prior to processing.
9. Unground green waste averages 253 pounds per cubic yard.[13]
10. Stormwater management measures are conceptual and have not been sized for design storms.
11. Twenty percent is added to total area to allow for access, maneuvering, stormwater, and irregularly shaped areas.
12. One acre area is allocated for screening and product distribution.

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[13] Robert Rynk et al., "Appendix B - Typical Characteristics of Composting Feedstocks", The Composting Handbook, CREF, 2022, https://compostfoundation.org/CH-Appendices.

13. No structures are included in areas, such as for office or equipment storage/maintenance.
14. Biosolids are 16 percent solids, digested.
15. Food waste and biosolids are immediately incorporated into windrows and are not stockpiled onsite.
16. To reduce the need for food waste or biosolids to balance the C:N ratio, approximately half of all green waste received will be ground and marketed as mulch and not composted.

Based on these assumptions, Burns & McDonnell estimated the maximum annual processing rates for the three on-site locations being considered for the composting facility, as summarized in Section 7.0.

Table 5-3: Windrow Composting Maximum Annual Process

Candidate Site	Area (Acres)	Annual Processing Rate (Tons per Year)
Site A – The Long Meadow	40	80,000
Site B – The Elbow	82	170,000
Site C – Old Town	88	180,000

As shown in Section 3.8, Sites B and C are large enough to accommodate the estimated best case annual throughput for maximum annual recoverable tonnages generated by a City composting program plus approximately 52,600 to 62,600 tons per year to accommodate additional future growth or third-party tonnage provided by the facility operator. Additional details are provided Appendix D.

5.5 Key Findings and Recommendations

This section provides key findings and recommendations for the processing technology evaluation described in the preceding sections.

1. A windrow composting facility is likely to be the most spatially demanding processing technology included in this Study and is therefore the conservative choice for developing a concept design and opinion of probable cost. This selection does not indicate a preference of the City's, and it is acknowledged that other technologies could also be suitable for this facility depending on the maximum annual tonnage to be processed.
2. State permitting and regulatory requirements are determined by the composting facility's feedstock rather than processing technology. Yard waste and food waste facilities trigger the lowest tier of regulations, biosolids initiate the next higher tier, while FOG and mixed MSW trigger the highest degree of regulations.
3. Developing the maximum available areas in Sites B and C would provide approximately 170,000 to 180,000 tons per year of processing capacity which would accommodate the estimated maximum annual recoverable tonnages generated by the City's proposed Phase 2 composting program plus 52,600 to 62,600 tons per year to accommodate additional future growth or third-party tonnage provided by the facility operator.
4. If the City partners with a third-party contractor for operations only, they should solicit feedback from any potential operating partners prior to making a final decision on their choice of processing technology. If the City decides to develop a composting facility in partnership with a private company through a Design-Build-Operate (DBO) procurement, it may be advantageous for the City to give respondents flexibility to propose turned windrow or aerated static pile technology based on the types and quantities of feedstock that they intend to process.

6.0 Traffic Volume Analysis

This section provides an understanding of potential changes to the number of vehicles accessing the Landfill property based on the estimated phased throughput tonnages described in Sections 3.7.1 and 3.7.2.

6.1 Estimated Additional Inbound Vehicles

For the sake of this Evaluation, inbound vehicles are defined as those hauling feedstock material to the composting facility and the vehicles of dedicated staff arriving at the site. The number of inbound haul vehicles was estimated based on assumed vehicle load capacities and the anticipated feedstock tonnages of 31,600 tons per year for Phase 1 and 117,400 tons per year for Phase 2 as further described in Section 3.8. A maximum Site B throughput of 170,000 tons per year was also considered, please refer to Section 7.3 for the significance of this scenario. The division of City collection vehicles versus other collection vehicles was estimated based on the current split of landfill-bound organics as well as their anticipated capture rates (both discussed above in Section 3.0). Assumed staffing requirements are based on per-ton industry standards for windrow composting. Table 6-1 below summarizes the results of this exercise.

Table 6-1: Estimated Daily Inbound Vehicles

Vehicles	Phase 1	Phase 2	Maximum Throughput
City Collection[a]	2.2	26.7	26.7
Collection by Others[b]	28.5	52.2	110.1
Staff	5.0	10.0	13.0
Total	**35.7**	**88.8**	**149.8**

[a] City collection vehicles are assumed to carry an average load of 10 tons of feedstock.
[b] Other collection vehicles are assumed to carry an average load of 3.5 tons of feedstock.

Of the total estimated inbound vehicles received at the composting facility, it is assumed that the City collection vehicles hauling clean loads of source separated green waste would result in no net increase to total site traffic since this material was previously received at the landfill tipping face in commingled loads. Any other organics haulers with loads of green and/or food waste are assumed to be additional traffic to the site compared to current operations. All staff vehicle trips are also considered additional traffic to the site. This is summarized below in Table 6-2.

Table 6-2: Rerouted vs. Additional Daily Inbound Traffic

Traffic Impact	Phase 1	Phase 2	Maximum Throughput
Rerouted Vehicles	2.2	26.7	26.7
Additional Vehicles	34.5	64.2	123.1

Rerouted vehicles are expected to improve the traffic flow to the Landfill tipping face, whereas additional vehicles could have negative repercussions at the Landfill property.

6.2 Estimated Additional Outbound Vehicles

For the sake of this Evaluation, outbound vehicles are defined as those distributing finished product and the vehicles of dedicated staff leaving the site. The number of outbound vehicles was estimated based on assumed distribution vehicle load capacities and assumed product output volumes for Phases 1 and 2 (see Section 3.9). Assumed staffing requirements are based on per-ton industry standards for windrow composting. Table 6-3 below summarizes this exercise.

Table 6-3: Estimated Daily Outbound Vehicles

Vehicles[a]	Phase 1	Phase 2	Maximum Throughput
Compost Distribution	2.5	9.6	13.9
Mulch Distribution	2.8	12.3	17.8
Staff	5.0	10.0	13.0
Total	**10.3**	**33.8**	**44.7**

[a] Compost and mulch distribution vehicles are assumed to carry an average load of 45 CY of finished product.

All outbound vehicles are assumed to be new additions to daily Landfill traffic.

6.3 Percent Change in Daily Landfill Traffic

Finally, the percent change in daily traffic at the Landfill for both diversion scenarios was calculated as shown below in Table 6-4.

Table 6-4: Percent Change in Daily Landfill Traffic

Vehicles	Phase 1	Phase 2	Maximum Throughput
Percent Change	3.9%	8.6%	15.8%

This estimation was reached by comparing the average daily Landfill transactions for FY 2023 (excluding Sundays) from City-provided data to the anticipated additional inbound and outbound composting facility traffic. The additional staff traffic was not counted twice between the inbound and outbound vehicles.

6.4 Key Findings and Recommendations

This section provides key findings and recommendations for the traffic analysis described in the preceding sections.

1. A total of 35.7 daily inbound vehicle trips, including 2.2 rerouted vehicles from the Landfill tipping face and 33.5 additional vehicles, are estimated for a composting facility handling 162,500 cubic yards of feedstock per year (Phase 1). This facility could anticipate about 10.3 daily outbound trips.
2. A total of 88.8 daily inbound vehicle trips, including 26.7 rerouted vehicles from the Landfill tipping face and 62.2 additional vehicles, are estimated for a composting facility handling 693,200 cubic yards of feedstock per year (Phase 2). This facility could anticipate about 31.8 daily outbound trips.
3. A total of 149.8 daily inbound vehicle trips, including 26.7 rerouted vehicles from the Landfill tipping face and 123.1 additional vehicles, are estimated for a composting facility handling

1,004,200 cubic yards of feedstock per year (Maximum Throughput). This facility could anticipate about 44.7 daily outbound trips.

4. Overall, the Landfill property could experience a 3.9% increase in daily traffic volume for a facility handling the Phase 1 feedstock, an 8.6% increase in daily traffic volume for a facility handling the Phase 2 feedstock, and a 15.8% increase in daily traffic volume for a facility handling the Maximum Throughput feedstock.
5. The City should consider separating composting traffic from Landfill traffic, as feasible, to mitigate negative impacts this new operation could have on existing traffic flow. This can be achieved by utilizing a quicker alternative, like load volume scanning (LVS), to track incoming composting feedstock.

7.0 Site Evaluation and Facility Concept

The City has identified three potential locations for a new composting facility at the Landfill property. This section includes an overview of each of these potential locations and possible restrictions related to physical constraints and infrastructure, regulatory requirements, environmental considerations, and transportation needs. Based on the findings of these criteria, one location was ultimately selected to develop a concept design and opinion of probable cost for the processing technology selected above in Section 5.0.

7.1 Overview of Potential Locations

All three of the potential sites identified for this Evaluation are located within the property boundary of the McCommas Bluff Landfill at 5100 Youngblood Road in Dallas, Texas. The locations are as follows:

7.1.1 Site A - The Long Meadow

The site labeled as 'The Long Meadow' is located near the intersection of Simpson Stuart Road and Locust Drive, along the northern edge of the property (See Figure 7-1). This location is long, narrow, and is the smallest of the three sites with an area of about 40 acres. The City has noted that this site has been flagged as a preferred location for other future projects.

Figure 7-1: Site A – The Long Meadow

7.1.2 Site B - The Elbow

Site B, or ‘The Elbow’ is situated south of Site A (The Long Meadow), east of FCC Environmental Services and north of the Landfill’s existing stormwater pond (See Figure 7-2). This location is less narrow and larger than Site A at about 82 acres. However, this site exists in the footprint of a horizontal expansion of the Landfill planned for roughly 2034 and would therefore present only a temporary solution for the City’s composting infrastructure.

Figure 7-2: Site B – The Elbow

7.1.3 Site C - Old Town

The largest of the three sites is ‘Old Town’ with an area of approximately 88 acres. This site is located just south of the scale house on Youngblood Road on an old, closed portion of the Landfill (See Figure 7-3).

Figure 7-3: Site C – Old Town

7.2 Site Selection Criteria

While evaluating the three site locations, considerations were made including physical constraints and infrastructure, regulatory requirements, environmental restrictions, and transportation needs. Due to the proximity of the three sites in question, the discussion below only analyzes criteria that may differentiate one option from the other within the Landfill property. A location analysis for the property on a larger scale can be found above in Section 4.0.

7.2.1 Physical Constraints and Infrastructure

Physical constraints that may impact the location of a composting facility include:

- Area
- Topography
- Existing Conditions (level of effort for site preparation)
- Previous Use
- Landfill Operational Impact
- Security

Site C benefits from the largest area of the three locations while Site A is notably smaller than the other two locations. Table 5-3 above illustrates the areas of each candidate site and their estimated maximum throughput based on the turned windrow sizing needs defined in Section 5.4.2.

All three sites are suitably sized for the initial proposed policy of establishing preferential pricing for both green waste and food waste at the composting facility (Phase 1). Should the City proceed with the subsequent proposed policy of collecting green waste at the curb (Phase 2), Site A would no longer serve the spatial needs of the composting operation.

Topography for the three locations was retrieved from the City's GIS database in October of 2024 for this desktop review. Site A possesses the most ideal topography with an overall elevation change of 12 feet and an average ground slope of 2.8 percent within its boundary. Site B exhibits a slightly greater elevation change of 30 feet and an average ground slope of 2.7 percent. Though most of Site B is also relatively flat, a more dramatic grade exists both along the levee / access road bordering the northern border of the site and the area ultimately grading into the existing stormwater pond in its southwestern corner. Site C, as expected, has the least ideal topography with an overall elevation change of 46 feet and an average ground slope of 6.3 percent. The historical waste disposal that occurred in Site C has left an undulating ground surface with significant differential settlement between trenches filled with lightly compacted waste and undisturbed ground. Both Sites A and B share ideal existing slopes for site drainage, though Site B poses a slight challenge with areas of greater elevation change.

Because of the Landfill's proximity to the floodplain, it is likely that any of the three sites would require improvements to their existing soils to support the heavy equipment necessary for composting. In terms of existing soils, Site A is anticipated to experience the shallowest groundwater table with its location outside of the Landfill levee. The City has indicated the presence of sand lenses near the southwest corner of Site B that would require further investigation prior to facility design and construction. As can already be witnessed at Site C, the presence of buried waste creates a high likelihood of unpredictable settlement well into the future.

Besides existing soils, vegetation can also contribute to the level of effort required for site preparation. From aerial imagery, Site C shows little to no sign of existing dense vegetation (See Figure 7-3). Site A possesses minimal dense vegetation with intermittent trees scattered mostly around the eastern half of the location (See Figure 7-1). Site B is the most densely vegetated with approximately 30 percent cover focused primarily to the western half of the site (See Figure 7-2).

Site B's location within the future planned footprint of the Landfill makes it the only of the three options with a negative impact on Landfill operations. Development of a composting facility at either Sites A or C could be considered permanent installations, whereas the development of Site B, without modifications to the composting system or operational efficiency, would be a temporary facility with a lifespan of approximately 10 years from 2024.

With all three possible locations inside the perimeter fencing of the Landfill, no single site poses a greater security concern than another. It is assumed that a composting facility at any of the three locations would have its own perimeter fencing and security gates in addition to the outer Landfill access control.

Additionally, some common infrastructure needed for composting operations includes electricity, a water source, fuel, waste management, and the ability to manage stormwater. With the existence of solid waste facilities near each of these sites, connections to these utilities are all assumed to be feasible if needed.

7.2.2 Regulatory

The discussion below addresses regulatory issues like compliance, zoning and land use, and proximity to sensitive receptors.

7.2.2.1 Compliance

The permitting of a greenfield composting facility can take a considerable amount of time - sometimes years. Sites A and C are not currently permitted for composting and would therefore require this effort, whereas Site B has been previously approved by TCEQ for windrow composting operations.

The turned windrow composting facility that is currently authorized on Site B was approved by TCEQ as a landfill permit modification. The composting facility and operation were developed in compliance with the regulatory requirements for a registration-tier facility as defined in 30 TAC Section 332 Subchapter C. Registration-tier facilities may choose to compost the following categories of feedstocks; however, they are not required to accept all categories if they choose not to:

- Sewage sludge
- Positively sorted organic materials from the municipal solid waste stream
- Source-separated organic materials
- Paper mill sludge
- Disposable diapers
- Source separated yard trimmings, clean wood material, vegetative material, paper, manure, meat, fish, dairy, oil grease or dead animal carcasses

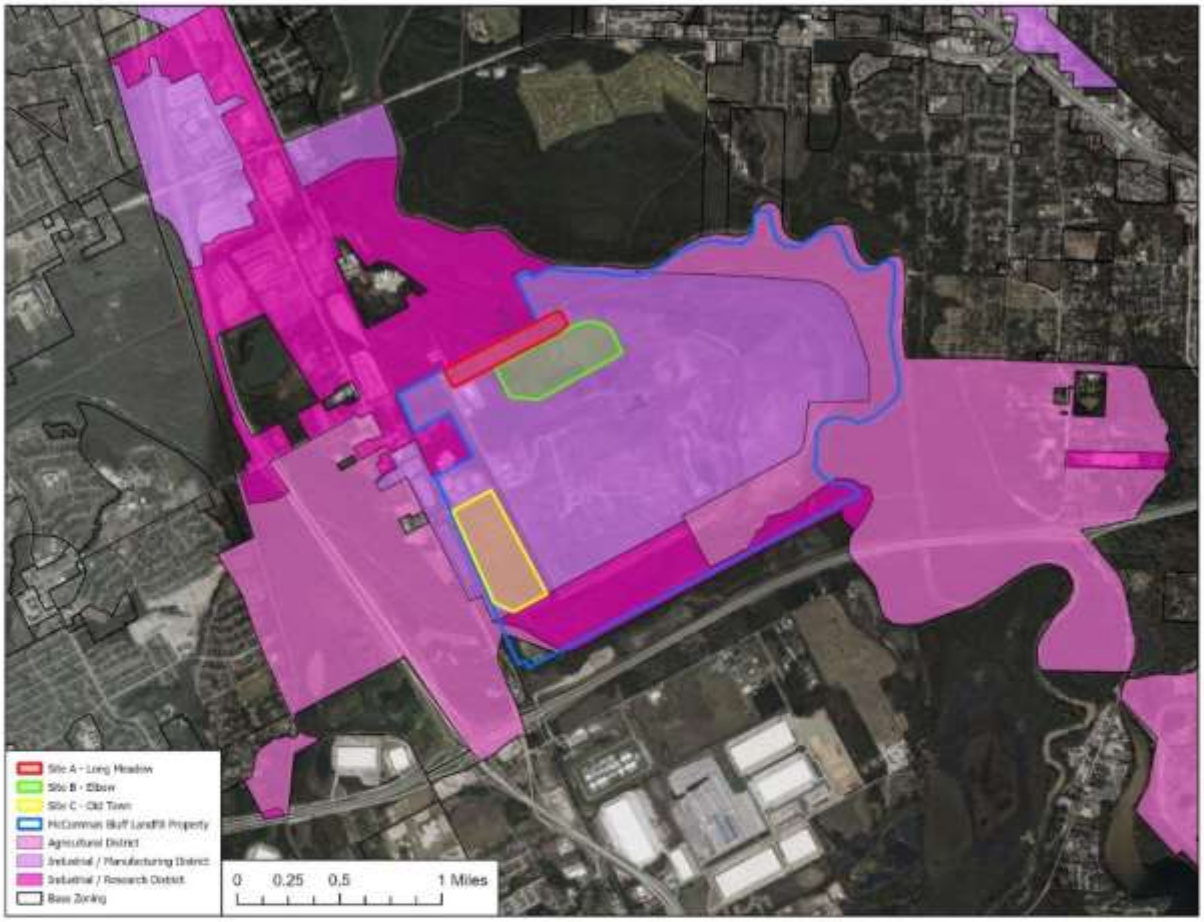
The landfill permit modification includes a layout drawing which indicates general areas of processing activities, facility access route, and a lined stormwater pond. Among other operational considerations, the Site Operating Plan for the composting operation states that the Composting Operations Area, Initial Composting Area, and surface water drainage channels will be constructed on a pad designed to protect groundwater where sludge is stored or processed. This groundwater protection will not be required unless and until sludge is accepted in any given area. Neither will the groundwater protection pad be required for final product storage areas because any final product will have met disinfection standards and be approved for unrestricted use.

Construction testing to document regulatory design standards will be required for the groundwater protection pad. If any substantive modifications to the currently authorized facility layout or Site Operations Plan are required, a minor permit modification will be necessary. Any such modification is not expected to require public notice. If composting takes place within the landfill permit boundary, it will be necessary to update the landfill Stormwater Pollution Prevention Plan prior to operation.

7.2.2.2 Zoning and Land Use

The Landfill property falls within the following zoning codes: Agricultural District, Industrial/Manufacturing District, and Industrial/Research District. These zoning codes all allow for land uses compatible with a composting facility. Refer to Figure 7-4 for a zoning map of the area.

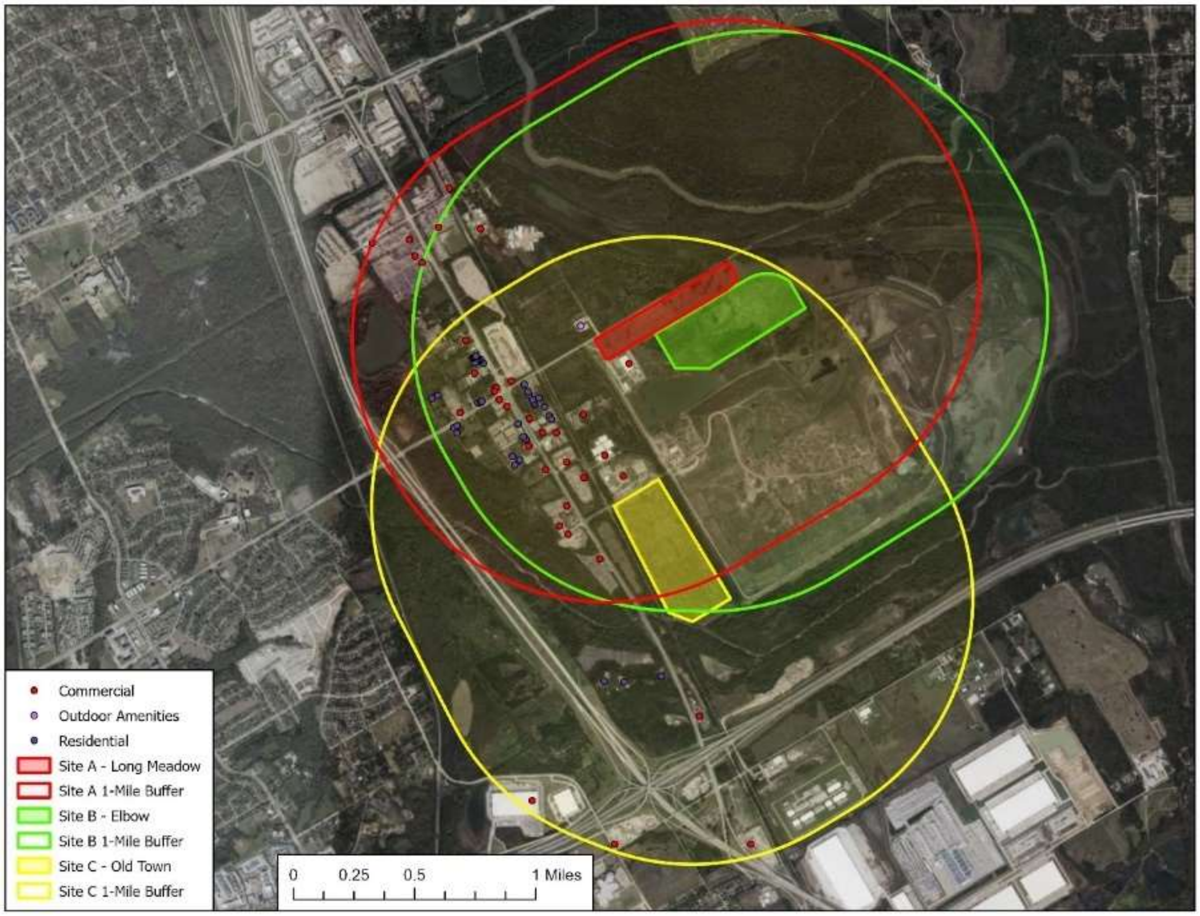
Figure 7-4: Zoning and Land Use



7.2.2.3 Proximity to Sensitive Receptors

Proximity to sensitive receptors including churches, hospitals, outdoor amenities, residential areas, and commercial establishments was assessed within a 1-mile buffer of the proposed sites. This area includes approximately 37 residences, with the closest residences about 1,700 feet from Site A (The Long Meadow), 2,900 feet from Site B (The Elbow), and 1,350 feet from Site C (Old Town). Additionally, the buffer contains approximately 34 commercial establishments, with the nearest located about 100 feet from Site A, 750 feet from Site B, and 450 feet from Site C. As shown in Figure 7-5, the buffer also includes one outdoor amenity, but no churches or hospitals. Site B is noticeably furthest from both residential and commercial buildings, making it the most suitable option within the 1-mile buffer for minimizing potential impacts to sensitive receptors.

