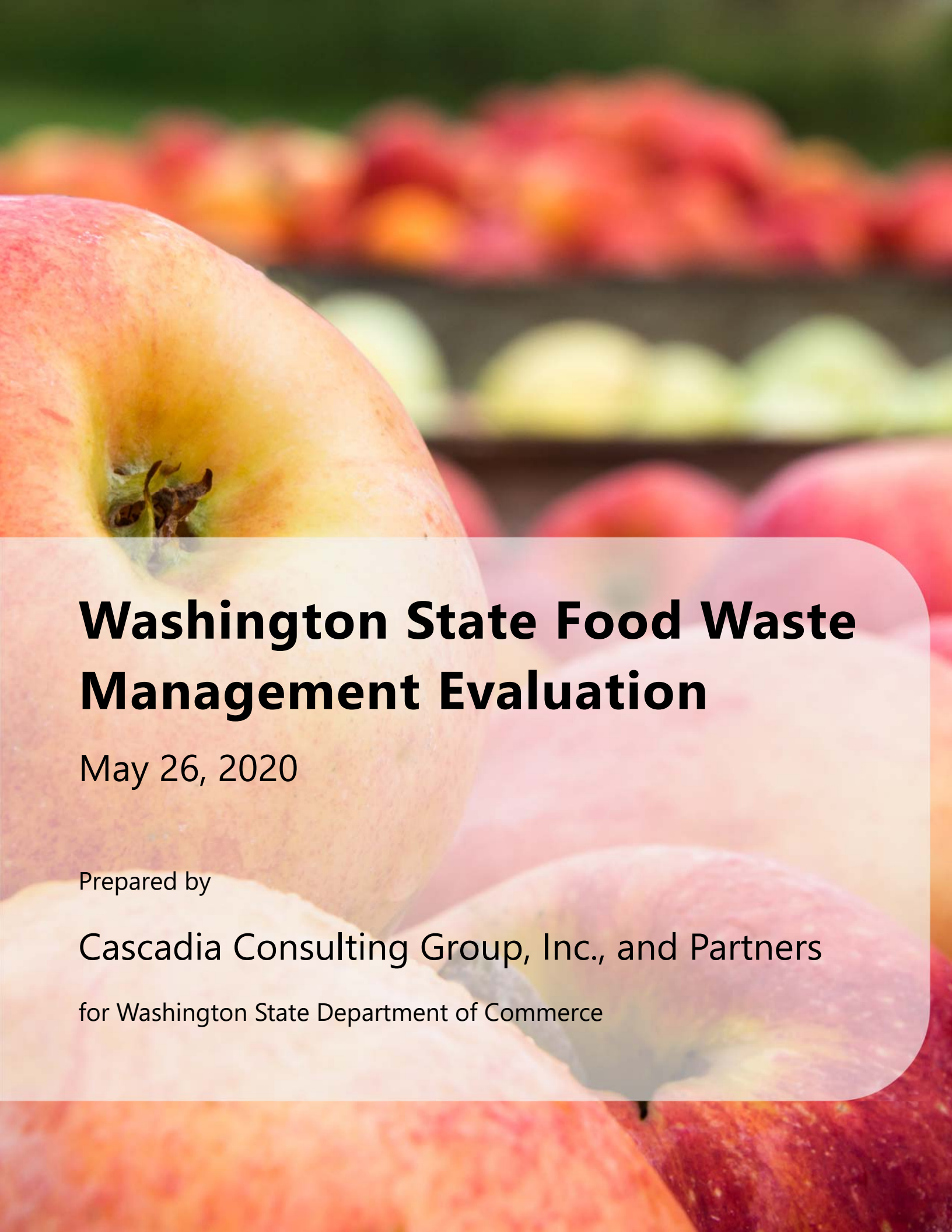

Washington State Food Waste Management Evaluation

May 26, 2020

Prepared by

Cascadia Consulting Group, Inc., and Partners

for Washington State Department of Commerce

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BACKGROUND AND INTRODUCTION

Cascadia Consulting Group, Inc. (Cascadia) began this evaluation of Washington State's excess food and food waste management system in January 2020 on behalf of the Department of Commerce (Commerce) and the Department of Ecology (Ecology). The purpose of the evaluation is to support the Use Food Well Washington Plan (Plan) being prepared by Ecology under HB 1114. This undertaking recognizes the importance of understanding current data as a starting point to develop and implement plans to reduce and divert food waste moving forward.