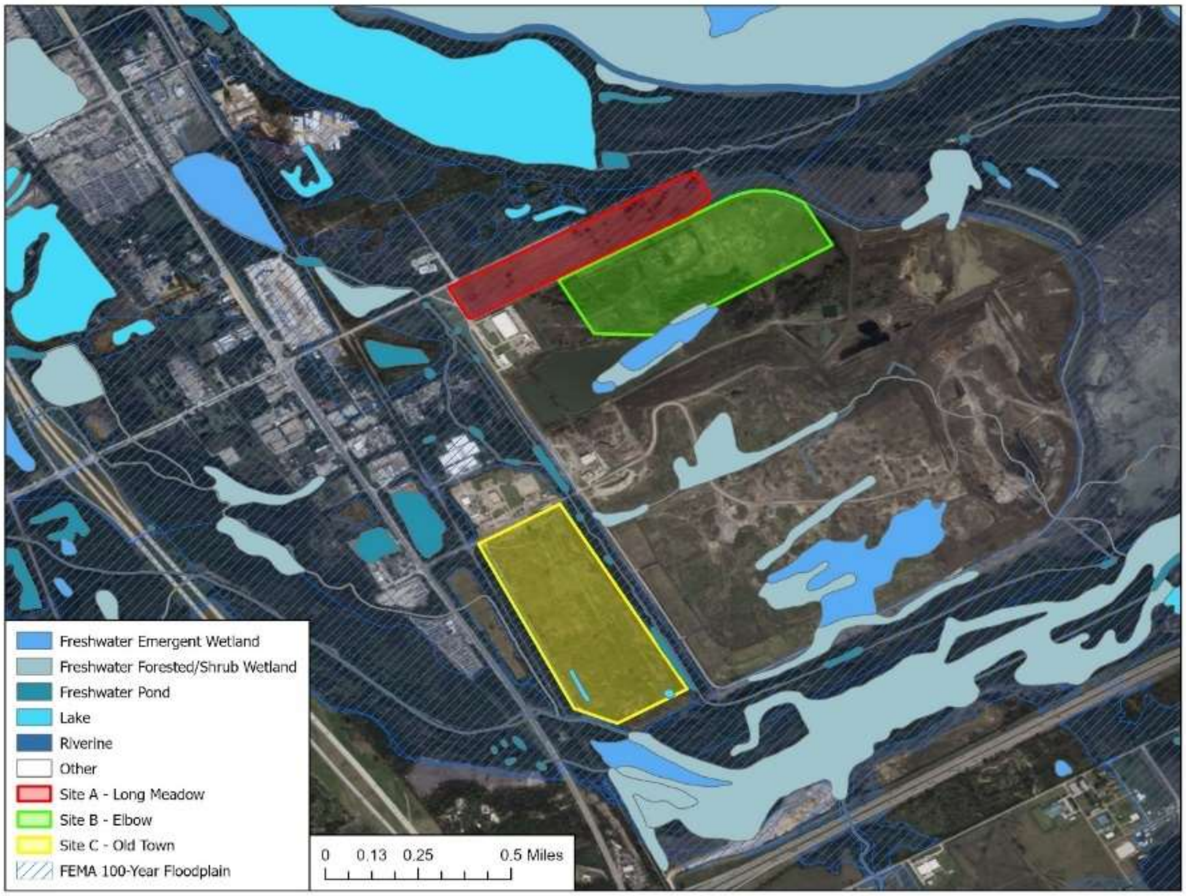
Figure 7-5: Proximity to Sensitive Receptors



7.2.3 Environmental

As can be seen in Figure 7-6, most of the Landfill property has been protected by levee from the Federal Emergency Management Agency (FEMA) 100-year floodplain, with Site A (The Long Meadow) being the only proposed site within the 100-year floodplain. Figure 7-6 also shows an overlay of National Wetlands Inventory (NWI) data. Freshwater emergent and forested/shrub wetlands are shown in several locations within the permitted landfill footprint. These wetlands are confirmed to be historic and previously mitigated by the City during previous Landfill permitting efforts..

Figure 7-6: Wetlands and Floodplains



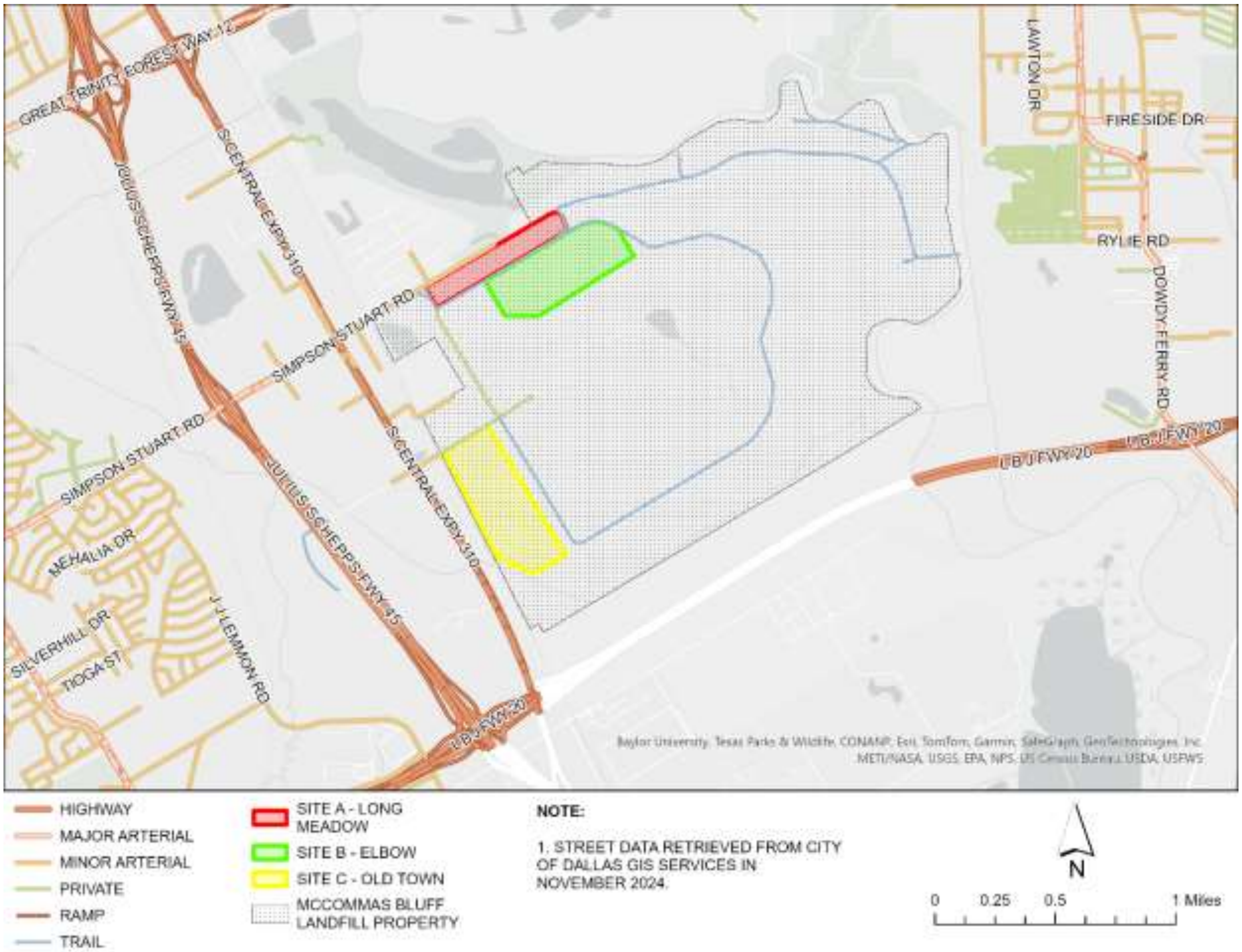
7.2.4 Transportation

The transportation discussion below addresses general considerations for the purpose of evaluating the three potential site locations. The recommended traffic routing for this proposed composting facility is further described below in Section 7.4.

7.2.4.1 Classification of Support Roads

Because the Landfill already attracts solid waste vehicles like those that would be expected at a composting facility, access to the appropriately classified streets is not of particular concern to any of the three potential siting locations. Figure 7-7 below illustrates the classifications of surrounding streets according to the City's database.

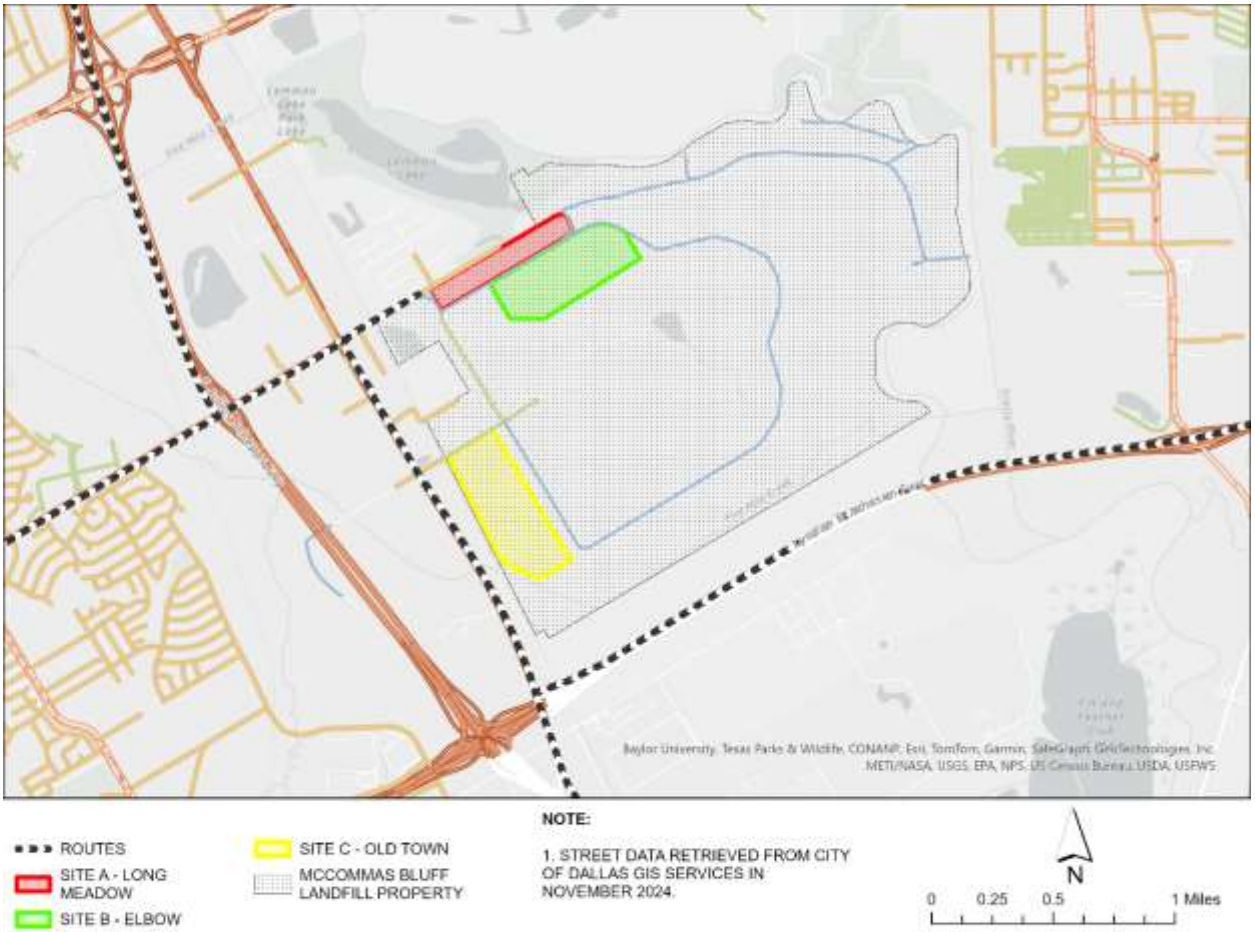
Figure 7-7: Classification of Support Roads



7.2.4.2 Feeding Road Network

The Landfill already experiences significant daily traffic volumes without the addition of another facility on the property. A key point of queuing congestion occurs at the scale house on Youngblood Road just north of Site C. Routes that enable composting traffic to avoid Youngblood Road altogether would minimize potential negative impact this new operation could have on existing Landfill operations. Figure 7-8 demonstrates options for these routes for vehicles approaching the facility from generally the four cardinal directions.

Figure 7-8: Feeding Road Network



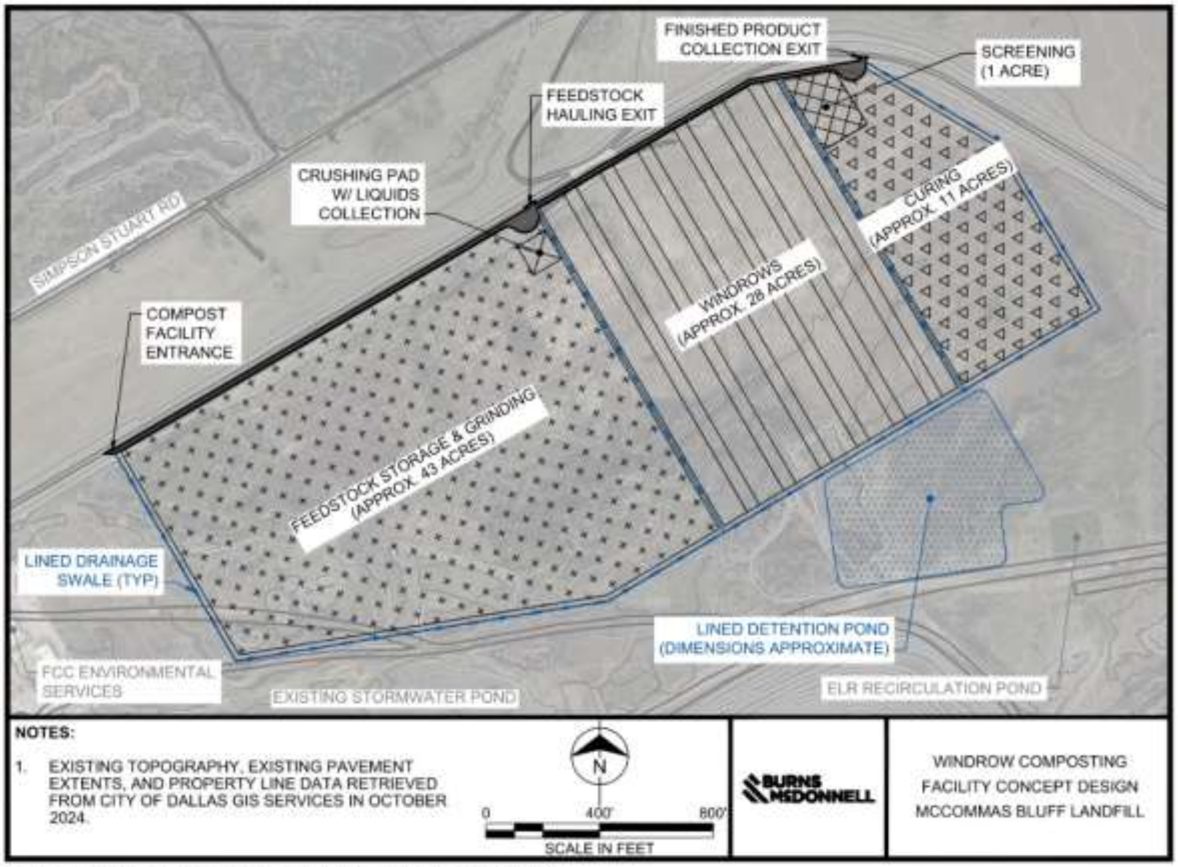
As shown above in Figure 7-8, Sites A and B prove to have locations better suited for segregating composting traffic from Landfill traffic along Youngblood Road. Because Youngblood Road borders the northwestern edge of Site C, composting traffic accessing this site would likely conflict with the existing Landfill traffic.

7.3 Facility Concept Design

Site B (The Elbow) was identified as the preferred location when considering the criteria discussed above in Section 7.2. Below, Figure 7-9 provides a conceptual design for a windrow composting facility (See Section 5.4) on Site B managing a maximum of 170,000 annual tons of feedstock.

Key considerations made while arranging the facility include existing permit conditions, surface water management, existing topography, material flow through the composting process, future Landfill encroachment, safety and accessibility, and footprint minimization.

Figure 7-9: Windrow Composting Facility Concept Design



As summarized above in Section 7.2.2, Site B has been previously permitted with the TCEQ for composting. In the interest of easing permit modification efforts for the City, the footprint of the composting pad and lined detention pond have been maintained. This is possible because the estimated throughput of the previously permitted footprint (170,000 tons per year) exceeds the largest anticipated diversion of City feedstock during this planning period (Phase 2 - 117,400 tons per year) (See Table 5-3). This extra area represents approximately 52,600 tons worth of feedstock processing capacity in addition to the City's estimated best case Phase 2 throughput of 117,400 tons per year. This excess capacity can be used to accommodate unanticipated growth or to process third party tonnage to maximize throughput and reduce per-ton operating costs. If the excess capacity is not needed immediately, the City may consider constructing a smaller facility initially and then expanding to the full permitted size at a later date.

Lined drainage swales would serve to separate runoff between the individual process areas and ultimately convey the water to the lined detention pond. The location of the detention pond is compatible with the existing site drainage pattern.

Materials will generally flow linearly through the facility from west to east beginning in the feedstock storage and grinding area, moving through the windrows to the curing area, then finally through the screening area before it is collected for distribution. This direction was chosen to accommodate the possible future scenario in which the overall footprint of the facility must recede to the west because of the Landfill's horizontal expansion. The higher capital development costs are typically associated with the earlier steps of the composting process. By placing these areas near the western side of the site, the City could maximize the life of these investments.

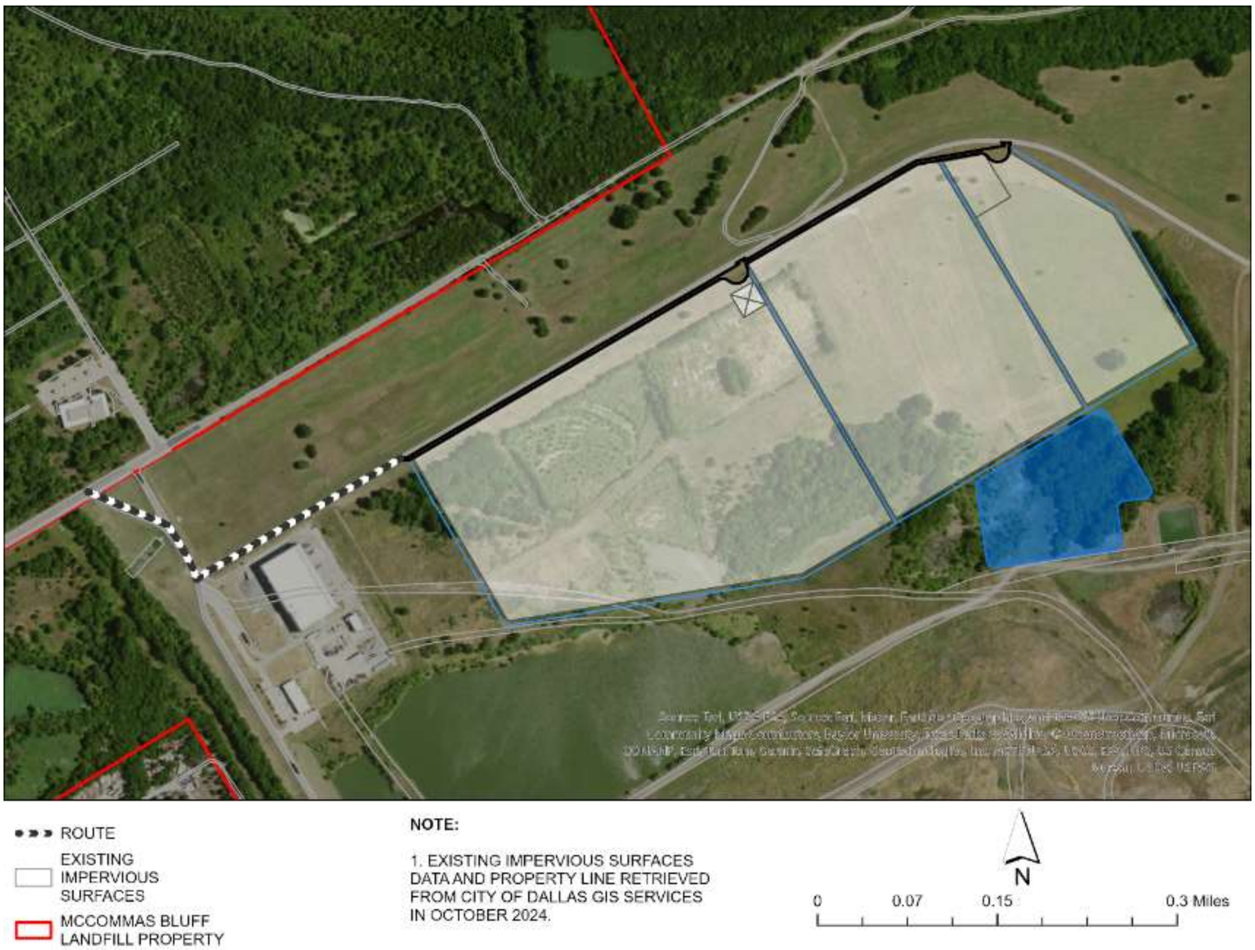
7.4 Traffic Routes

In continuation of the transportation evaluation discussed above in Sections 6.0 and 7.2.4, this section provides recommended traffic routes through the Landfill property for vehicles accessing the composting facility illustrated above in Figure 7-9.

7.4.1 Inbound

As discussed above in Section 7.2.4.2, directing composting traffic away from the Landfill's scale house on Youngblood Road would prove the least disruptive route to existing Landfill operations. The City could employ a quicker technology to estimate composting feedstock quantities, like LVS, to allow for this relief traffic at the scale. Figure 7-10 illustrates this recommended inbound traffic route from Simpson Stuart Road.

Figure 7-10: Recommended Inbound Traffic Route

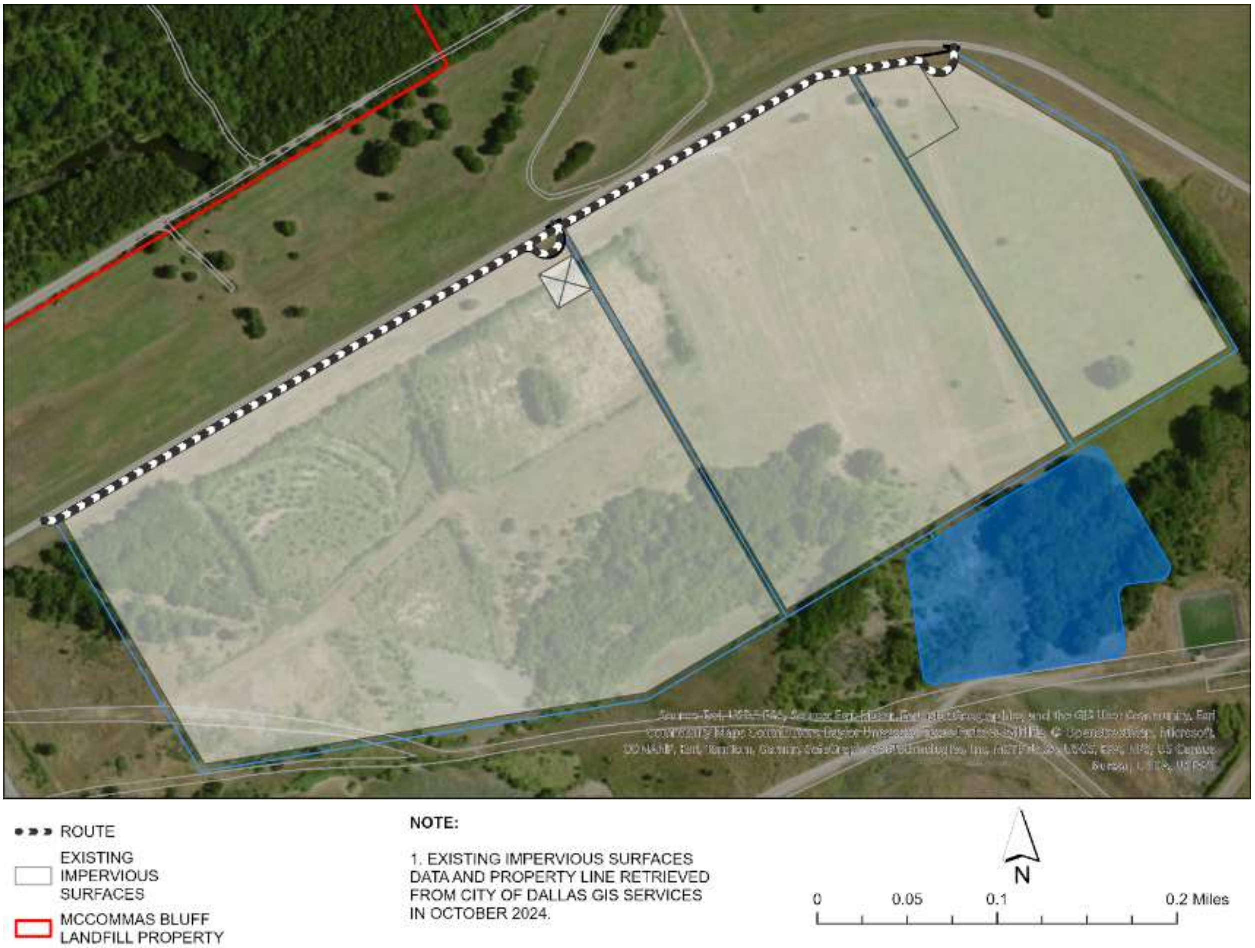


Significant improvements to this existing levee road are not anticipated.

7.4.2 Onsite

To minimize conflict points and maximize operational safety, onsite vehicle traffic is intended to flow from west to east in one direction from like the material itself. Figure 7-11 demonstrates this recommended onsite traffic route.

Figure 7-11: Recommended Onsite Traffic Route



Inbound traffic would enter the facility in the northwest corner from the existing levee road. From there they would proceed along the northern edge of the composting pad, offloading material in the appropriate part of the feedstock storage and grinding area if applicable. Vehicles hauling feedstock material would have the option to exit the facility onto the levee road in the northeast corner of the feedstock storage and grinding area to minimize unnecessary transportation distances. Haul trucks collecting finished compost product would proceed along the northern edge of the composting pad until the screening area is reached. Once loaded, the truck would exit the facility onto the levee road in the northeastern corner of the screening / curing area. A discussion of the traffic volumes anticipated at this facility can be found in Section 6.0.

7.4.3 Outbound

To maintain the best possible division of composting traffic from that of the Landfill, it is recommended to direct outbound traffic back to the levee road, continuing east around the composting pad on existing access roads, and ultimately back to Simpson Stuart Road. Figure 7-12 illustrates this recommended outbound traffic route to Simpson Stuart Road.

Figure 7-12: Recommended Outbound Traffic Route

New road segments and improvements to existing road segments along the later 75 percent of this route will be required.

7.5 Capital and Operating Opinion of Probable Costs

A planning-level opinion of probable capital and operating costs was developed for the facility shown above in Figure 7-9. Burns and McDonnell's estimates, analyses, and recommendations presented in this Evaluation are based on our professional experience and judgment, as well as external sources and assumptions. While we believe the information presented herein is reasonably accurate, the project team does not guarantee that actual values or scenarios will not differ from those presented upon implementation. Further evaluation of certain information, assumptions, and scenarios may be warranted at the discretion of the City.

The facility construction cost estimate includes conservative assumptions including development of the full 82-acre permitted area, construction of a low permeability liner in the windrow area to permit the processing of biosolids, construction of a permanent, fully serviced, metal framed building for offices and equipment maintenance, and contingencies that reflect the preliminary conceptual nature of the assumed design. These assumptions may be revisited and refined during detailed design.

7.5.1 Opinion of Probable Capital Costs

The opinion of probable construction cost (OPCC) in 2024 United States dollars (2024 USD) for the 10-yr projected windrow composting facility described above in Section 7.3 is approximately $14.6 million, including a 20 percent contingency and 15 percent permitting and design fee. Further breakdown of this OPCC is presented below in Table 7-1.

Table 7-1: Opinion of Probable Construction Cost (+/- 50%)

Item No.	Description	Qty	Unit	Unit Cost (2024 USD)	Total Cost (2024 USD)
1	General Conditions	15	MO	$61,040	$915,600
2	Erosion Control	1	LS	$86,300	$86,300
3	Removals	1	LS	$1,040,700	$1,040,700
4	Earthwork	1	LS	$6,255,900	$6,255,900
5	Aggregates	1	LS	$88,700	$88,700
6	Concrete Paving / Crushing Station	1	LS	$66,770	$66,770
7	Bollards & Signage	1	LS	$29,020	$29,020
8	Sanitary Sewer	1	LS	$117,100	$117,100
9	Water & Fire Lines	1	LS	$272,100	$272,100
10	Fencing	1	LS	$424,395	$424,395
11	Metal Building	5,000	SF	$283.20	$1,416,000
12	Landscaping	1	LS	$120,800	$120,800
				Total Direct OPCC	**$10,833,385**
				Project Contingency (20%)	$2,166,000
				Permitting and Design (15%)	$1,625,000
				Total Combined OPCC	**$14,624,385**

In general, the OPCC assumes the same surface materials for the composting pad areas, detention pond, and drainage swales as previously permitted for this site (See Section 7.2.2). Fill soils are conservatively assumed to require sourcing from offsite. No soil stabilization is included in this OPCC however, with the substantial footprint of this facility, the findings of the soil investigation recommended above in Section 7.2.1 could have significant impact to construction costs.

The OPCC also includes basic amenities for staff including paved parking for 12 personnel and a 5,000 square foot (SF) metal building with two overhead doors for equipment maintenance, electrical service, and facilities.

It should be noted that, with removals and earthwork making up approximately 65 percent of direct construction costs, this effort will likely be required to accommodate the future horizontal Landfill expansion regardless of the temporary siting of a composting facility. The City may further benefit from construction cost efficiencies by investigating during detailed design whether this facility could support the future planned landfill base grades.

Windrow composting is especially demanding when it comes to heavy equipment needs. The total equipment capital is estimated at a little over $6.6 million in 2024 USD. A tabulation of anticipated equipment needs and their associated capital costs is shown in Table 7-2 below.

Table 7-2: Opinion of Probable Equipment Capital Cost

Equipment	Lifespan[a] (yrs)	Qty	Unit	Unit Cost (2024 USD)	Total Cost (2024 USD)
Load Volume Scanning	15	1	LS	$70,000	$70,000
Front-End Loader	5	5	EA	$250,000	$1,250,000
Excavator	5	2	EA	$340,000	$680,000
Grinder	10	2	EA	$1,400,000	$2,800,000
Windrow Turner	10	1	EA	$750,000	$750,000
Water Tanker	10	1	EA	$270,000	$270,000
Monitoring	2	1	LS	$12,000	$12,000
Screen	15	1	EA	$770,000	$770,000
Total Equipment Capital					**$6,602,000**

[a] Equipment lifespans are estimated based on vendor projections, as available, and estimated annual operating hours.

When combining the OPCC and the estimated initial equipment capital investment, the City could expect a capital cost of about $21.2 million in 2024 USD (+/- 50%) for the facility shown in Figure 7-9. This initial capital investment could be reduced through operational efficiencies (See Section 5.5) or phased commissioning of the facility in line with a phased implementation of feedstock diversion policy (See Section 3.7).

7.5.2 Opinion of Probable Operating Costs

Labor is often the greatest operating expense of a composting facility. The hands-on nature of windrow composting requires sufficient personnel capable of operating the equipment. In addition to Heavy Equipment Operators (HEOs), laborers will be needed to manage feedstock receipt and compost monitoring data. Supervisors are necessary to maintain efficient operations of a facility of this magnitude while meeting compliance requirements and marketing products. Below, Table 7-3 demonstrates this concept with a summary of the personnel necessary to operate the facility.

Table 7-3: Opinion of Probable Labor Costs

Personnel	Base Salary ($2024)	Benefits ($2024)	Total Compensation[a] ($2024)	Qty	Total Cost ($2024)
Supervisor	$85,800	$26,600	$112,400	2	$224,800
HEO	$72,100	$22,400	$94,500	8	$756,000
Laborer	$44,500	$13,800	$58,300	3	$174,900
Totals				**13**	**$1,155,700**

[a] Labor compensation is intended to match current regional averages based on a local salary survey completed by Burns & McDonnell. This salary analysis assumes that the facility will be operated by a third party.

Table 7-4 summarizes probable operating costs by equipment type, as estimated for reporting purposes to the TCEQ Composting Refund Program. As shown, the combined estimated annual operating cost is estimated at $3.1 million in 2024 USD assuming that the City will partner with a third-party operator.

Table 7-4: Opinion of Probable Operating Costs

Equipment	Annual Operating Hours[a]	Labor[b] (2024 USD)	Fuel[c] (2024 USD)	Maintenance[d] (2024 USD)	Admin[e] (2024 USD)	Operator Margin[f] (2024 USD)	Total (2024 USD)
Load Volume Scanning	2,080	$127,300	$-	$10,500	$6,900	$29,000	$173,700
Front-End Loader	8,415	$515,000	$115,900	$187,500	$41,000	$171,900	$1,031,300
Excavator	2,625	$160,600	$27,800	$102,000	$14,600	$61,000	$366,000
Grinder	2,700	$165,200	$90,900	$420,000	$33,900	$142,000	$852,000
Windrow Turner	870	$53,200	$26,700	$112,500	$9,700	$40,500	$242,600
Water Tanker	765	$46,800	$40,500	$40,500	$5,300	$22,100	$132,300
Monitoring	520	$31,800	$-	$2,200	$1,700	$7,200	$42,900
Screen	910	$55,700	$16,800	$115,500	$9,400	$39,500	$236,900
Total	**18,885**	**$1,155,600**	**$260,100**	**$990,700**	**$122,500**	**$513,200**	**$3,077,700**

[a] Annual operating hours are estimated from a material handling exercise based on a facility schedule of 8 hours per day, 5 days per week, and 52 weeks per year.
[b] See Table 7-3.
[c] Fuel costs are based on a diesel price of $3.06 per gallon and average vendor fuel efficiencies.
[d] Maintenance costs are estimated to be 15 percent of annualized equipment capital costs.
[e] Administrative costs are estimated to be 5 percent of combined labor, fuel, and maintenance costs.
[f] Operator margin is estimated at a 20 percent markup of combined labor, fuel, maintenance, and administrative costs.

7.6 Key Findings and Recommendations

This section provides key findings and recommendations for the site evaluation and concept design described in the preceding sections.

1. Of the three potential locations identified at the Landfill, Site B (The Elbow) may be the best suited for a windrow composting facility.
2. The windrow composting facility capable of processing up to 170,000 annual tons of feedstock material as shown in Figure 7-9 would require an initial capital investment of approximately $21.2 million in 2024 USD.
3. The windrow composting facility capable of processing up to 170,000 annual tons of feedstock material as shown in Figure 7-9 would require an annual operating investment of approximately $3.1 million in 2024 USD.
4. The City should further investigate existing soil properties and permit modification requirements of Site B (The Elbow) to better understand limitations of the location.
5. The City should look for synchronization with the future planned Landfill cell during detailed facility design to maximize efficiency in construction costs.
6. The City should solicit feedback from any potential operating partners prior to detailed facility design, permitting, and construction to facilitate early collaboration.

8.0 Financial Evaluation

The following sections present annualized capital and operating costs, costs per ton, impacts on Landfill costs and revenue, and recommended pricing. The analysis in this section builds from the financial pro forma that was developed for Site B at the Landfill, utilizing the opinion of probable capital and operating costs described in Section 7.5.

There are several factors, particularly policy decisions, that can influence the amount of material brought into the composting facility. The City has initially expressed interest in establishing preferential pricing for green and food waste at the composting facility, which could yield up to 31,600 tons of annual feedstock (Phase 1). They have also indicated the possibility of later establishing curbside collection of green waste within this 10-year planning period, potentially raising the feedstock to 117,400 tons per year (Phase 2). The maximum throughput of the facility, as mentioned in Section 7.0, is estimated at 170,000 tons per year, accommodating approximately 52,600 additional tons of feedstock beyond the Phase 2 estimate. Given the range of potential material that could be processed at the composting facility, Burns & McDonnell developed the financial analysis for the following three scenarios:

- Phase 1: 31,000 tons per year
- Phase 2: 117,400 tons per year
- Maximum Throughput: 170,000 tons per year

A summary and the pro forma for the three scenarios is provided in Appendix C.

Some of the tons in each scenario are currently going to the Landfill. The baseline analysis conservatively assumes that all tons would otherwise be disposed of in the Landfill. However, a sensitivity analysis was conducted to show the impact of 50 percent of inbound tonnage coming from external sources (not originally disposed of at the Landfill).

8.1 Annualized Costs

Annualized facility capital costs, including construction and equipment, are presented in Table 8-1. Phase 1 construction costs, specifically removals, earthwork, aggregates, and contingency are scaled back assuming the based on the proportional amount of inbound volume between Phase 1 and Maximum Throughput. Assuming that a private operator would be responsible for the facility development, the total capital cost was adjusted to include a 20 percent operator margin to account for profit, taxes, and depreciation. Annualized costs are calculated assuming each item will be financed by the private sector over the asset's useful life at an interest rate of six percent. If the City chooses to finance any construction or equipment costs, there is an opportunity for cost savings by reducing the operator margin for profit, taxes, and depreciation, and potentially paying a lower interest rate over the useful life of each asset. The assumed site useful life is 10 years, at which point the land will be repurposed for Landfill cell development. If the City can prolong the life of the existing cell or continue operations on the footprint of the new cell, increasing the useful life of the composting facility, there is an opportunity to reduce the annualized construction capital costs. Useful life for each equipment type is based on the number of lifetime hours recommended for operation compared to the number of annual operating hours required to perform composting activities under each scenario. Similarly, the required daily operating hours by equipment type were utilized to evaluate the amount of equipment that must be purchased for operations.

Table 8-1: Annual Facility Construction and Equipment Costs

Annualized Costs	Description	Phase 1	Phase 2	Maximum Throughput
1	General Conditions	$149,300	$149,300	$149,300
2	Erosion Control	$14,100	$14,100	$14,100
3	Removals	$30,500	$169,700	$169,700
4	Earthwork	$182,900	$1,020,000	$1,020,000
5	Aggregates	$2,600	$14,500	$14,500
6	Concrete Paving / Crushing Station	$10,900	$10,900	$10,900
7	Bollards & Signage	$4,800	$4,800	$4,800
8	Sanitary Sewer	$19,200	$19,200	$19,200
9	Water & Fire Lines	$44,400	$44,400	$44,400
10	Fencing	$69,200	$69,200	$69,200
11	Metal Building	$230,900	$230,900	$230,900
12	Landscaping	$19,800	$19,800	$19,800
13	Project Contingency	$155,700	$353,200	$353,200
14	Permits & Design	$265,000	$265,000	$265,000
Subtotal		**$1,199,300**	**$2,385,000**	**$2,385,000**
1	Load Volume Scanning	$8,700	$8,700	$8,700
2	Front-End Loader	$53,800	$284,900	$356,100
3	Excavator	$32,100	$89,400	$193,800
4	Grinder	$228,300	$228,300	$456,600
5	Windrow Turner	$69,500	$122,300	$122,300
6	Water Tanker	$44,100	$44,100	$44,100
7	Monitoring	$7,900	$7,900	$7,900
8	Screen	$78,200	$95,200	$95,200
Subtotal		**$522,600**	**$880,800**	**$1,284,700**
Total		**$1,721,900**	**$3,265,800**	**$3,669,700**

Operating costs are presented in Table 8-2 and are based on the average annual operating hours by equipment type. Direct composting operation costs are assumed to include labor, fuel, and maintenance. Administrative costs are estimated to be five percent of the combined labor, fuel, and maintenance costs and are considered ancillary to direct composting operations. The operator margin is estimated at a 20 percent markup of combined labor, fuel, maintenance, and administrative costs.

The structure of the financial analysis is consistent with the informational requirements for the TCEQ Composting Refund. The TCEQ offers a Compost Refund Program[14] in which "MSW facility permittees are eligible to receive a credit of 15 percent of the solid waste fees collected by the facility up to allowable composting costs as provided for in Texas Health and Safety Code (HSC) Section (§) 361.0235(a)." To qualify for this refund, the facility must submit a Compost Plan describing the equipment used in the operation and corresponding operating hours. Administrative and operator margin costs are assumed to not qualify for the Compost Refund Program. Table 7-4 in Section 7.5.2 shows the detailed breakdown of

[14] TCEQ, "Guidelines for Participation in the Compost Refund Program", 2014, Guidelines for Participation in the Compost Refund Program

operating costs for the Maximum Throughput scenario, consistent with the informational requirements for the TCEQ Composting Refund.