The goal of the Plan is to reduce by 50 percent the amount of food waste generated annually in the state of Washington, relative to 2015 levels, using the following strategies:

- **Strategy 1:** Prevent and reduce the amount of edible food that is wasted by residents and businesses.
- **Strategy 2:** Help match and support the capacity for edible food that would otherwise be wasted with food banks and other distributors that will ensure the food reaches those who need it.
- **Strategy 3:** Support productive uses of inedible food materials, including using it for animal feed, energy production through anaerobic digestion, or other commercial uses, and for off-site or on-site management systems including composting, vermicomposting, or other biological systems.

This evaluation aims to support Strategy 3 by creating a snapshot of the quantity and types of food flowing through Washington State's hunger relief, animal feed, compost, and industrial uses systems and describing the capacity of these systems to manage more material in the future, as a preferable alternative to landfill.

Cascadia completed this evaluation with the assistance of stakeholders creating the Plan, including:

- The **Core Team**, a support and decision-making structure led by Mary Harrington of Ecology that meets monthly to help develop the Plan, engage stakeholders, and ensure compliance with legislative mandates. It is made up of employees from state government agencies that will be affected by the Plan, including the Department of Agriculture (WSDA), Department of Health (DOH), Office of the Superintendent of Public Instruction (OSPI), and Department of Commerce (Commerce).
- **Subject Matter Expert (SME) Work Groups**, which were formed to assist with the Plan in recognition that reducing wasted food will require many fields of expertise working together in cooperation. SMEs receive invitations to participate in work groups as regularly as they choose.

Terms and Definitions

The terms used in this report reflect those used in the text of HB 1114.

Food Waste	Waste from fruits, vegetables, meats, dairy products, fish, shellfish, nuts, seeds, grains, and similar materials that results from the storage, preparation, cooking, handling, selling, or serving of food for human consumption. Includes, but is not limited to, excess, spoiled, or unusable food and includes inedible parts commonly associated with food preparation such as pits, shells, bones, and peels. Does not include dead animals not intended for human consumption or animal excrement.
Food Waste Management	Any management of food that wasn't consumed by its primary intended recipient. Includes distribution, processing, preserving, serving, selling, and composting. Does not include disposal.
Wasted Food	The edible portion of food waste.