Table 8-2: Annual Facility Operating Costs

Equipment	Phase 1		Phase 2		Maximum Throughput	
	Annual Operating Hours	Annualized Costs	Annual Operating Hours	Annualized Costs	Annual Operating Hours	Annualized Costs
Load Volume Scanning	2,080	$246,400	2,080	$185,200	2,080	$173,700
Front-End Loader	1,430	$232,400	5,820	$770,700	8,415	$1,031,300
Excavator	405	$115,100	1,820	$239,000	2,625	$366,000
Grinder	420	$329,600	1,870	$498,500	2,700	$852,000
Windrow Turner	155	$165,300	600	$214,600	870	$242,600
Water Tanker	135	$70,100	525	$109,700	765	$132,300
Monitoring	520	$61,100	520	$45,900	520	$42,900
Screen	165	$168,000	625	$211,700	910	$236,900
Total	**5,310**	**$1,388,000**	**13,860**	**$2,275,300**	**18,885**	**$3,077,700**

8.2 Unit Costs

Table 8-3 presents the unit costs for the composting facility and is broken down into the three primary cost components, construction, equipment, and operating costs. This section reflects the costs of the composting facility only and when determining pricing, the City should consider the revenue generated from the sale of material as discussed in Section 8.4. As the City increases inbound material through policy decisions, operator tonnage requirements, or public education, the cost per inbound CY will decrease significantly with a cost differential between the Phase 1 and Maximum Throughput scenarios of $38.93 per CY.

Table 8-3: Composting Facility Unit Costs

	Annualized Cost	Annual Inbound Tons	Annualized Cost per Inbound Ton	Annual Inbound CY	Annualized Cost per Inbound CY
Phase 1					
Construction	$1,199,300	31,600	$37.95	48,816	$24.57
Equipment	$522,600	31,600	$16.54	48,816	$10.71
Operating	$1,388,000	31,600	$43.92	48,816	$28.43
Total	**$3,109,900**	**31,600**	**$98.41**	**48,816**	**$63.71**
Phase 2					
Construction	$2,385,000	117,400	$20.32	188,162	$12.68
Equipment	$880,800	117,400	$7.50	188,162	$4.68

	Annualized Cost	Annual Inbound Tons	Annualized Cost per Inbound Ton	Annual Inbound CY	Annualized Cost per Inbound CY
Operating	$2,275,300	117,400	$19.38	188,162	$12.09
Total	**$5,541,100**	**117,400**	**$47.20**	**188,162**	**$29.45**
Maximum Throughput					
Construction	$2,385,000	170,000	$14.03	272,332	$8.76
Equipment	$1,284,700	170,000	$7.56	272,332	$4.72
Operating	$3,077,700	170,000	$18.10	272,332	$11.30
Total	**$6,747,400**	**170,000**	**$39.69**	**272,332**	**$24.78**

8.3 Impacts on Landfill Costs and Revenue

The useful life of the site is assumed to be 10 years because the City will eventually need to use the land for cell development. Implementing a composting program will reduce the amount of material disposed of in the Landfill and, correspondingly, the amount of airspace consumed. The City can either fill this airspace with additional revenue tons or preserve the airspace for additional Landfill life in the future. Over time the value of the preserved Landfill airspace space will continue to appreciate in value. In this analysis the value of additional revenue tons or future airspace value are not considered to provide a more conservative financial evaluation. Table 8-4 presents the impact of the composting program on landfill costs and revenues.

There is a direct financial benefit to the landfill operation through the reduction in tonnage, which is quantified through several costs, including cell development, cell development construction quality assurance (CQA), closure/post-closure, landfill grinding, and TCEQ fees. The City also benefits from the Composting Refund Program through the TCEQ. According to the TCEQ Guidelines for Participation[15] in the Compost Refund Program document, the refund received by the City will not exceed either of the following:

- All allowable equipment and operator expenses incurred as a direct result of composting operations; and
- 15 percent of the solid waste fees collected by the facility under Health and Safety Code § 361.0135(a), for the same fiscal year; or
- 20 percent of the solid waste fees collected by the facility under Health and Safety Code § 361.0135(a), for the same fiscal year if, in addition to composting the yard waste, the operator of the facility voluntarily bans the bans the disposal of yard waste at the facility.

The amount of revenue the City can receive from the Refund Program is capped by 15 percent of the $0.94 per ton disposal fee paid to the TCEQ at the Landfill. Additional revenue can be generated through the refund if the City implements the ban on yard waste disposal at the Landfill.

Reducing the annual tonnage disposed of at the Landfill decreases the City's annual revenue from landfill tipping fees until the preserved airspace is consumed in the future. This deferred revenue is calculated by

[15] TCEQ, "Guidelines for Participation in the Compost Refund Program", 2014, Guidelines for Participation in the Compost Refund Program

multiplying the $46.33 per ton tipping fee[16] (including environmental and processing fees) for cash customers at the Landfill by the number of inbound tons per year at the composting facility. The analysis considers two scenarios: in the first scenario (Full Internal Diversion), all inbound material at the composting facility is assumed to be existing material currently disposed of at the landfill; in the second scenario (50 Percent External), 50 percent of the inbound tonnage at the composting facility is not currently disposed of at the Landfill.

Future cell development costs are $14,521,629 and CQA costs are $755,982, with capacity for 8,450,000 tons. The annual cost reduction is calculated by multiplying the assumed inbound tonnage currently disposed at the Landfill by $1.72 for construction and $0.09 for CQA. The same methodology is applied to calculate the cost reduction for closure/post-closure and TCEQ fees. In FY 2025, the City's cost of capacity for closure/post-closure savings expressed per ton is $1.85. The TCEQ fee per ton is $0.94.

Table 8-4: Impacts on Landfill Costs and Revenues

	Phase 1	Phase 2	Maximum Throughput
Full Internal Diversion			
Cell Development	$(54,306)	$(201,756)	$(292,151)
Cell Development CQA	$(2,827)	$(10,503)	$(15,209)
Closure/Post-Closure	$(58,527)	$(217,440)	$(314,862)
Landfill Grinding	$-	$-	$-
TCEQ Fees	$(29,704)	$(110,356)	$(159,800)
Composting Refund	$(227,342)	$(215,245)	$(207,828)
Deferred Revenue	$1,464,028	$5,439,142	$7,876,100
Net Financial Impact to the Landfill	**$1,091,321**	**$4,683,842**	**$6,886,250**
Annualized Cost per Inbound Ton	**$34.54**	**$39.90**	**$40.51**
Annualized Cost per Inbound CY	**$22.36**	**$24.89**	**$25.29**
50 Percent External			
Cell Development	$(27,153)	$(100,878)	$(146,076)
Cell Development CQA	$(1,414)	$(5,252)	$(7,605)
Closure/Post-Closure	$(29,264)	$(108,720)	$(157,431)
Landfill Grinding	$-	$-	$-
TCEQ Fees	$(14,852)	$(55,178)	$(79,900)
Composting Refund	$(222,709)	$(216,660)	$(212,952)
Deferred Revenue	$732,014	$2,719,571	$3,938,050
Net Financial Impact to the Landfill	**$436,623**	**$2,232,883**	**$3,334,087**
Annualized Cost per Inbound Ton	**$13.82**	**$19.02**	**$19.61**
Annualized Cost per Inbound CY	**$8.94**	**$11.87**	**$12.24**

8.4 Composting Revenue and Break-Even Pricing

The analysis assumes that 50 percent of the green waste processed at the facility will become mulch as a final product. The volume of composted material is expected to be reduced by 40 percent from the

[16] The City charges a tipping fee of $44.33 per ton for contracted customers. However, the cash customer rate of $46.33 per ton is used for all revenue calculations. This assumption is made because a significant portion of the green waste disposed of at the landfill is brought in by landscapers who pay the cash customer rate. Using this rate for all diverted inbound tons provides a more conservative estimate of deferred revenue.

original inbound volume. The assumed pricing for bulk compost is $26.00 per CY, based on recently reviewed proposals by Burns & McDonnell for the sale of bulk compost. The assumed pricing for mulch is $18.00 per CY, informed by regional benchmarking of untreated or uncolored mulch. Discussions with City staff have indicated that markets are strong for these materials; therefore, all processed compost and 60 percent of the mulch is assumed to be sold at the stated pricing levels.

Break-even pricing is presented in Table 8-5 as the break-even cost per ton, including a 20 percent profit margin for the private operator for capital and operating expenditure. The break-even pricing or gate rates for the composting facility were calculated by finding the net cost of the direct composting operation and the sale of processed materials. The impact on landfill costs and revenues is intentionally excluded from the net cost of direct composting operations because these costs are not reflected in the cash flow of the composting operation. As stated in Section 8.3, revenue generated through tipping fees is expected to decrease if the City constructs the composting facility. The reduction in revenue is considered to be deferred, and over time, the value of the preserved airspace will continue to appreciate. The net revenue is then divided by the quantity and volume of material to calculate break-even pricing. The prices are provided on both a per ton and per CY basis to allow the City to determine whether weight- or volume-based screening is preferable. Break-even pricing does not consider any processing fees or taxes.

Table 8-5: Break-Even Pricing

	Phase 1	Phase 2	Maximum Throughput
Inbound Tonnage Composition			
Green Waste	18,500	82,800	119,620
Food Waste	13,100	34,600	50,380
Total Inbound Tons	**31,600**	**117,400**	**170,000**
Material Sales			
Outbound Compost Volume	19,604	69,546	100,771
Sale of Compost	$509,700	$1,808,206	$2,620,042
Outbound Mulch Volume	16,143	72,251	104,380
Sale of Mulch	$174,346	$780,314	$1,127,309
Total Sale of Processed Materials	**$684,046**	**$2,588,520**	**$3,747,351**
Annualized Costs			
Construction	$(1,199,300)	$(2,385,000)	$(2,385,000)
Equipment	$(522,600)	$(880,800)	$(1,284,700)
Operating	$(1,388,000)	$(2,275,300)	$(3,077,700)
Total Composting Costs	**$(3,109,900)**	**$(5,541,100)**	**$(6,747,400)**
Net Revenue for Recovery Through Gate Rates	**$(2,425,854)**	**$(2,952,580)**	**$(3,000,049)**
Break-Even Price per Inbound Ton	**$76.77**	**$25.15**	**$17.65**
Break-Even Price per Inbound CY	**$49.69**	**$15.69**	**$11.02**

The pricing in the table above represents the break-even price for each scenario, assuming many fixed variables. Actual conditions may vary year-to-year, so it is imperative that pricing remains conservative and considers the following factors. If the City proceeds with the RFP process for a private operator, pricing should be developed in collaboration with the operator based on their knowledge of regional markets and available feedstock. The price needs to be competitive with other regional facilities, but it should also consider the City's location advantage due to reduced hauling time. Additionally, the pricing should be equal to or less expensive than landfill disposal to encourage the use of the composting facility.

An additional sensitivity analysis was developed for the Phase 2 scenario, where the City sizes the facility for 117,400 tons of inbound material per year but does not receive enough tonnage to operate at full capacity. Assuming that annualized capital and operating costs are fixed and the City can charge a maximum gate rate for composting equal to the contractor customer gate rate at the Landfill ($44.33 per ton), the minimum breakeven tonnage was calculated to be 83,477 tons per year as summarized in Table 8-6. This analysis further illustrates the impact of tonnage throughput on average processing cost per ton and the potential benefit of having a private partner who can source additional feedstock for the facility.

Table 8-6: Minimum Breakeven Tonnage for Phase 2 Facility

	Fixed Equipment and Operating Costs
Price per Inbound Ton	$44.33
Inbound Tonnage Composition	
Green Waste	58,875
Food Waste	24,602
Minimum Breakeven Inbound Tonnage	**83,477**
Annualized Costs	
Construction	$(2,385,000)
Equipment	$(880,800)
Operating	$(2,275,300)
Total Composting Costs	**$(5,541,100)**
Material Sales	
Outbound Compost Volume	49,451
Sale of Compost	$1,285,719
Outbound Mulch Volume	51,374
Sale of Mulch	$554,840
Total Sale of Processed Materials	**$1,840,559**
Net Revenue for Recovery Through Gate Rates	**$(3,700,541)**
Break-Even Price per Inbound Ton	**$44.33**

8.5 Key Findings and Recommendations

This section provides key findings and recommendations for the financial evaluation described in the preceding sections.

1. The cost per ton of a composting facility generally decreases as tonnage increases. Feedstock may be sourced through a combination of City policies and programs and the efforts of a private operator.
2. Tipping fees for the composting facility can be competitive with the cost of landfill disposal, provided that the composting facility has enough incoming material. The lowest tonnage scenario (Phase 1) of 31,000 tons per year results in a break-even cost $76.77 per ton, while Phase 2 at 117,000 and the Maximum Tonnage at 170,000 tons per year result in costs per ton of $25.15 and $17.65, respectively.

3. Several variables, mainly inbound tonnage, may vary year-to-year at the composting facility. If the City proceeds with the RFP process for a private operator, pricing should be developed in collaboration with the operator based on their knowledge of regional markets and available feedstock. The price for disposal needs to be competitive with other regional facilities, but it should also consider the City's location advantage due to reduced hauling time. Additionally, the pricing must be less expensive than landfill disposal to encourage the use of the composting facility.
4. Diverting material away from the City’s Landfill has positive and negative short- and long-term financial benefits. In the short-term, material that is diverted from the Landfill means less revenue from landfill tipping fees. While less revenue is partially offset from deferred costs for landfill development, closure-post closure and TCEQ fees, there is a negative cash flow impact on the Landfill that increases as the tonnages grow. The City can either fill this airspace with additional revenue tons or preserve the airspace for additional Landfill life in the future. Over time the value of the preserved Landfill airspace space will continue to appreciate in value and the City should be able to recover the deferred revenue.
5. Implementing a composting refund should allow the City to receive a composting rebate from the TCEQ. The City should proceed with the composting refund process and clearly communicate that any revenue from the composting refund will accrue to the City and not a private operator.

9.0 Implementation Strategy and Timeline

In previous sections, Burns & McDonnell provided a detailed feasibility analysis for the development of a composting facility located at the Landfill property. Through this analysis, it was determined that a turned windrow composting facility located within the previously permitted area (Site B) would provide sufficient capacity to process projected tonnages generated through implementation of preferential pricing for commercial sector green waste and food waste and potential future development of a City-operated curbside green waste collection program. This section provides a discussion of key issues and implementation steps if the City decides to proceed with the project. Prior to project implementation, Burns & McDonnell recommends consulting with the City's legal counsel and purchasing staff to ensure compliance with state and local regulations.

9.1 Facility Development Options

There are various levels of involvement that the City and the private sector could have in the development of a composting facility at the Landfill. Prior to facility procurement, the City should determine its preferred level of involvement in the following key areas:

- Land ownership
- Capital investment
- Facility operations

Project responsibilities can be shared in multiple ways in a public private partnership as shown in Table 9-1.

Table 9-1: Options for Public Private Partnership

Project Responsibility	City Owned and Operated	City Owned with Private Operations	Privately Owned and Operated on City Land
Land Ownership	City	City	City
Capital Investment	City	City	Private
Facility Operation	City	Private	Private

9.1.1 Land Ownership

The proposed composting facility would be located on City-owned land at the Landfill property. The City will retain ownership of the land, which will ultimately be used for future development of landfill cells. It is anticipated that all or part of the proposed composting facility site will be required for landfill cell development in approximately 10 years, at which time the City may consider relocating all or parts of the composting operation to an onsite location within the Landfill property or to an offsite location. Any procurement of composting-related services with a private sector partner will need to clearly establish the City's continued ownership of the land and the timelines in which the composting facility will be permitted to operate. The composting facility could be owned by the City or by a private company under a site lease arrangement with the City, and it could be operated by the City or by a private company as further discussed below.

9.1.2 Capital Investment

The City could finance the capital investment in a composting facility or require a private partner to finance construction and recover their costs through operating fees over the lifespan of the facility. Public financing would typically be the lower cost option for financing a facility on City-owned land. The advantages of the City making the capital investment include:

- The City's cost of capital is likely lower than the private sector partner's cost of capital, thus lowering the overall cost of the facility.
- The City would not be required to earn a return on capital investment for the facility. Private companies typically earn a return on capital invested, thus increasing the cost to the City.
- Given the City's need to reclaim the site for Landfill operations, the private sector partner would need to recover their entire investment in facility capital within a 10-year timeframe, which will tend to further increase the private partner's operating fees.

If public funding is not available or otherwise not of interest to the City, the facility could be developed with private financing. Private financing may also be beneficial if there are any applicable tax credits or other incentives available to the private sector. Privately financed infrastructure and equipment may be publicly or privately owned depending on the terms established in the contract. The City could consider shared financing, whereby the City and the private company finance different aspects of the project. For example, with private operation it might be beneficial to have the private company make the capital investment in the processing equipment.

Design and construction of the facility may be undertaken by the City or by the private partner, with any required reimbursement for private partner design and construction services occurring through operating fees or through lump sum payments by the City upon the achievement of various project milestones. A Design-Build-Operate (DBO) procurement like the approach that was used to develop the City's material recovery facility (MRF) can potentially accelerate project development timelines by allowing design, construction, permitting, and operating services to be procured in a single step and implemented in parallel to the maximum possible extent. A DBO approach can provide a facility that is optimally designed for the feedstock materials and finished product market sectors targeted by the facility operator.

Under a public-private partnership that includes private ownership of a facility on City-owned land, contractual arrangements would need to provide for the transfer of ownership of stationary infrastructure to the City at the end of the operating contract.

9.1.3 Operation

A City composting facility could be publicly or privately operated. Burns & McDonnell recommends that the City consider private operation of the facility for the following reasons:

- Many private companies have extensive experience operating composting facilities in other communities. A private company can leverage this experience to the benefit of the City.
- Private operators have existing networks of customers for finished products and suppliers of process inputs, both of which would take time for the City to establish.
- Private operators have existing sources of feedstock that could be processed at the City's facility. Maximizing facility throughput by allowing the contractor to process third party tonnage spreads fixed capital and operating costs over more tonnage and minimizes per-ton processing costs to the City. This approach may be especially important if the City's program takes several years to ramp up to full capacity, or if the City needs sources of food waste to balance green waste collected through a City curbside collection program.
- Private operators can supply backup equipment from their other operations, if required.

- Private operators have more opportunity to beneficially use any undepreciated specialty equipment remaining at the end of the contract, such as windrow turners, grinders, and depackaging, bagging, or mulch-dyeing equipment, reducing lifecycle operating costs.

During a DBO procurement process, the City could request separate pricing for operation by the contractor and operation by the City and evaluate both options before making a final decision.

9.2 Procurement Options

This section discusses different approaches available for procuring a City composting facility. As discussed in Section 9.1.1, the facility would be located on City land at Landfill and could operate until approximately 2034 before some or all of the land is redeveloped as a future landfill cell.

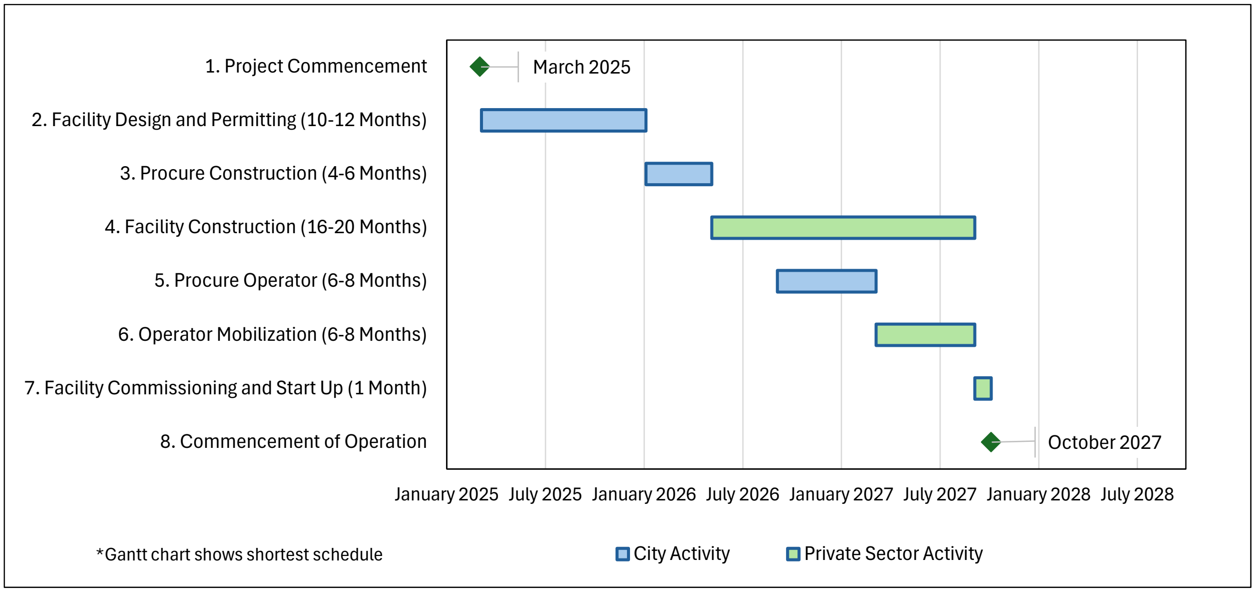
9.2.1 Traditional Project Delivery (Design-Bid-Build)

In traditional Design-Bid-Build (DBB), the City would procure a design firm that would complete the design of the composting facility prior to procuring a construction firm and site operator. The City would put the facility design out for construction bids and would separately procure an operator or coordinate for City operation. While there are some advantages to traditional project delivery, such as a high level of control for the City and institutional familiarity with the process, there are the following disadvantages:

- There is no collaboration between the design engineer and the construction contractor to address potential constructability issues or between the designer and the operating firm to address operating issues in the design phase.
- The project schedule is longer because design, construction and operation services are procured separately.
- The City is the ultimate manager of the entire process, from design to construction.

A sample project schedule for traditional project delivery is shown in Figure 9-1.

Figure 9-1: Traditional Project Delivery Sample Schedule



As shown in Figure 9-1, the estimated minimum time required for facility development under traditional project delivery is approximately 31 months.

9.2.2 Alternative Project Delivery (Design-Build-Operate)

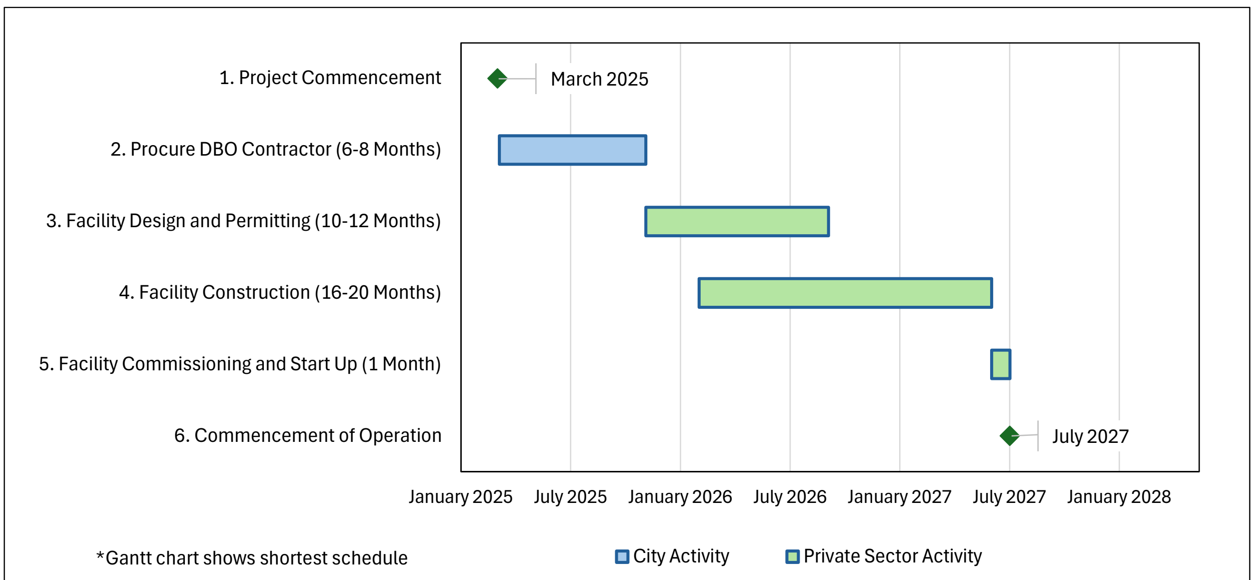
To save time and share project risks with private companies, many municipalities have transitioned to using alternative project delivery methods. While there are many different formats for alternative delivery, a DBO process would be a suitable approach for a new composting facility located at the Landfill.

In DBO, the City selects one firm or team of firms that will design, construct, and operate the composting facility. The DBO firm would be selected through an RFCSP. While there are some disadvantages to alternative project delivery, such as reduced control for the City and a cost on the part of the vendor community for preparation of a proposal (which can limit competition), there are the following advantages:

- There is a high degree of collaboration between the designer, construction contractor, and operator, as all are part of a single team.
- The contractor can consider design alternatives such as constructing an aerated static pile facility to increase throughput if they are able to contribute enough additional feedstock from external sources to justify the investment.
- The single city procurement process and parallel design, construction, and permitting by the contractor accelerate the overall project schedule.
- There is a single point of accountability for all aspects of the project.
- Management of the overall project shifts from the City to the DBO contractor.

A DBO process was used successfully by the City to design, construct and operate the MRF that is also located on the Landfill property. As discussed in Section 2.2.1, organic waste processors also expressed a preference for a DBO process with construction financing by the City during stakeholder engagement interviews. Based on these advantages, Burns & McDonnell recommends that the City consider DBO procurement if it decides to implement a composting facility at Landfill. A sample project schedule for DBO procurement is shown in Figure 9-2.

Figure 9-2: DBO Procurement Sample Schedule



As shown in Figure 9-2, the minimum time required for facility development under alternative project delivery is approximately 28 months, which is three months less than the time required for traditional project delivery. This reduction in project delivery time is an important consideration given the limited time that the composting facility can operate at full capacity before Landfill operations encroach on the composting facility footprint. Extending the composting facility's total useful life maximizes the City's opportunity to make a return on its investment in facility capital.

9.3 Stakeholder Engagement

Stakeholder communication should be integrated into project procurement and implementation to provide an open and transparent process that solicits stakeholder input as appropriate. Stakeholders include elected City officials (City Council), environmental and other interest groups, the South Dallas community, and the wider public community. These stakeholders will have different levels of interest and may require different levels of communication, as summarized below. The Project Team recommends developing a detailed stakeholder communication plan early in the procurement process.

9.3.1 City Council

City Council should be routinely advised of project activity and key findings, with an emphasis on schedules and decision-making steps to ensure the process moves forward in the right direction and at a suitable pace to meet City objectives. Communication with City Council should be as-needed as well as on a periodic basis, through briefings and in accordance with existing City practices.

9.3.2 Interest Groups

Environmental or other interest groups may have an interest in the City's plans to develop a composting facility. The City could interact with these groups through events and activities designed for the wider public as outlined in the following sections or it could consider conducting one-on-one meetings with these groups to obtain their feedback as needed.

9.3.3 Southeast Dallas

It will be particularly important for the City to proactively communicate and engage with Southeast Dallas residents if a composting facility is constructed at the Landfill. Burns & McDonnell recommends engaging with the neighborhood associations as early in the process as appropriate to inform them of the City's plans, solicit feedback, and inform residents about the benefits of this facility to the community. If a facility is to be constructed on the Landfill property, it may be beneficial for the City to rely on its internal Public Relations staff or engage the services of an outside public relations firm.

9.3.4 General Public

It will be beneficial for the City to conduct one or more public meetings to inform the public at-large about the project and answer any questions that they may have. The timing of these public meetings could be toward the end of the process to focus the meetings on any changes that may affect the public and to educate the public about the benefits of the project.

Since the TCEQ has already permitted a composting facility in the proposed location, the Project Team does not anticipate that formal public notice or public hearings will be required for permitting purposes for a potential new composting facility.

9.4 Key Findings and Recommendations

The following are Burns & McDonnell's key findings and recommendations regarding the implementation process for developing a composting facility on the Landfill property.

1. The proposed composting facility location lies within the ultimate footprint of Landfill development and is expected to be available for composting operations for approximately 10

years. If the City decides to implement a project, the procurement process should begin as early as possible to maximize the facility's useful life and the City's investment in capital.

2. The City should consider DBO facility procurement to accelerate development timelines and provide opportunities for optimal facility design through collaboration between the designer, constructor, and operator.
3. The City should take a non-prescriptive approach to technology requirements, allowing vendors maximum flexibility to optimize the facility to match their business and operational strategies.
4. Public financing of infrastructure can reduce costs by leveraging the City's lower borrowing costs and removing the need for the contractor to make a return on facility capital.
5. Allowing the contractor to process third party feedstock at the City's facility spreads facility capital costs over more tonnage and increases access to different types of feedstock to balance carbon, nitrogen, and moisture requirements.
6. Private facility operation allows the contractor to leverage their operating experience and existing equipment, customer and supplier networks to the benefit of the City.
7. Through a RFCSP, the City can request separate pricing for facility operation by the contractor and facility operation by the City and evaluate both options before making a final decision.
8. Stakeholder engagement with City Council, interest groups, the southeast Dallas community, and the general public should be integrated into project procurement and implementation to provide an open and transparent process that solicits stakeholder input as appropriate.

APPENDIX A – STAKEHOLDER INTERVIEWS

City of Dallas Organics Study

Stakeholder Engagement Letter and Interview Questions

Introduction:

The City of Dallas has retained Burns & McDonnell Engineering Company, Inc. to develop a comprehensive technical evaluation for siting a regional composting facility at the McCommas Bluff Landfill (5100 Youngblood Rd, Dallas, TX). As part of the evaluation, the City is engaging stakeholders to understand potential sources of organic waste, generation quantities, interest in organics diversion, and interest in a public private partnership for the operations of a facility.

Organics diversion in the City is currently provided by private haulers and processing facilities. The City is currently developing a program to support commercial organics recycling that will target special events and food service establishments. The City is in the process of procuring an organics collection and processing service to collect material from businesses and events on a pilot basis. The quality and quantity of organic material to be generated by this new City program during the initial years is currently unknown.

The City does not intend to collect or haul organic materials and will rely on private haulers for delivery of materials to the proposed compost facility. The City has identified three potential locations for the compost facility at McCommas Bluff Landfill with sizes ranging from 37 to 82 acres and will be evaluating the feasibility of each of these sites as well as various processing technologies. The City anticipates pursuing a public private partnership for facility operations only, or for facility operations and development.

Burns & McDonnell will be facilitating stakeholder interviews with generators, haulers, processors, and community partners to develop an understanding of the current system, challenges, opportunities, and service needs. We will be scheduling virtual interviews between January 2, 2024 and January 12, 2024 and we invite your organization to participate. Virtual interviews may be scheduled using the following link, or by contacting Emma Billings at (816) 448 – 7489 or embillings@burnsmcd.com.

https://www.signupgenius.com/go/10C0B4CAEA92EAAFCC52-46850163-city

If you cannot participate in a virtual interview, we also welcome submittal of written responses to the questions below to embillings@burnsmcd.com. Written responses must be received by January 19, 2024 to be included in the study. Your input is valuable, and we would like to hear from you.

The following is a list of the questions that we would like to discuss during the interviews. **All information provided by private companies will be aggregated prior to sharing with the City to protect the confidentiality of the respondents.**

Organics Material Processors

1. What level of interest in a public-private partnership would your company have in responding to an RFP issued by the City with multiple proposal options (e.g., operations only or operations and facility development)?

2. What would be your company's preferred approach to providing organics processing services to the City, including: use of an existing facility in the region; development of a new private facility; or development of a facility in partnership with the City at the McCommas Bluff Landfill?

3. Describe advantages and disadvantages for a city-owned and operated facility as compared to the City partnering with a private company.

4. What would be the optimal or preferred public-private partnership scenario for a facility at the McCommas Bluff Landfill?

5. The City wants to create an equitable arrangement and divert as much as possible. What would you propose as a financial arrangement that is win/win for both you and the City (specifically regarding additional material that is brought to the facility)?

6. Can your company commit feedstock to the facility? If yes, approximately how many tons (by material type) would you have?

7. The City is considering a variety of technologies. What is your experience and interest in each of these technologies:

    - Windrow
    - Aerated Static Pile
    - In Vessel

8. The City is considering a variety of feedstocks. What is your experience and interest in processing each of these feedstocks:

    - Brush and yard trimmings
    - Pre-consumer food waste
    - Post-consumer food waste
    - Wood waste
    - Fats, oil and grease (FOG)
    - Agricultural waste
    - Construction and demolition debris
    - Biosolids

9. Does the City need to guarantee feedstock? If so, what material types?

10. How reliant would the proposed compost facility need to be on City collection of residential yard waste? (The City does not have immediate plans for separation of yard waste at the curb).

11. Describe your approach to marketing compost.

12. What other ideas or recommendations would you like to share with the City?

Large Quantity Generators – Food Industry

1. What types of food waste or organic feedstock are generated at your facility?

2. What quantity of food waste or organic feedstock does your facility generate? From how many facilities?

3. Are you currently involved in any food waste diversion efforts and if so, what? (Feeding animals, composting, anaerobic digestion)

4. If you are currently diverting food or organic waste, how are you managing this program? Where is the material going? What are the costs?

5. If you are currently diverting food or organic waste, what materials are accepted by the processor? Do you generate materials that cannot be accepted? Please provide examples.

6. What is your interest in diverting food waste or other organic feedstocks for composting?

7. What are the barriers to diverting food waste?
   - Insufficient markets for finished compost
   - Regulatory constraints
   - Costs
   - Logistics from operations, collection, disposal

8. Has your company set sustainability or zero waste goals? If yes, please describe.

9. Is there anything else you want to discuss about food waste diversion?

Large Quantity Generators – Haulers

1. What types of food waste or organic feedstock are you currently collecting?

2. What quantity of food waste or organic feedstock do you collect for diversion?

3. What is your current service area and are you interested in expanding your service area?

4. Where are you hauling the material that you collect?

5. What are the costs per ton for disposal?

6. What is accepted in your current service? Do you have restrictions on packaging? Do your customers have a need for de-packaging?

7. If the City developed a compost facility with competitive tipping fees at McCommas Bluff Landfill would you deliver material there? If so, how much material do you anticipate delivering and what types?

8. Is there anything else you want to discuss about food waste diversion?

Community Partners – Wastewater Facilities

1. How are biosolids currently handled from your facility and what type of processing do they go through? (anaerobic digestion, belt press, lime treatment, lagoons, etc.)

2. What quantity of biosolids do you generate?

3. Do you have any interest in composting biosolids generated at your facilities?

4. Have you been approached by any other WWTP wanting to bring you their biosolids?

5. Have you been approached by any large quantity generators wanting to dispose of food waste or other organic feedstocks? If so, what types of feedstocks, quantities, and who were they?

6. Is there anything else you want to discuss about organics diversion?

Community Partners – Dallas Water Utilities, Public Works, Parks and Recreation, Aviation, Convention and Event Services.

1. What types of organic materials are generated by your department and what quantities?

2. How are you currently managing these organic materials? Where is the material going? What are the costs?

3. If there were a City compost facility at McCommas Bluff Landfill, would you have an interest in managing your organic material there?

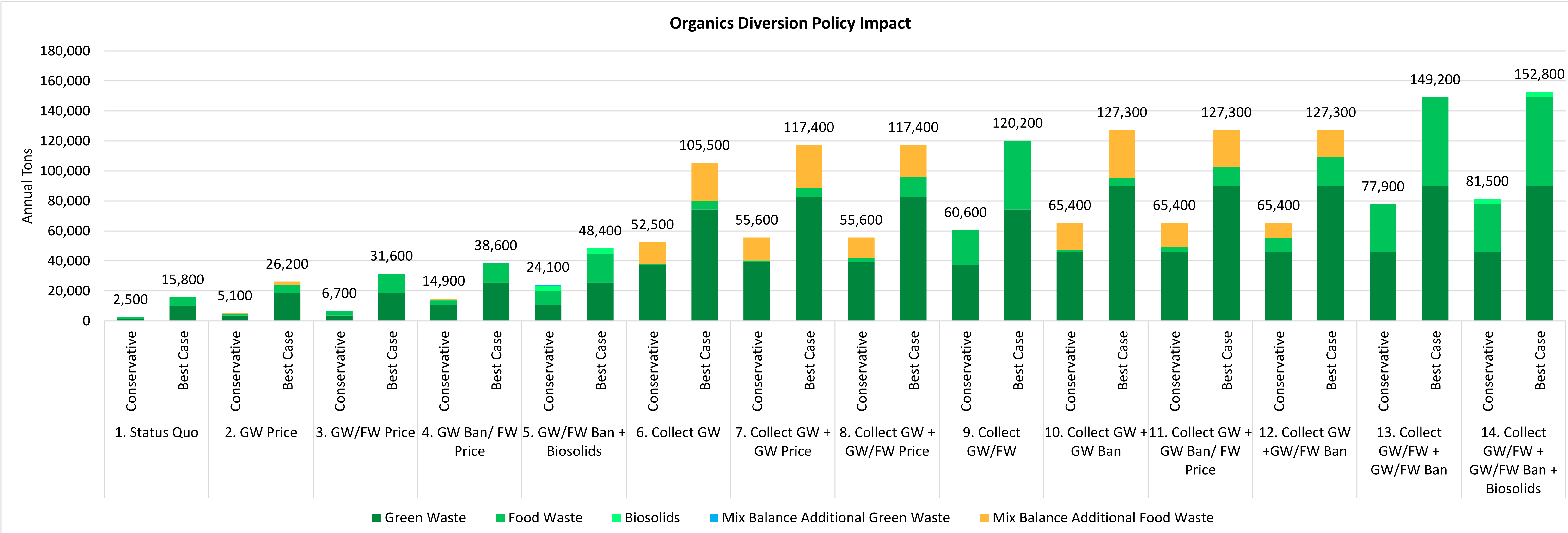
4. What are the benefits and/or challenges for your department in utilizing a proposed compost facility at McCommas Bluff Landfill?

5. Do you currently utilize any compost or similar in your operations such as fill dirt, soil stabilization, mulch, topsoil, etc.? if so, what quantities and at what costs?

6. Is there anything else you want to discuss about organics diversion?

7. Have you been approached by any large quantity generators wanting to dispose of food waste or other organic feedstocks? If so, what types of feedstocks, quantities, and who were they?

APPENDIX B – FEEDSTOCK CALCULATIONS



Scenario #	Scenario Name	Conservative							Best Case						
		Green Waste	Green Waste Composted	Food Waste	Biosolids	Mix Balance Additional Green Waste	Mix Balance Additional Food Waste	Total	Green Waste	Green Waste Composted	Food Waste	Biosolids	Mix Balance Additional Green Waste	Mix Balance Additional Food Waste	Total
1	Status Quo	1,400	700	1,100	0	0	0	2,500	10,100	5,050	5,700	0	0	0	15,800
2	GW Price	3,600	1,800	1,100	0	0	400	5,100	18,500	9,250	5,700	0	0	2,000	26,200
3	GW/FW Price	3,600	1,800	3,100	0	0	0	6,700	18,500	9,250	13,100	0	0	0	31,600
4	GW Ban/ FW Price	10,500	5,250	3,100	0	0	1,300	14,900	25,500	12,750	13,100	0	0	0	38,600
5	GW/FW Ban + Biosolids	10,500	5,250	9,300	3,600	700	0	24,100	25,500	12,750	19,300	3,600	0	0	48,400
6	Collect GW	37,000	18,500	1,100	0	0	14,400	52,500	74,400	37,200	5,700	0	0	25,400	105,500
7	Collect GW + GW Price	39,200	19,600	1,100	0	0	15,300	55,600	82,800	41,400	5,700	0	0	28,900	117,400
8	Collect GW + GW/FW Price	39,200	19,600	3,100	0	0	13,300	55,600	82,800	41,400	13,100	0	0	21,500	117,400
9	Collect GW/FW	37,000	18,500	23,600	0	0	0	60,600	74,400	37,200	45,800	0	0	0	120,200
10	Collect GW + GW Ban	46,100	23,050	1,100	0	0	18,200	65,400	89,800	44,900	5,700	0	0	31,800	127,300
11	Collect GW + GW Ban/ FW Price	46,100	23,050	3,100	0	0	16,200	65,400	89,800	44,900	13,100	0	0	24,400	127,300
12	Collect GW +GW/FW Ban	46,100	23,050	9,300	0	0	10,000	65,400	89,800	44,900	19,300	0	0	18,200	127,300
13	Collect GW/FW + GW/FW Ban	46,100	23,050	31,800	0	0	0	77,900	89,800	44,900	59,400	0	0	0	149,200
14	Collect GW/FW + GW/FW Ban + Biosolids	46,100	23,050	31,800	3,600	0	0	81,500	89,800	44,900	59,400	3,600	0	0	152,800

Phase 1 Tonnage Estimates (Conservative)