SYSTEM AND GEOGRAPHIC BOUNDARIES

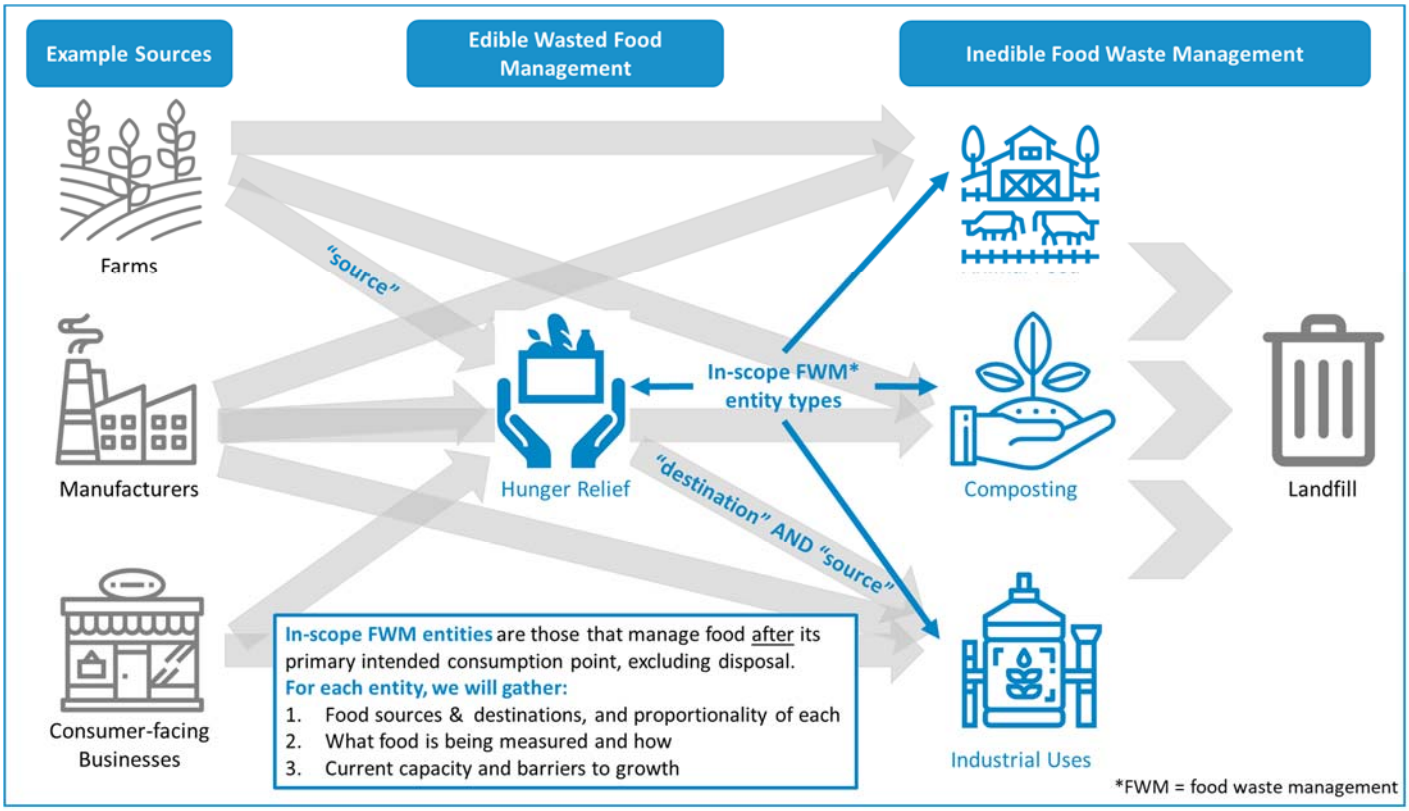
During this evaluation, Cascadia considered three main research areas: current flows of food waste and wasted food, the metrics and reporting protocols used to track segments of those flows over time, and the existing capacity, barriers, and opportunities for different types of entities to manage food waste and wasted food. To guide project work, Cascadia defined the following core questions by research area:

A. Flow of Food: How much food is currently flowing through each entity in the food waste management system, i.e., hunger relief, animal feed, compost, and industrial uses?
B. Metrics & Protocols: For each entity, what is being measured and how is it being measured? What opportunities exist to harmonize metrics and protocols across the system?
C. System Capacity: What is the current capacity of each entity in the system to handle wasted food and/or food waste? What are the barriers to increasing the capacity of each entity in the system?

System Boundaries

This evaluation focuses on the handling and disposition of food *after its primary intended point of consumption, excluding landfill*. Accordingly, our scope is composed of four food waste and wasted food management entity types: hunger relief organizations, animal feed distributors and direct users, compost facilities, and industrial users. Entities that generate food waste, such as farms, consumer-facing businesses, wholesalers, or distributors are out of scope for this evaluation. Figure 1 illustrates these scope boundaries.