			Green Waste				Food Waste				Biosolids				
Material	Included?	Total 2023 Disposal (tons)	Green Waste Composition (%)	Green Waste Disposal (tons)	Capture Efficiency (%)	Organics Captured (tons)	Food Waste Composition (%)	Food Waste Disposal (tons)	Capture Efficiency (%)	Organics Captured (tons)	Biosolids Composition (%)	Biosolids Disposal	Capture Efficiency (%)	Organics Captured (tons)	Notes
City Collected															
Program Options			Separate Residential Brush Collectior			**No**	Separate Residential Food Waste Col			**No**	Include Sludge/Septage?			**No**	
Direct Haul, McCommas Bluff															
Mixed Bulk and Brush	Included	136,478	45.0%	61,415	1.0%	600	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Direct-haul only. Based on 2024 observations
Garbage, Compacted	Included	86,263	5.8%	4,969	1.0%	-	26.2%	22,627	1.0%	200	0.0%	-	0.0%	-	Direct-haul only. Based on 2020 Dallas waste characterization
Garbage, Uncompacted	Included	9,989	3.2%	320	1.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Direct-haul only. Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Untreated Septage	Not Included	2,147	0.0%	-	0.0%	-	0.0%	-	0.0%	-	100.0%	-	0.0%	-	Assumed composition
Green Materials	Included	140	75.0%	105	1.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Sludge	Not Included	16	0.0%	-	0.0%	-	0.0%	-	0.0%	-	100.0%	-	0.0%	-	Assumed composition
McCommas Bluff Subtotal		**235,034**		**66,809**		**600**		**22,627**		**200**		**-**		**-**	
Bachman Transfer Station															
Mixed Bulk and Brush	Included	50,530	45.0%	22,738	1.0%	200	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Garbage, Compacted	Included	37,351	5.8%	2,166	1.0%	-	26.2%	9,786	1.0%	100	0.0%	-	0.0%	-	Based on 2020 Dallas waste characterization
Garbage, Uncompacted	Included	11,857	3.2%	379	1.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Green Materials	Included	4,910	75.0%	3,683	1.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Bachman TS Subtotal		**104,648**		**28,967**		**200**		**9,786**		**100**		**-**		**-**	
Fair Oaks Transfer Station															
Garbage, Compacted	Included	60,280	5.8%	3,496	1.0%	-	26.2%	15,793	1.0%	200	0.0%	-	0.0%	-	Based on 2020 Dallas waste characterization
Mixed Bulk and Brush	Included	3,179	45.0%	1,430	1.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Garbage, Uncompacted	Included	2,848	3.2%	91	1.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Green Materials	Included	50	75.0%	37	1.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Fair Oaks TS Subtotal		**66,357**		**5,055**		**-**		**15,793**		**200**		**-**		**-**	
Westmoreland Transfer Station															
Garbage, Compacted	Included	48,484	5.8%	2,812	1.0%	-	26.2%	12,703	1.0%	100	0.0%	-	0.0%	-	Based on 2020 Dallas waste characterization
Garbage, Uncompacted	Included	5,081	3.2%	163	1.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Green Materials	Included	12	75.0%	9	1.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Mixed Bulk and Brush	Included	2	45.0%	1	1.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Westmoreland TS Subtotal		**53,579**		**2,984**		**-**		**12,703**		**100**		**-**		**-**	
City Collected Subtotal		**459,618**	**22.6%**	**103,815**		**800**		**60,909**		**600**		**-**		**-**	
Collected by Others															
Program Options			Brush Landfill Ban?		**No**		Food Waste Landfill Ban'		**No**		Include Biosolids?			**No**	
			Brush Preferential Pricing'		**Yes**		Food Waste Preferential		**Yes**						
Direct Haul, McCommas Bluff															
Garbage, Uncompacted	Included	451,085	3.2%	14,435	10.0%	1,400	0.0%	-	10.0%	-	0.0%	-	0.0%	-	Direct-haul only. Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Garbage, Compacted	Included	120,265	3.2%	3,848	10.0%	400	18.5%	22,249	10.0%	2,200	0.0%	-	0.0%	-	Direct-haul only. Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Mixed Bulk & Brush	Included	12,244	45.0%	5,510	10.0%	600	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Direct-haul only. Based on 2024 observations
48Forty Solutions (Pallets)	Included	1,630	100.0%	1,630	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Sludge	Not Included	1,219	0.0%	-	0.0%	-	0.0%	-	0.0%	-	100.0%	-	0.0%	-	Assumed composition
Green Materials	Included	10	75.0%	7	10.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Untreated Septage	Not Included	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	100.0%	-	0.0%	-	Assumed composition
McCommas Bluff Subtotal		**586,454**		**25,431**		**2,400**		**22,249**		**2,200**		**-**		**-**	
Bachman Transfer Station															
Garbage, Uncompacted	Included	38,341	3.2%	1,227	10.0%	100	0.0%	-	10.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Garbage, Compacted	Included	1,170	3.2%	37	10.0%	-	18.5%	216	10.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Mixed Bulk & Brush	Included	941	45.0%	424	10.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Green Materials	Included	2	75.0%	1	10.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Bachman TS Subtotal		**40,453**		**1,689**		**100**		**216**		**-**		**-**		**-**	
Fair Oaks Transfer Station															
Green Materials	Included	35	75.0%	26	10.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Garbage, Compacted	Included	8	3.2%	0	10.0%	-	18.5%	2	10.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Garbage, Uncompacted	Included	-	3.2%	-	10.0%	-	0.0%	-	10.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG

			Green Waste				Food Waste				Biosolids				
Material	**Included?**	**Total 2023 Disposal (tons)**	**Green Waste Composition (%)**	**Green Waste Disposal (tons)**	**Capture Efficiency (%)**	**Organics Captured (tons)**	**Food Waste Composition (%)**	**Food Waste Disposal (tons)**	**Capture Efficiency (%)**	**Organics Captured (tons)**	**Biosolids Composition (%)**	**Biosolids Disposal**	**Capture Efficiency (%)**	**Organics Captured (tons)**	**Notes**
Mixed Bulk & Brush	Included	-	45.0%	-	10.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Fair Oaks TS Subtotal		**43**		**27**		**-**		**2**		**-**		**-**		**-**	
Westmoreland Transfer Station															
Garbage, Compacted	Included	0	3.2%	0	10.0%	-	18.5%	0	10.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Green Materials	Included	-	75.0%	-	10.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Garbage, Uncompacted	Included	-	3.2%	-	10.0%	-	0.0%	-	10.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Mixed Bulk & Brush	Included	-	45.0%	-	10.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Westmoreland TS Subtotal		**0**		**0**		**-**		0		**-**		**-**		**-**	
Collected By Others Subtotal		**626,951**		**27,147**		**2,500**		**22,467**		**2,200**		**-**		**-**	
Combined Total (2023)		**1,086,569**		**130,962**		**3,300**		**83,376**		**2,800**		**-**		**-**	
Combined Total (2034)		**1,188,700**		**143,271**		**3,600**		**91,213**		**3,100**		**-**		**-**	

Phase 1 Tonnage Estimates (Best Case)

			Green Waste				Food Waste				Biosolids				
Material	Included?	Total 2023 Disposal (tons)	Green Waste Composition (%)	Green Waste Disposal (tons)	Capture Efficiency (%)	Organics Captured (tons)	Food Waste Composition (%)	Food Waste Disposal (tons)	Capture Efficiency (%)	Organics Captured (tons)	Biosolids Composition (%)	Biosolids Disposal	Capture Efficiency (%)	Organics Captured (tons)	Notes
City Collected															
Program Options			Separate Residential Brush Collection?			**No**	Separate Residential Food Waste Col			**No**	Include Biosolids?			**No**	
Direct Haul, McCommas Bluff															
Mixed Bulk and Brush	Included	136,478	45.0%	61,415	5.0%	3,100	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Direct-haul only. Based on 2024 observations
Garbage, Compacted	Included	86,263	5.8%	4,969	5.0%	200	26.2%	22,627	5.0%	1,100	0.0%	-	0.0%	-	Direct-haul only. Based on 2020 Dallas waste characterization
Garbage, Uncompacted	Included	9,989	3.2%	320	5.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Direct-haul only. Based on studies for San Antonio, El Paso, & NCTCOG
Untreated Septage	Not Included	2,147	0.0%	-	0.0%	-	0.0%	-	0.0%	-	100.0%	-	0.0%	-	Assumed composition
Green Materials	Included	140	75.0%	105	5.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Sludge	Not Included	16	0.0%	-	0.0%	-	0.0%	-	0.0%	-	100.0%	-	0.0%	-	Assumed composition
McCommas Bluff Subtotal		**235,034**		**66,809**		**3,300**		**22,627**		**1,100**		**-**		**-**	
Bachman Transfer Station															
Mixed Bulk and Brush	Included	50,530	45.0%	22,738	5.0%	1,100	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Garbage, Compacted	Included	37,351	5.8%	2,166	5.0%	100	26.2%	9,786	5.0%	500	0.0%	-	0.0%	-	Based on 2020 Dallas waste characterization
Garbage, Uncompacted	Included	11,857	3.2%	379	5.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Green Materials	Included	4,910	75.0%	3,683	5.0%	200	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Bachman TS Subtotal		**104,648**		**28,967**		**1,400**		**9,786**		**500**		**-**		**-**	
Fair Oaks Transfer Station															
Garbage, Compacted	Included	60,280	5.8%	3,496	5.0%	200	26.2%	15,793	5.0%	800	0.0%	-	0.0%	-	Based on 2020 Dallas waste characterization
Mixed Bulk and Brush	Included	3,179	45.0%	1,430	5.0%	100	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Garbage, Uncompacted	Included	2,848	3.2%	91	5.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Green Materials	Included	50	75.0%	37	5.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Fair Oaks TS Subtotal		**66,357**		**5,055**		**300**		**15,793**		**800**		**-**		**-**	
Westmoreland Transfer Station															
Garbage, Compacted	Included	48,484	5.8%	2,812	5.0%	100	26.2%	12,703	5.0%	600	0.0%	-	0.0%	-	Based on 2020 Dallas waste characterization
Garbage, Uncompacted	Included	5,081	3.2%	163	5.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Green Materials	Included	12	75.0%	9	5.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Mixed Bulk and Brush	Included	2	45.0%	1	5.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Westmoreland TS Subtotal		**53,579**		**2,984**		**100**		**12,703**		**600**		**-**		**-**	
City Collected Subtotal		**459,618**	**22.6%**	**103,815**		**5,100**		**60,909**		**3,000**		**-**		**-**	
Collected by Others															
Program Options			Brush Landfill Ban? Brush Preferential Pricing?		**No** **Yes**		Food Waste Landfill Ban? Food Waste Preferential F		**No** **Yes**		Include Biosolids?			**No**	
Direct Haul, McCommas Bluff															
Garbage, Uncompacted	Included	451,085	3.2%	14,435	40.0%	5,800	0.0%	-	40.0%	-	0.0%	-	0.0%	-	Direct-haul only. Based on studies for San Antonio, El Paso, & NCTCOG
Garbage, Compacted	Included	120,265	3.2%	3,848	40.0%	1,500	18.5%	22,249	40.0%	8,900	0.0%	-	0.0%	-	Direct-haul only. Based on studies for San Antonio, El Paso, & NCTCOG
Mixed Bulk & Brush	Included	12,244	45.0%	5,510	40.0%	2,200	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Direct-haul only. Based on 2024 observations
48Forty Solutions (Pallets)	Included	1,630	100.0%	1,630	100.0%	1,600	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Sludge	Not Included	1,219	0.0%	-	0.0%	-	0.0%	-	0.0%	-	100.0%	-	0.0%	-	Assumed composition
Green Materials	Included	10	75.0%	7	40.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Untreated Septage	Not Included	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	100.0%	-	0.0%	-	Assumed composition
McCommas Bluff Subtotal		**586,454**		**25,431**		**11,100**		**22,249**		**8,900**		**-**		**-**	
Bachman Transfer Station															
Garbage, Uncompacted	Included	38,341	3.2%	1,227	40.0%	500	0.0%	-	40.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Garbage, Compacted	Included	1,170	3.2%	37	40.0%	-	18.5%	216	40.0%	100	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Mixed Bulk & Brush	Included	941	45.0%	424	40.0%	200	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Green Materials	Included	2	75.0%	1	40.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Bachman TS Subtotal		**40,453**		**1,689**		**700**		**216**		**100**		**-**		**-**	
Fair Oaks Transfer Station															
Green Materials	Included	35	75.0%	26	40.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition

			Green Waste				**Food Waste**				**Biosolids**				
Material	**Included?**	**Total 2023 Disposal (tons)**	**Green Waste Composition (%)**	**Green Waste Disposal (tons)**	**Capture Efficiency (%)**	**Organics Captured (tons)**	**Food Waste Composition (%)**	**Food Waste Disposal (tons)**	**Capture Efficiency (%)**	**Organics Captured (tons)**	**Biosolids Composition (%)**	**Biosolids Disposal**	**Capture Efficiency (%)**	**Organics Captured (tons)**	**Notes**
Garbage, Compacted	Included	8	3.2%	0	40.0%	-	18.5%	2	40.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Garbage, Uncompacted	Included	-	3.2%	-	40.0%	-	0.0%	-	40.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Mixed Bulk & Brush	Included	-	45.0%	-	40.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Fair Oaks TS Subtotal		**43**		**27**		**-**		**2**		**-**		**-**		**-**	
Westmoreland Transfer Station															
Garbage, Compacted	Included	0	3.2%	0	40.0%	-	18.5%	0	40.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Green Materials	Included	-	75.0%	-	40.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Garbage, Uncompacted	Included	-	3.2%	-	40.0%	-	0.0%	-	40.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Mixed Bulk & Brush	Included	-	45.0%	-	40.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Westmoreland TS Subtotal		**0**		**0**		**-**		0		**-**		**-**		**-**	
Collected By Others Subtotal		**626,951**		**27,147**		**11,800**		**22,467**		**9,000**		**-**		**-**	
Combined Total (2023)		**1,086,569**		**130,962**		**16,900**		**83,376**		**12,000**		**-**		**-**	
Combined Total (2034)		**1,188,700**		**143,300**		**18,500**		**91,200**		**13,100**		**-**		**-**	

Phase 2 Tonnage Estimates (Conservative)

			Green Waste				Food Waste				Biosolids				
Material	Included?	Total 2023 Disposal (tons)	Green Waste Composition (%)	Green Waste Disposal (tons)	Capture Efficiency (%)	Organics Captured (tons)	Food Waste Composition (%)	Food Waste Disposal (tons)	Capture Efficiency (%)	Organics Captured (tons)	Biosolids Composition (%)	Biosolids Disposal	Capture Efficiency (%)	Organics Captured (tons)	Notes
City Collected															
Program Options			Separate Residential Brush Collectior			**Yes**	Separate Residential Food Waste Col			**No**	Include Sludge/Septage?			**No**	
Direct Haul, McCommas Bluff															
Mixed Bulk and Brush	Included	136,478	45.0%	61,415	35.0%	21,500	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Direct-haul only. Based on 2024 observations
Garbage, Compacted	Included	86,263	5.8%	4,969	15.0%	700	26.2%	22,627	1.0%	200	0.0%	-	0.0%	-	Direct-haul only. Based on 2020 Dallas waste characterization
Garbage, Uncompacted	Included	9,989	3.2%	320	15.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Direct-haul only. Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Untreated Septage	Not Included	2,147	0.0%	-	0.0%	-	0.0%	-	0.0%	-	100.0%	-	0.0%	-	Assumed composition
Green Materials	Included	140	75.0%	105	35.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Sludge	Not Included	16	0.0%	-	0.0%	-	0.0%	-	0.0%	-	100.0%	-	0.0%	-	Assumed composition
McCommas Bluff Subtotal		**235,034**		**66,809**		**22,200**		**22,627**		**200**		**-**		**-**	
Bachman Transfer Station															
Mixed Bulk and Brush	Included	50,530	45.0%	22,738	35.0%	8,000	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Garbage, Compacted	Included	37,351	5.8%	2,166	15.0%	300	26.2%	9,786	1.0%	100	0.0%	-	0.0%	-	Based on 2020 Dallas waste characterization
Garbage, Uncompacted	Included	11,857	3.2%	379	15.0%	100	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Green Materials	Included	4,910	75.0%	3,683	35.0%	1,300	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Bachman TS Subtotal		**104,648**		**28,967**		**9,700**		**9,786**		**100**		**-**		**-**	
Fair Oaks Transfer Station															
Garbage, Compacted	Included	60,280	5.8%	3,496	15.0%	500	26.2%	15,793	1.0%	200	0.0%	-	0.0%	-	Based on 2020 Dallas waste characterization
Mixed Bulk and Brush	Included	3,179	45.0%	1,430	35.0%	500	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Garbage, Uncompacted	Included	2,848	3.2%	91	15.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Green Materials	Included	50	75.0%	37	35.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Fair Oaks TS Subtotal		**66,357**		**5,055**		**1,000**		**15,793**		**200**		**-**		**-**	
Westmoreland Transfer Station															
Garbage, Compacted	Included	48,484	5.8%	2,812	15.0%	400	26.2%	12,703	1.0%	100	0.0%	-	0.0%	-	Based on 2020 Dallas waste characterization
Garbage, Uncompacted	Included	5,081	3.2%	163	15.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Green Materials	Included	12	75.0%	9	35.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Mixed Bulk and Brush	Included	2	45.0%	1	35.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Westmoreland TS Subtotal		**53,579**		**2,984**		**400**		**12,703**		**100**		**-**		**-**	
City Collected Subtotal		**459,618**	**22.6%**	**103,815**		**33,300**		**60,909**		**600**		**-**		**-**	
Collected by Others															
Program Options			Brush Landfill Ban?		**No**		Food Waste Landfill Ban'		**No**		Include Biosolids?			**No**	
			Brush Preferential Pricing'		**Yes**		Food Waste Preferential		**Yes**						
Direct Haul, McCommas Bluff															
Garbage, Uncompacted	Included	451,085	3.2%	14,435	10.0%	1,400	0.0%	-	10.0%	-	0.0%	-	0.0%	-	Direct-haul only. Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Garbage, Compacted	Included	120,265	3.2%	3,848	10.0%	400	18.5%	22,249	10.0%	2,200	0.0%	-	0.0%	-	Direct-haul only. Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Mixed Bulk & Brush	Included	12,244	45.0%	5,510	10.0%	600	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Direct-haul only. Based on 2024 observations
48Forty Solutions (Pallets)	Included	1,630	100.0%	1,630	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Sludge	Not Included	1,219	0.0%	-	0.0%	-	0.0%	-	0.0%	-	100.0%	-	0.0%	-	Assumed composition
Green Materials	Included	10	75.0%	7	10.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Untreated Septage	Not Included	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	100.0%	-	0.0%	-	Assumed composition
McCommas Bluff Subtotal		**586,454**		**25,431**		**2,400**		**22,249**		**2,200**		**-**		**-**	
Bachman Transfer Station															
Garbage, Uncompacted	Included	38,341	3.2%	1,227	10.0%	100	0.0%	-	10.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Garbage, Compacted	Included	1,170	3.2%	37	10.0%	-	18.5%	216	10.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Mixed Bulk & Brush	Included	941	45.0%	424	10.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Green Materials	Included	2	75.0%	1	10.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Bachman TS Subtotal		**40,453**		**1,689**		**100**		**216**		**-**		**-**		**-**	
Fair Oaks Transfer Station															
Green Materials	Included	35	75.0%	26	10.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Garbage, Compacted	Included	8	3.2%	0	10.0%	-	18.5%	2	10.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Garbage, Uncompacted	Included	-	3.2%	-	10.0%	-	0.0%	-	10.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG

			Green Waste				Food Waste				Biosolids				
Material	Included?	Total 2023 Disposal (tons)	Green Waste Composition (%)	Green Waste Disposal (tons)	Capture Efficiency (%)	Organics Captured (tons)	Food Waste Composition (%)	Food Waste Disposal (tons)	Capture Efficiency (%)	Organics Captured (tons)	Biosolids Composition (%)	Biosolids Disposal	Capture Efficiency (%)	Organics Captured (tons)	Notes
Mixed Bulk & Brush	Included	-	45.0%	-	10.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Fair Oaks TS Subtotal		**43**		**27**		**-**		**2**		**-**		**-**		**-**	
Westmoreland Transfer Station															
Garbage, Compacted	Included	0	3.2%	0	10.0%	-	18.5%	0	10.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Green Materials	Included	-	75.0%	-	10.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Garbage, Uncompacted	Included	-	3.2%	-	10.0%	-	0.0%	-	10.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Mixed Bulk & Brush	Included	-	45.0%	-	10.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Westmoreland TS Subtotal		**0**		**0**		**-**		0		**-**		**-**		**-**	
Collected By Others Subtotal		**626,951**		**27,147**		**2,500**		**22,467**		**2,200**		**-**		**-**	
Combined Total (2023)		**1,086,569**		**130,962**		**35,800**		**83,376**		**2,800**		**-**		**-**	
Combined Total (2034)		**1,188,700**		**143,271**		**39,200**		**91,213**		**3,100**		**-**		**-**	

Phase 2 Tonnage Estimates (Best Case)

			Green Waste				Food Waste				Biosolids				
Material	Included?	Total 2023 Disposal (tons)	Green Waste Composition (%)	Green Waste Disposal (tons)	Capture Efficiency (%)	Organics Captured (tons)	Food Waste Composition (%)	Food Waste Disposal (tons)	Capture Efficiency (%)	Organics Captured (tons)	Biosolids Composition (%)	Biosolids Disposal	Capture Efficiency (%)	Organics Captured (tons)	Notes
City Collected															
Program Options			Separate Residential Brush Collection?			**Yes**	Separate Residential Food Waste Col			**No**	Include Biosolids?			**No**	
Direct Haul, McCommas Bluff															
Mixed Bulk and Brush	Included	136,478	45.0%	61,415	65.0%	39,900	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Direct-haul only. Based on 2024 observations
Garbage, Compacted	Included	86,263	5.8%	4,969	40.0%	2,000	26.2%	22,627	5.0%	1,100	0.0%	-	0.0%	-	Direct-haul only. Based on 2020 Dallas waste characterization
Garbage, Uncompacted	Included	9,989	3.2%	320	40.0%	100	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Direct-haul only. Based on studies for San Antonio, El Paso, & NCTCOG
Untreated Septage	Not Included	2,147	0.0%	-	0.0%	-	0.0%	-	0.0%	-	100.0%	-	0.0%	-	Assumed composition
Green Materials	Included	140	75.0%	105	65.0%	100	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Sludge	Not Included	16	0.0%	-	0.0%	-	0.0%	-	0.0%	-	100.0%	-	0.0%	-	Assumed composition
McCommas Bluff Subtotal		**235,034**		**66,809**		**42,100**		**22,627**		**1,100**		**-**		**-**	
Bachman Transfer Station															
Mixed Bulk and Brush	Included	50,530	45.0%	22,738	65.0%	14,800	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Garbage, Compacted	Included	37,351	5.8%	2,166	40.0%	900	26.2%	9,786	5.0%	500	0.0%	-	0.0%	-	Based on 2020 Dallas waste characterization
Garbage, Uncompacted	Included	11,857	3.2%	379	40.0%	200	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Green Materials	Included	4,910	75.0%	3,683	65.0%	2,400	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Bachman TS Subtotal		**104,648**		**28,967**		**18,300**		**9,786**		**500**		**-**		**-**	
Fair Oaks Transfer Station															
Garbage, Compacted	Included	60,280	5.8%	3,496	40.0%	1,400	26.2%	15,793	5.0%	800	0.0%	-	0.0%	-	Based on 2020 Dallas waste characterization
Mixed Bulk and Brush	Included	3,179	45.0%	1,430	65.0%	900	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Garbage, Uncompacted	Included	2,848	3.2%	91	40.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Green Materials	Included	50	75.0%	37	65.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Fair Oaks TS Subtotal		**66,357**		**5,055**		**2,300**		**15,793**		**800**		**-**		**-**	
Westmoreland Transfer Station															
Garbage, Compacted	Included	48,484	5.8%	2,812	40.0%	1,100	26.2%	12,703	5.0%	600	0.0%	-	0.0%	-	Based on 2020 Dallas waste characterization
Garbage, Uncompacted	Included	5,081	3.2%	163	40.0%	100	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Green Materials	Included	12	75.0%	9	65.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Mixed Bulk and Brush	Included	2	45.0%	1	65.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Westmoreland TS Subtotal		**53,579**		**2,984**		**1,200**		**12,703**		**600**		**-**		**-**	
City Collected Subtotal		**459,618**	**22.6%**	**103,815**		**63,900**		**60,909**		**3,000**		**-**		**-**	
Collected by Others															
Program Options			Brush Landfill Ban?		**No**		Food Waste Landfill Ban?		**No**		Include Biosolids?			**No**	
			Brush Preferential Pricing?		**Yes**		Food Waste Preferential F		**Yes**						
Direct Haul, McCommas Bluff															
Garbage, Uncompacted	Included	451,085	3.2%	14,435	40.0%	5,800	0.0%	-	40.0%	-	0.0%	-	0.0%	-	Direct-haul only. Based on studies for San Antonio, El Paso, & NCTCOG
Garbage, Compacted	Included	120,265	3.2%	3,848	40.0%	1,500	18.5%	22,249	40.0%	8,900	0.0%	-	0.0%	-	Direct-haul only. Based on studies for San Antonio, El Paso, & NCTCOG
Mixed Bulk & Brush	Included	12,244	45.0%	5,510	40.0%	2,200	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Direct-haul only. Based on 2024 observations
48Forty Solutions (Pallets)	Included	1,630	100.0%	1,630	100.0%	1,600	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Sludge	Not Included	1,219	0.0%	-	0.0%	-	0.0%	-	0.0%	-	100.0%	-	0.0%	-	Assumed composition
Green Materials	Included	10	75.0%	7	40.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Untreated Septage	Not Included	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	100.0%	-	0.0%	-	Assumed composition
McCommas Bluff Subtotal		**586,454**		**25,431**		**11,100**		**22,249**		**8,900**		**-**		**-**	
Bachman Transfer Station															
Garbage, Uncompacted	Included	38,341	3.2%	1,227	40.0%	500	0.0%	-	40.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Garbage, Compacted	Included	1,170	3.2%	37	40.0%	-	18.5%	216	40.0%	100	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Mixed Bulk & Brush	Included	941	45.0%	424	40.0%	200	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Green Materials	Included	2	75.0%	1	40.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Bachman TS Subtotal		**40,453**		**1,689**		**700**		**216**		**100**		**-**		**-**	
Fair Oaks Transfer Station															
Green Materials	Included	35	75.0%	26	40.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition

			Green Waste				Food Waste				Biosolids				
Material	**Included?**	**Total 2023 Disposal (tons)**	**Green Waste Composition (%)**	**Green Waste Disposal (tons)**	**Capture Efficiency (%)**	**Organics Captured (tons)**	**Food Waste Composition (%)**	**Food Waste Disposal (tons)**	**Capture Efficiency (%)**	**Organics Captured (tons)**	**Biosolids Composition (%)**	**Biosolids Disposal**	**Capture Efficiency (%)**	**Organics Captured (tons)**	**Notes**
Garbage, Compacted	Included	8	3.2%	0	40.0%	-	18.5%	2	40.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Garbage, Uncompacted	Included	-	3.2%	-	40.0%	-	0.0%	-	40.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Mixed Bulk & Brush	Included	-	45.0%	-	40.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Fair Oaks TS Subtotal		**43**		**27**		**-**		**2**		**-**		**-**		**-**	
Westmoreland Transfer Station															
Garbage, Compacted	Included	0	3.2%	0	40.0%	-	18.5%	0	40.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Green Materials	Included	-	75.0%	-	40.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Assumed composition
Garbage, Uncompacted	Included	-	3.2%	-	40.0%	-	0.0%	-	40.0%	-	0.0%	-	0.0%	-	Based on non-city tonnage studies for San Antonio, El Paso, & NCTCOG
Mixed Bulk & Brush	Included	-	45.0%	-	40.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%	-	Based on 2024 observations
Westmoreland TS Subtotal		**0**		**0**		**-**		0		**-**		**-**		**-**	
Collected By Others Subtotal		**626,951**		**27,147**		**11,800**		**22,467**		**9,000**		**-**		**-**	
Combined Total (2023)		**1,086,569**		**130,962**		**75,700**		**83,376**		**12,000**		**-**		**-**	
Combined Total (2034)		**1,188,700**		**143,300**		**82,800**		**91,200**		**13,100**		**-**		**-**	

Feedstock Calculation Inputs

Growth Assumptions

Annual Tonnage Growth	0.82%	Ten-year population growth rate per NCTCOG (2013-2023)
Future Growth Allowance Period	11 years	Adjust from 2023 to 2034 (Landfill reaches compost facility)

Assumed Aggregate Feedstock Properties

Material	Solids Content	Moisture Content	Carbon (dry)	Nitrogen (dry)
Green Waste	85.0%	15.0%	50.0%	1.0%
Food Waste	31.0%	69.0%	34.8%	2.4%
Biosolids	16.0%	84.0%	30.0%	5.0%

C:N Ratio Assumptions[1]

Minimum C:N Ratio	25
Maximum C:N Ratio	35

1. Minimum and maximum C:N are for preliminary analysis purposes only.
   Acceptable C:N range 20-60:1, Ideal 25-40:1

Green Waste Percent Composted 50.0%

APPENDIX C – FINANCIAL EVALUATION

	Phase 1	Phase 2	Maximum Throughput
Annual Inbound Tonnage	31,600	117,400	170,000
Annual Inbound Volume (CY)	48,816	188,162	272,332
Annual Outbound Compost (CY)	19,604	69,546	100,771
Annual Outbound Mulch (CY)	16,143	72,251	104,380
Annualized Costs			
Facility Construction	$ (1,199,300)	$ (2,385,000)	$ (2,385,000)
Equipment	$ (522,600)	$ (880,800)	$ (1,284,700)
Operations	$ (1,388,000)	$ (2,275,300)	$ (3,077,700)
Total	**$ (3,109,900)**	**$ (5,541,100)**	**$ (6,747,400)**
Annual Revenue			
Compost Price per CY	$ 26.00	$ 26.00	$ 26.00
Sale of Compost Material	**$ 509,700**	**$ 1,808,206**	**$ 2,620,042**
Mulch Price per CY	$ 18.00	$ 18.00	$ 18.00
Sale of Mulch	**$ 174,346**	**$ 780,314**	**$ 1,127,309**
Net Revenue for Recovery Through Gate Rates	$ (2,425,854)	$ (2,952,580)	$ (3,000,049)
Cost per Inbound Ton	**$ (76.77)**	**$ (25.15)**	**$ (17.65)**
Cost per Inbound CY	**$ (49.69)**	**$ (15.69)**	**$ (11.02)**
Net Impact to Landfill	$ (1,091,321)	$ (4,683,842)	$ (6,886,250)
Net Impact to Landfill (50% of Inbound Tons are External)	$ (436,623)	$ (2,232,883)	$ (3,334,087)

Date	3/27/2025
Estimate Basis	Construction of Composting Facility at Site B ("The Elbow")
Scenario	Phase 1

Assumptions	
Current Year	FY 2025
Inbound Processing Tonnage	31,600
Inbound Processing CY	48,816
Green Waste Designated for Mulch	50%
Processing Volume Reduction	40%
Landfill Gate Rate, Environmental Fee, and Processing Fee	$46.33
Site Life	10 Years
Benefits Percentage	31%
City Interest Rate	5%
Private Interest Rate	6%
Maintenance (% of CAPEX)	15%
Administration (% of OPEX)	5%
Operator Margin (profit, taxes, and depreciation)	20%
Composting Refund Percentage of Landfill Revenue	15%
Bulk Compost Price per CY	$26.00
Percent of Compost Sold	100%
Bulk Mulch Price per CY	$18.00
Percent of Mulch Sold	60%

Composting Facility
Capital Cost Estimate

Facility Construction	Funding Source	Count	Units	Useful Life	Unit Price	Total Price	Adjusted Price (Operator Margin)	Annualized Cost
GENERAL CONDITIONS	Private	15	MO	10 Years	$ 61,040	$ 915,600	$ 1,098,800	$ 149,300
EROSION CONTROL	Private	1	LS	10 Years	$ 86,300	$ 86,300	$ 103,600	$ 14,100
REMOVALS	Private	0.18	LS	10 Years	$ 1,040,700	$ 186,548	$ 223,900	$ 30,500
EARTHWORK	Private	0.18	LS	10 Years	$ 6,255,900	$ 1,121,386	$ 1,345,700	$ 182,900
AGGREGATES	Private	0.18	LS	10 Years	$ 88,700	$ 15,900	$ 19,100	$ 2,600
CONCRETE PAVING/CRUSHING STATION	Private	1	LS	10 Years	$ 66,770	$ 66,770	$ 80,200	$ 10,900
BOLLARDS & SIGNAGE	Private	1	LS	10 Years	$ 29,020	$ 29,020	$ 34,900	$ 4,800
SANITARY SEWER FOR BLDG	Private	1	LS	10 Years	$ 117,100	$ 117,100	$ 140,600	$ 19,200
WATER LINE TO BLDG AND FIRE LINE	Private	1	LS	10 Years	$ 272,100	$ 272,100	$ 326,600	$ 44,400
FENCING	Private	1	LS	10 Years	$ 424,395	$ 424,395	$ 509,300	$ 69,200
METAL BUILDING	Private	5000	SF	10 Years	$ 283	$ 1,416,000	$ 1,699,200	$ 230,900
LANDSCAPING	Private	1	LS	10 Years	$ 120,800	$ 120,800	$ 145,000	$ 19,800
Subtotal						**$ 4,771,919**	**$ 5,726,900**	**$ 778,600**
Project Contingency (20%)	Private	1	LS	10 Years	$ 954,384	$ 954,384	$ 1,145,300	$ 155,700
Permits & Design (15%)	Private	1	LS	10 Years	$ 1,625,000	$ 1,625,000	$ 1,950,000	$ 265,000
Subtotal						**$ 2,579,384**	**$ 3,095,300**	**$ 420,700**
Total with Contingency, Permits & Design						**$ 7,351,303**	**$ 8,822,200**	**$ 1,199,300**

Facility Equipment	Funding Source	Count	Units	Useful Life	Unit Price	Total Price	Adjusted Price (Operator Margin)	Annualized Cost
Load Volume Scanning	Private	1	LS	15 Years	$ 70,000	$ 70,000	$ 84,000	$ 8,700
Front-End Loader	Private	1	LS	7 Years	$ 250,000	$ 250,000	$ 300,000	$ 53,800
Excavator	Private	1	LS	25 Years	$ 340,000	$ 340,000	$ 408,000	$ 32,100
Grinder	Private	1	LS	10 Years	$ 1,400,000	$ 1,400,000	$ 1,680,000	$ 228,300
Windrow Turner	Private	1	LS	26 Years	$ 750,000	$ 750,000	$ 900,000	$ 69,500
Water Tanker	Private	1	LS	10 Years	$ 270,000	$ 270,000	$ 324,000	$ 44,100
Monitoring	Private	1	LS	2 Years	$ 12,000	$ 12,000	$ 14,400	$ 7,900
Screen	Private	1	LS	21 Years	$ 770,000	$ 770,000	$ 924,000	$ 78,200
Total						**$ 3,862,000**	**$ 4,634,400**	**$ 522,600**

Operating Cost Estimate

Facility Equipment	Operator	Annual Operating Hours	Labor	Fuel	Maintenance	Administration	Operator Margin	Annualized Cost
Load Volume Scanning	Private	2,080	$ 185,000	$ -	$ 10,500	$ 9,800	$ 41,100	$ 246,400
Front-End Loader	Private	1,430	$ 127,100	$ 19,700	$ 37,500	$ 9,300	$ 38,800	$ 232,400
Excavator	Private	405	$ 36,000	$ 4,300	$ 51,000	$ 4,600	$ 19,200	$ 115,100
Grinder	Private	420	$ 37,300	$ 14,200	$ 210,000	$ 13,100	$ 55,000	$ 329,600
Windrow Turner	Private	155	$ 13,800	$ 4,800	$ 112,500	$ 6,600	$ 27,600	$ 165,300
Water Tanker	Private	135	$ 12,000	$ 3,100	$ 40,500	$ 2,800	$ 11,700	$ 70,100
Monitoring	Private	520	$ 46,200	$ -	$ 2,200	$ 2,500	$ 10,200	$ 61,100
Screen	Private	165	$ 14,700	$ 3,100	$ 115,500	$ 6,700	$ 28,000	$ 168,000
Total		**5,310**	**$ 472,100**	**$ 49,200**	**$ 579,700**	**$ 55,400**	**$ 231,600**	**$ 1,388,000**

Cost Component	Total	Annualized Cost	Annualized Cost per Inbound Ton	Annualized Cost per Inbound CY
Facility Construction Cost	$ 8,822,200	$ 1,199,300	$ 37.95	$ 24.57
Equipment Capital Cost	$ 4,634,400	$ 522,600	$ 16.54	$ 10.71
Operating Cost	$ 13,880,000	$ 1,388,000	$ 43.92	$ 28.43
Total	**$ 27,336,600**	**$ 3,109,900**	**$ 98.41**	**$ 63.71**

Landfill Cost Reduction for Composting Tonnage	Total	Annualized Cost	Annualized Cost per Inbound Ton	Annualized Cost per Inbound CY
Cell Development	$ (543,057)	$ (54,306)	$ (1.72)	$ (1.11)
Cell Development CQA	$ (28,271)	$ (2,827)	$ (0.09)	$ (0.06)
Closure/Post-Closure	$ (585,273)	$ (58,527)	$ (1.85)	$ (1.20)
Landfill Grinding	$ -	$ -	$ -	$ -
TCEQ Fees	$ (297,040)	$ (29,704)	$ (0.94)	$ (0.61)
Composting Refund	$ (2,273,423)	$ (227,342)	$ (7.19)	$ (4.66)
Lost Revenue	$ 14,640,280	$ 1,464,028	$ 46.33	$ 29.99
Net Financial Impact to the Landfill	**$ 10,913,215**	**$ 1,091,321**	**$ 34.54**	**$ 22.36**
Total Net Cost	**$ 38,249,815**	**$ 4,201,221**	**$ 132.95**	**$ 86.06**

Landfill Cost Reduction for Composting Tonnage (50% of Inbound Tonnage from Outside Landfill)	**Total**	**Annualized Cost**	**Annualized Cost per Inbound Ton**	**Annualized Cost per Inbound CY**
Cell Development	$ (271,529)	$ (27,153)	$ (0.86)	$ (0.56)
Cell Development CQA	$ (14,136)	$ (1,414)	$ (0.04)	$ (0.03)
Closure/Post-Closure	$ (292,637)	$ (29,264)	$ (0.93)	$ (0.60)
Landfill Grinding	$ -	$ -	$ -	$ -
TCEQ Fees	$ (148,520)	$ (14,852)	$ (0.47)	$ (0.30)
Composting Refund	$ (2,227,089)	$ (222,709)	$ (7.05)	$ (4.56)
Lost Revenue	$ 7,320,140	$ 732,014	$ 23.17	$ 15.00
Net Financial Impact to the Landfill	**$ 4,366,230**	**$ 436,623**	**$ 13.82**	**$ 8.94**
Total Net Cost	**$ 31,702,830**	**$ 3,546,523**	**$ 112.23**	**$ 72.65**

Inbound Material Volumes	**yd^3/yr**
Green Waste (ground)	32,286
Food Waste	16,530
Biosolids	0

Outbound Composting Volumes	**yd^3/yr**
Compost	19,604
Mulch	16,143

Annual Composting Revenue	$ 509,700
Annual Mulch Revenue	$ 174,346
Annual Composting Cost	$ (3,109,900)
Annual Net Financial Impact to the Landfill	$ (1,091,321)
Net Revenue (Required Recovery by Gate Rate)	**$ (3,517,176)**
Annual Inbound Tonnage	31,600
Cost per Ton	**$ (111.30)**
Annual Inbound Volume	48,816
Cost per CY	**$ (72.05)**

Date	3/27/2025
Estimate Basis	Construction of Composting Facility at Site B ("The Elbow")
Scenario	Phase 2

Assumptions	
Current Year	FY 2025
Inbound Processing Tonnage	117,400
Inbound Processing CY	188,162
Green Waste Designated for Mulch	50%
Processing Volume Reduction	40%
Landfill Gate Rate, Environmental Fee, and Processing Fee	$46.33
Site Life	10 Years
Benefits Percentage	31%
City Interest Rate	5%
Private Interest Rate	6%
Maintenance (% of CAPEX)	15%
Administration (% of OPEX)	5%
Operator Margin (profit, taxes, and depreciation)	20%
Composting Refund Percentage of Landfill Revenue	15%
Bulk Compost Price per CY	$26.00
Percent of Compost Sold	100%
Bulk Mulch Price per CY	$18.00
Percent of Mulch Sold	60%

Composting Facility
Capital Cost Estimate

Facility Construction	Funding Source	Count	Units	Useful Life	Unit Price	Total Price	Adjusted Price (Operator Margin)	Annualized Cost
GENERAL CONDITIONS	Private	15	MO	10 Years	$ 61,040	$ 915,600	$ 1,098,800	$ 149,300
EROSION CONTROL	Private	1	LS	10 Years	$ 86,300	$ 86,300	$ 103,600	$ 14,100
REMOVALS	Private	1	LS	10 Years	$ 1,040,700	$ 1,040,700	$ 1,248,900	$ 169,700
EARTHWORK	Private	1	LS	10 Years	$ 6,255,900	$ 6,255,900	$ 7,507,100	$ 1,020,000
AGGREGATES	Private	1	LS	10 Years	$ 88,700	$ 88,700	$ 106,500	$ 14,500
CONCRETE PAVING/CRUSHING STATION	Private	1	LS	10 Years	$ 66,770	$ 66,770	$ 80,200	$ 10,900
BOLLARDS & SIGNAGE	Private	1	LS	10 Years	$ 29,020	$ 29,020	$ 34,900	$ 4,800
SANITARY SEWER FOR BLDG	Private	1	LS	10 Years	$ 117,100	$ 117,100	$ 140,600	$ 19,200
WATER LINE TO BLDG AND FIRE LINE	Private	1	LS	10 Years	$ 272,100	$ 272,100	$ 326,600	$ 44,400
FENCING	Private	1	LS	10 Years	$ 424,395	$ 424,395	$ 509,300	$ 69,200
METAL BUILDING	Private	5000	SF	10 Years	$ 283	$ 1,416,000	$ 1,699,200	$ 230,900
LANDSCAPING	Private	1	LS	10 Years	$ 120,800	$ 120,800	$ 145,000	$ 19,800
Subtotal						**$ 10,833,385**	**$ 13,000,700**	**$ 1,766,800**
Project Contingency (20%)	Private	1	LS	10 Years	$ 2,166,000	$ 2,166,000	$ 2,599,200	$ 353,200
Permits & Design (15%)	Private	1	LS	10 Years	$ 1,625,000	$ 1,625,000	$ 1,950,000	$ 265,000
Subtotal						**$ 3,791,000**	**$ 4,549,200**	**$ 618,200**
Total with Contingency, Permits & Design						**$ 14,624,385**	**$ 17,549,900**	**$ 2,385,000**

Facility Equipment	Funding Source	Count	Units	Useful Life	Unit Price	Total Price	Adjusted Price (Operator Margin)	Annualized Cost
Load Volume Scanning	Private	1	LS	15 Years	$ 70,000	$ 70,000	$ 84,000	$ 8,700
Front-End Loader	Private	4	LS	5 Years	$ 250,000	$ 1,000,000	$ 1,200,000	$ 284,900
Excavator	Private	1	LS	5 Years	$ 340,000	$ 340,000	$ 408,000	$ 89,400
Grinder	Private	1	LS	10 Years	$ 1,400,000	$ 1,400,000	$ 1,680,000	$ 228,300
Windrow Turner	Private	1	LS	10 Years	$ 750,000	$ 750,000	$ 900,000	$ 122,300
Water Tanker	Private	1	LS	10 Years	$ 270,000	$ 270,000	$ 324,000	$ 44,100
Monitoring	Private	1	LS	2 Years	$ 12,000	$ 12,000	$ 14,400	$ 7,900
Screen	Private	1	LS	15 Years	$ 770,000	$ 770,000	$ 924,000	$ 95,200
Total						**$ 4,612,000**	**$ 5,534,400**	**$ 880,800**

Operating Cost Estimate

Facility Equipment	Operator	Annual Operating Hours	Labor	Fuel	Maintenance	Administration	Operator Margin	Annualized Cost
Load Volume Scanning	Private	2,080	$ 136,400	$ -	$ 10,500	$ 7,400	$ 30,900	$ 185,200
Front-End Loader	Private	5,820	$ 381,400	$ 80,200	$ 150,000	$ 30,600	$ 128,500	$ 770,700
Excavator	Private	1,820	$ 119,300	$ 19,300	$ 51,000	$ 9,500	$ 39,900	$ 239,000
Grinder	Private	1,870	$ 122,600	$ 63,000	$ 210,000	$ 19,800	$ 83,100	$ 498,500
Windrow Turner	Private	600	$ 39,300	$ 18,400	$ 112,500	$ 8,600	$ 35,800	$ 214,600
Water Tanker	Private	525	$ 34,400	$ 12,100	$ 40,500	$ 4,400	$ 18,300	$ 109,700
Monitoring	Private	520	$ 34,100	$ -	$ 2,200	$ 1,900	$ 7,700	$ 45,900
Screen	Private	625	$ 41,000	$ 11,500	$ 115,500	$ 8,400	$ 35,300	$ 211,700
Total		**13,860**	**$ 908,500**	**$ 204,500**	**$ 692,200**	**$ 90,600**	**$ 379,500**	**$ 2,275,300**

Cost Component	Total	Annualized Cost	Annualized Cost per Inbound Ton	Annualized Cost per Inbound CY
Facility Construction Cost	$ 17,549,900	$ 2,385,000	$ 20.32	$ 12.68
Equipment Capital Cost	$ 5,534,400	$ 880,800	$ 7.50	$ 4.68
Operating Cost	$ 22,753,000	$ 2,275,300	$ 19.38	$ 12.09
Total	**$ 45,837,300**	**$ 5,541,100**	**$ 47.20**	**$ 29.45**

Landfill Cost Reduction for Composting Tonnage	Total	Annualized Cost	Annualized Cost per Inbound Ton	Annualized Cost per Inbound CY
Cell Development	$ (2,017,561)	$ (201,756)	$ (1.72)	$ (1.07)
Cell Development CQA	$ (105,032)	$ (10,503)	$ (0.09)	$ (0.06)
Closure/Post-Closure	$ (2,174,402)	$ (217,440)	$ (1.85)	$ (1.16)
Landfill Grinding	$ -	$ -	$ -	$ -
TCEQ Fees	$ (1,103,560)	$ (110,356)	$ (0.94)	$ (0.59)
Composting Refund	$ (2,152,445)	$ (215,245)	$ (1.83)	$ (1.14)
Lost Revenue	$ 54,391,420	$ 5,439,142	$ 46.33	$ 28.91
Net Financial Impact to the Landfill	**$ 46,838,420**	**$ 4,683,842**	**$ 39.90**	**$ 24.89**
Total Net Cost	**$ 92,675,720**	**$ 10,224,942**	**$ 87.09**	**$ 54.34**

Landfill Cost Reduction for Composting Tonnage (50% of Inbound Tonnage from Outside Landfill)	**Total**	**Annualized Cost**	**Annualized Cost per Inbound Ton**	**Annualized Cost per Inbound CY**
Cell Development	$ (1,008,781)	$ (100,878)	$ (0.86)	$ (0.54)
Cell Development CQA	$ (52,516)	$ (5,252)	$ (0.04)	$ (0.03)
Closure/Post-Closure	$ (1,087,201)	$ (108,720)	$ (0.93)	$ (0.58)
Landfill Grinding	$ -	$ -	$ -	$ -
TCEQ Fees	$ (551,780)	$ (55,178)	$ (0.47)	$ (0.29)
Composting Refund	$ (2,166,600)	$ (216,660)	$ (1.85)	$ (1.15)
Lost Revenue	$ 27,195,710	$ 2,719,571	$ 23.17	$ 14.45
Net Financial Impact to the Landfill	**$ 22,328,833**	**$ 2,232,883**	**$ 19.02**	**$ 11.87**
Total Net Cost	**$ 68,166,133**	**$ 7,773,983**	**$ 66.22**	**$ 41.32**

Inbound Material Volumes	**yd^3/yr**
Green Waste (ground)	144,503
Food Waste	43,659
Biosolids	0

Outbound Composting Volumes	**yd^3/yr**
Compost	69,546
Mulch	72,251

Annual Composting Revenue	$ 1,808,206
Annual Mulch Revenue	$ 780,314
Annual Composting Cost	$ (5,541,100)
Annual Net Financial Impact to the Landfill	$ (4,683,842)
Net Revenue (Required Recovery by Gate Rate)	**$ (7,636,422)**
Annual Inbound Tonnage	117,400
Cost per Ton	**$ (65.05)**
Annual Inbound Volume	188,162
Cost per CY	**$ (40.58)**

Date	3/27/2025
Estimate Basis	Construction of Composting Facility at Site B ("The Elbow")
Scenario	Maximum Throughput

Assumptions	
Current Year	FY 2025
Inbound Processing Tonnage	170,000
Inbound Processing CY	272,332
Green Waste Designated for Mulch	50%
Processing Volume Reduction	40%
Landfill Gate Rate, Environmental Fee, and Processing Fee	$46.33
Site Life	10 Years
Benefits Percentage	31%
City Interest Rate	5%
Private Interest Rate	6%
Maintenance (% of CAPEX)	15%
Administration (% of OPEX)	5%
Operator Margin (profit, taxes, and depreciation)	20%
Composting Refund Percentage of Landfill Revenue	15%
Bulk Compost Price per CY	$26.00
Percent of Compost Sold	100%
Bulk Mulch Price per CY	$18.00
Percent of Mulch Sold	60%

Composting Facility
Capital Cost Estimate

Facility Construction	Funding Source	Count	Units	Useful Life	Unit Price	Total Price	Adjusted Price (Operator Margin)	Annualized Cost
GENERAL CONDITIONS	Private	15	MO	10 Years	$ 61,040	$ 915,600	$ 1,098,800	$ 149,300
EROSION CONTROL	Private	1	LS	10 Years	$ 86,300	$ 86,300	$ 103,600	$ 14,100
REMOVALS	Private	1	LS	10 Years	$ 1,040,700	$ 1,040,700	$ 1,248,900	$ 169,700
EARTHWORK	Private	1	LS	10 Years	$ 6,255,900	$ 6,255,900	$ 7,507,100	$ 1,020,000
AGGREGATES	Private	1	LS	10 Years	$ 88,700	$ 88,700	$ 106,500	$ 14,500
CONCRETE PAVING/CRUSHING STATION	Private	1	LS	10 Years	$ 66,770	$ 66,770	$ 80,200	$ 10,900
BOLLARDS & SIGNAGE	Private	1	LS	10 Years	$ 29,020	$ 29,020	$ 34,900	$ 4,800
SANITARY SEWER FOR BLDG	Private	1	LS	10 Years	$ 117,100	$ 117,100	$ 140,600	$ 19,200
WATER LINE TO BLDG AND FIRE LINE	Private	1	LS	10 Years	$ 272,100	$ 272,100	$ 326,600	$ 44,400
FENCING	Private	1	LS	10 Years	$ 424,395	$ 424,395	$ 509,300	$ 69,200
METAL BUILDING	Private	5000	SF	10 Years	$ 283	$ 1,416,000	$ 1,699,200	$ 230,900
LANDSCAPING	Private	1	LS	10 Years	$ 120,800	$ 120,800	$ 145,000	$ 19,800
Subtotal						**$ 10,833,385**	**$ 13,000,700**	**$ 1,766,800**
Project Contingency (20%)	Private	1	LS	10 Years	$ 2,166,000	$ 2,166,000	$ 2,599,200	$ 353,200
Permits & Design (15%)	Private	1	LS	10 Years	$ 1,625,000	$ 1,625,000	$ 1,950,000	$ 265,000
Subtotal						**$ 3,791,000**	**$ 4,549,200**	**$ 618,200**
Total with Contingency, Permits & Design						**$ 14,624,385**	**$ 17,549,900**	**$ 2,385,000**

Facility Equipment	Funding Source	Count	Units	Useful Life	Unit Price	Total Price	Adjusted Price (Operator Margin)	Annualized Cost
Load Volume Scanning	Private	1	LS	15 Years	$ 70,000	$ 70,000	$ 84,000	$ 8,700
Front-End Loader	Private	5	LS	5 Years	$ 250,000	$ 1,250,000	$ 1,500,000	$ 356,100
Excavator	Private	2	LS	5 Years	$ 340,000	$ 680,000	$ 816,000	$ 193,800
Grinder	Private	2	LS	10 Years	$ 1,400,000	$ 2,800,000	$ 3,360,000	$ 456,600
Windrow Turner	Private	1	LS	10 Years	$ 750,000	$ 750,000	$ 900,000	$ 122,300
Water Tanker	Private	1	LS	10 Years	$ 270,000	$ 270,000	$ 324,000	$ 44,100
Monitoring	Private	1	LS	2 Years	$ 12,000	$ 12,000	$ 14,400	$ 7,900
Screen	Private	1	LS	15 Years	$ 770,000	$ 770,000	$ 924,000	$ 95,200
Total						**$ 6,602,000**	**$ 7,922,400**	**$ 1,284,700**

Operating Cost Estimate

Facility Equipment	Operator	Annual Operating Hours	Labor	Fuel	Maintenance	Administration	Operator Margin	Annualized Cost
Load Volume Scanning	Private	2,080	$ 127,300	$ -	$ 10,500	$ 6,900	$ 29,000	$ 173,700
Front-End Loader	Private	8,415	$ 515,000	$ 115,900	$ 187,500	$ 41,000	$ 171,900	$ 1,031,300
Excavator	Private	2,625	$ 160,600	$ 27,800	$ 102,000	$ 14,600	$ 61,000	$ 366,000
Grinder	Private	2,700	$ 165,200	$ 90,900	$ 420,000	$ 33,900	$ 142,000	$ 852,000
Windrow Turner	Private	870	$ 53,200	$ 26,700	$ 112,500	$ 9,700	$ 40,500	$ 242,600
Water Tanker	Private	765	$ 46,800	$ 17,600	$ 40,500	$ 5,300	$ 22,100	$ 132,300
Monitoring	Private	520	$ 31,800	$ -	$ 2,200	$ 1,700	$ 7,200	$ 42,900
Screen	Private	910	$ 55,700	$ 16,800	$ 115,500	$ 9,400	$ 39,500	$ 236,900
Total		**18,885**	**$ 1,155,600**	**$ 295,700**	**$ 990,700**	**$ 122,500**	**$ 513,200**	**$ 3,077,700**

Cost Component	Total	Annualized Cost	Annualized Cost per Inbound Ton	Annualized Cost per Inbound CY
Facility Construction Cost	$ 17,549,900	$ 2,385,000	$ 14.03	$ 8.76
Equipment Capital Cost	$ 7,922,400	$ 1,284,700	$ 7.56	$ 4.72
Operating Cost	$ 30,777,000	$ 3,077,700	$ 18.10	$ 11.30
Total	**$ 56,249,300**	**$ 6,747,400**	**$ 39.69**	**$ 24.78**

Landfill Cost Reduction for Composting Tonnage	Total	Annualized Cost	Annualized Cost per Inbound Ton	Annualized Cost per Inbound CY
Cell Development	$ (2,921,511)	$ (292,151)	$ (1.72)	$ (1.07)
Cell Development CQA	$ (152,091)	$ (15,209)	$ (0.09)	$ (0.06)
Closure/Post-Closure	$ (3,148,622)	$ (314,862)	$ (1.85)	$ (1.16)
Landfill Grinding	$ -	$ -	$ -	$ -
TCEQ Fees	$ (1,598,000)	$ (159,800)	$ (0.94)	$ (0.59)
Composting Refund	$ (2,078,279)	$ (207,828)	$ (1.22)	$ (0.76)
Lost Revenue	$ 78,761,000	$ 7,876,100	$ 46.33	$ 28.92
Net Financial Impact to the Landfill	**$ 68,862,496**	**$ 6,886,250**	**$ 40.51**	**$ 25.29**
Total Net Cost	**$ 125,111,796**	**$ 13,633,650**	**$ 80.20**	**$ 50.06**

Landfill Cost Reduction for Composting Tonnage (50% of Inbound Tonnage from Outside Landfill)	**Total**	**Annualized Cost**	**Annualized Cost per Inbound Ton**	**Annualized Cost per Inbound CY**
Cell Development	$ (1,460,756)	$ (146,076)	$ (0.86)	$ (0.54)
Cell Development CQA	$ (76,046)	$ (7,605)	$ (0.04)	$ (0.03)
Closure/Post-Closure	$ (1,574,311)	$ (157,431)	$ (0.93)	$ (0.58)
Landfill Grinding	$ -	$ -	$ -	$ -
TCEQ Fees	$ (799,000)	$ (79,900)	$ (0.47)	$ (0.29)
Composting Refund	$ (2,129,517)	$ (212,952)	$ (1.25)	$ (0.78)
Lost Revenue	$ 39,380,500	$ 3,938,050	$ 23.17	$ 14.46
Net Financial Impact to the Landfill	**$ 33,340,871**	**$ 3,334,087**	**$ 19.61**	**$ 12.24**
Total Net Cost	**$ 89,590,171**	**$ 10,081,487**	**$ 59.30**	**$ 37.02**

Inbound Material Volumes	**yd^3/yr**
Green Waste (ground)	208,761
Food Waste	63,571
Biosolids	0

Outbound Composting Volumes	**yd^3/yr**
Compost	100,771
Mulch	104,380

Annual Composting Revenue	$ 2,620,042
Annual Mulch Revenue	$ 1,127,309
Annual Composting Cost	$ (6,747,400)
Annual Net Financial Impact to the Landfill	$ (6,886,250)
Net Revenue (Required Recovery by Gate Rate)	**$ (9,886,298)**
Annual Inbound Tonnage	170,000
Cost per Ton	**$ (58.15)**
Annual Inbound Volume	272,332
Cost per CY	**$ (36.30)**

APPENDIX D – FACILITY SIZING CALCULATIONS

Site A: Facility Throughput - Full Permitted Area

Inbound Feedstock

Material Stream		Annual Tons	Density, lb/yd^3		Annual Cubic Yards	
			Unground	Ground	Unground	Ground
Green Waste	70%	56,000	253	573	442,688	195,462
Food Waste	30%	24,000	1,585			30,284
Biosolids	0%	0	1,683			0
Total		**80,000**				**225,746**

Feedstock Storage and Grinding

Total Allocated Area, Acres	43
Maximum Storage Period for Unground Green Waste, Days	140
Total Unground Green Waste Volume Stored, Cubic Yards	169,798
Perimeter, Feet	20
Pile Width, Feet	24
Pile Height, Feet	12
Aisle Width	20
Pile Length with no Breaks, Feet	15,919
Number of Rows, if Square	19.2
Area if Square, Acres	17
Allowance for Operations, Traffic, Drainage, Contingency	20%
Minimum Feedstock Stoarge and Grinding Area, Acres	**20.7**

Screening Area, Acres	1.0
Grinding Area	Included in Green Waste Storage

Windrow Processing

Processing Time, Days	122
Percentage of Green Waste Composted	50%
Total Volume in Windrows, Cubic Yards	42,789
Windrow Perimeter Width, Feet	20
Windrow Width, Feet	18
Windrow Height, Feet	8
Windrow Aisle Width, Feet	10
Windrow Side Slope	1:1
Windrow Cross-Sectional Area, Square Yards	8.89
Total Windrow Length, Feet	14,441
Number of Rows, if Square	23
Area if Square, Acres (Incl. Perimeter)	10.3
Allowance for Operations, Traffic, Drainage, Contingency	20%
Minimum Windrow Processing Area, Acres	**12.4**

Curing Area

Time in Curing, Days	95
Volume Reduction Percentage	40%
Total Volume in Curing Area, Cubic Yards	19,991

Curing Area Perimeter, Feet	20
Curing Pile Width, Feet	24
Curing Pile Height, Feet	12
Curing Pile Aisle Width, Feet	20
Curing Pile Side Slope	1:1
Curing Pile Cross-Sectional Area, Square Yards	16.00
Total Curing Pile Length, Feet	3,748
Number of Rows, if Square	9
Area if Square, Acres (Incl. Perimeter)	4.4
Allowance for Operations, Traffic, Drainage, Contingency	20%
Minimum Curing Area, Acres	**5.2**

Minimum Total Area Requirement

Feedstock Storage and Grinding	20.7
Screening Area	1.0
Windrow Processing	12.4
Curing	5.2
Minimum Total Area Requirement, Acres	**39.3**
Available Area, Acres	40

Site B: Facility Throughput - Full Permitted Area

Inbound Feedstock

Material Stream		Annual Tons	Density, lb/yd^3		Annual Cubic Yards	
			Unground	Ground	Unground	Ground
Green Waste	70%	119,000	253	573	940,711	415,358
Food Waste	30%	51,000	1,585			64,353
Biosolids	0%	0	1,683			0
Total		**170,000**				**479,711**

Feedstock Storage and Grinding

Total Allocated Area, Acres	43
Maximum Storage Period for Unground Green Waste, Days	140
Total Unground Green Waste Volume Stored, Cubic Yards	360,821
Perimeter, Feet	20
Pile Width, Feet	24
Pile Height, Feet	12
Aisle Width	20
Pile Length with no Breaks, Feet	33,827
Number of Rows, if Square	28.0
Area if Square, Acres	36
Allowance for Operations, Traffic, Drainage, Contingency	20%
Minimum Feedstock Stoarge and Grinding Area, Acres	**43.0**
Concept Design Allowance, Acres	43

Screening Area, Acres	1.0
Grinding Area	Included in Green Waste Storage

Windrow Processing

Processing Time, Days	122
Percentage of Green Waste Composted	50%
Total Volume in Windrows, Cubic Yards	90,926
Windrow Perimeter Width, Feet	20
Windrow Width, Feet	18
Windrow Height, Feet	8
Windrow Aisle Width, Feet	10
Windrow Side Slope	1:1
Windrow Cross-Sectional Area, Square Yards	8.89
Total Windrow Length, Feet	30,687
Number of Rows, if Square	33
Area if Square, Acres (Incl. Perimeter)	21.2
Allowance for Operations, Traffic, Drainage, Contingency	20%
Minimum Windrow Processing Area, Acres	**25.5**
Concept Design Allowance	28

Curing Area

Time in Curing, Days	95

Volume Reduction Percentage	40%
Total Volume in Curing Area, Cubic Yards	42,482
Curing Area Perimeter, Feet	20
Curing Pile Width, Feet	24
Curing Pile Height, Feet	12
Curing Pile Aisle Width, Feet	20
Curing Pile Side Slope	1:1
Curing Pile Cross-Sectional Area, Square Yards	16.00
Total Curing Pile Length, Feet	7,965
Number of Rows, if Square	14
Area if Square, Acres (Incl. Perimeter)	8.9
Allowance for Operations, Traffic, Drainage, Contingency	20%
Minimum Curing Area, Acres	**10.7**
Concept Design Allowance	11

Minimum Total Area Requirement

Feedstock Storage and Grinding	43.0
Screening Area	1.0
Windrow Processing	25.5
Curing	10.7
Minimum Total Area Requirement	**80.2**
Available Area	82

Site C: Facility Throughput - Full Permitted Area

Inbound Feedstock

Material Stream		Annual Tons	Density, lb/yd^3		Annual Cubic Yards	
			Unground	Ground	Unground	Ground
Green Waste	70%	126,000	253	573	996,047	439,791
Food Waste	30%	54,000	1,585			68,139
Biosolids	0%	0	1,683			0
Total		**180,000**				**507,929**

Feedstock Storage and Grinding

Total Allocated Area, Acres	43
Maximum Storage Period for Unground Green Waste, Days	140
Total Unground Green Waste Volume Stored, Cubic Yards	382,046
Perimeter, Feet	20
Pile Width, Feet	24
Pile Height, Feet	12
Aisle Width	20
Pile Length with no Breaks, Feet	35,817
Number of Rows, if Square	28.8
Area if Square, Acres	38
Allowance for Operations, Traffic, Drainage, Contingency	20%
Minimum Feedstock Stoarge and Grinding Area, Acres	**45.5**

Screening Area, Acres	1.0
Grinding Area	Included in Green Waste Storage

Windrow Processing

Processing Time, Days	122
Percentage of Green Waste Composted	50%
Total Volume in Windrows, Cubic Yards	96,274
Windrow Perimeter Width, Feet	20
Windrow Width, Feet	18
Windrow Height, Feet	8
Windrow Aisle Width, Feet	10
Windrow Side Slope	1:1
Windrow Cross-Sectional Area, Square Yards	8.89
Total Windrow Length, Feet	32,493
Number of Rows, if Square	34
Area if Square, Acres (Incl. Perimeter)	22.4
Allowance for Operations, Traffic, Drainage, Contingency	20%
Minimum Windrow Processing Area, Acres	**26.9**

Curing Area

Time in Curing, Days	95
Volume Reduction Percentage	40%
Total Volume in Curing Area, Cubic Yards	44,981

Curing Area Perimeter, Feet	20
Curing Pile Width, Feet	24
Curing Pile Height, Feet	12
Curing Pile Aisle Width, Feet	20
Curing Pile Side Slope	1:1
Curing Pile Cross-Sectional Area, Square Yards	16.00
Total Curing Pile Length, Feet	8,434
Number of Rows, if Square	14
Area if Square, Acres (Incl. Perimeter)	9.4
Allowance for Operations, Traffic, Drainage, Contingency	20%
Minimum Curing Area, Acres	**11.3**

Minimum Total Area Requirement

Feedstock Storage and Grinding	45.5
Screening Area	1.0
Windrow Processing	26.9
Curing	11.3
Minimum Total Area Requirement, Acres	**84.7**
Available Area, Acres	88

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