Figure 1. Project Scope Boundaries



Geographic Boundaries

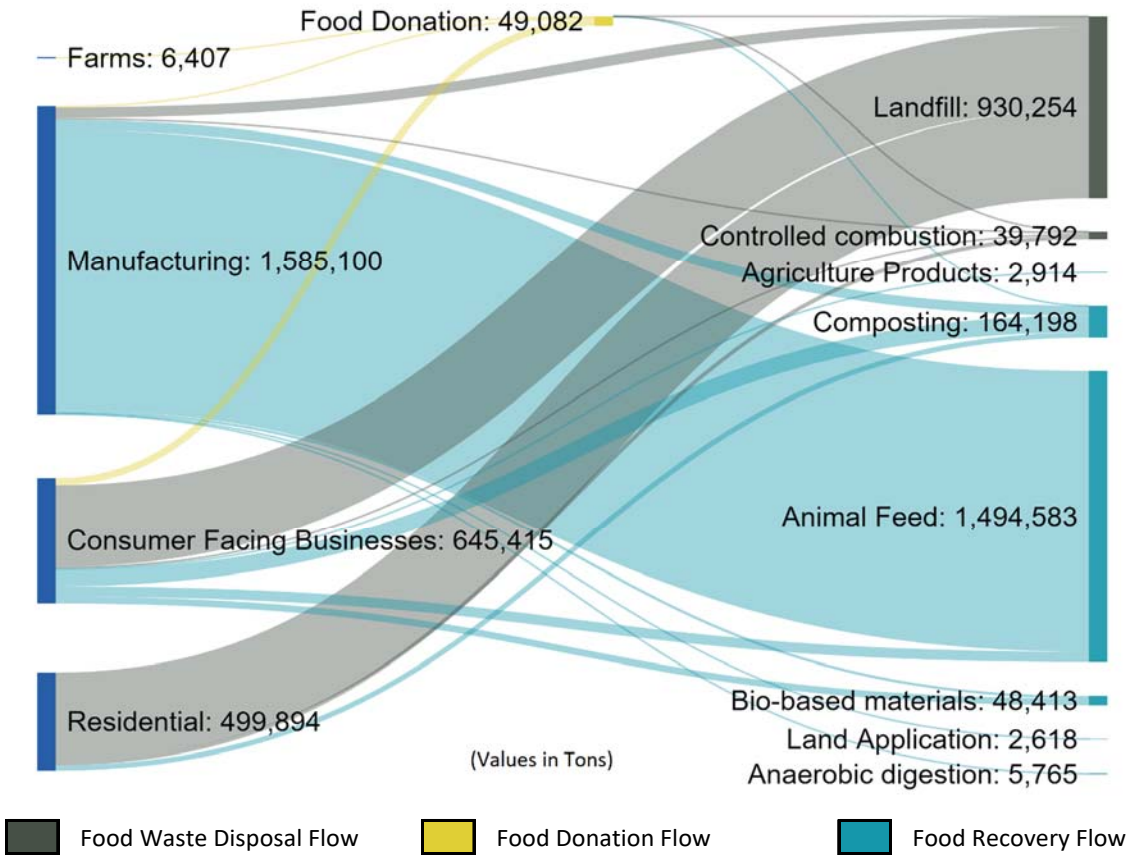
While the scope of this evaluation does not include entities outside of Washington State, we recognize that some surplus food and/or food waste handled by in-scope entities comes from out-of-state sources. We have included these sources of surplus food and food waste to provide context for understanding the capacity of in-state entities. These amounts are noted and separated where possible.

EXECUTIVE SUMMARY AND KEY FINDINGS

Flows of Food Waste and Wasted Food in Washington State

Based on secondary data collection efforts, literature reviews, and extrapolation of datasets, we estimate that Washington State generates 2.7 million tons of food waste. Of this amount, 1.7 million tons are recovered by hunger relief organizations, animal feed distributors and direct recipients, compost facilities, and anaerobic digesters. The remaining 1.0 million tons go to landfill (96%) or controlled combustion (4%). Figure 2 illustrates the estimated generation across four segments of the food supply chain that are consistent with ReFED's Roadmap to Reduce US Food Waste: farms, food manufacturers, consumer-facing businesses (including distributors, retail grocers, restaurants, foodservice providers, and institutions), and residential (including all dwellings). The data and model that produced the estimates in Figure 2 and throughout this document are summarized in Appendix A: .

Figure 2. Washington State Food Waste and Wasted Food Management Pathways (tons)



Edible Wasted Food to Landfill

The distinction between edible and inedible food is meaningful and necessary when measuring the potential for increasing food recovery for human consumption. To our knowledge, Washington State's 2015-2016 statewide waste characterization study was the first large-scale study in Washington include this distinction. Table 1 shows results from that study by sector. Overall, 47 percent of food waste to landfill was identified as edible. (Cascadia Consulting Group, 2018)

Table 1. 2015-2016 Washington Statewide Waste Characterization Study Edible Food Portions of Disposed Organics

	Total Food (tons)	Edible Food (tons)	Edible Portion (%)
Residential	369,178	159,923	43.3%
Commercial	390,757	191,746	49.1%
Self-Haul C&D	3,580	1,589	44.4%
Self-Haul Other	32,579	21,233	65.2%
Statewide	**796,094**	**374,490**	**47.0%**

Since the completion of this study, other Washington city and county waste studies have measured edible and inedible food. According to a 2019 study, King County residents and businesses generated an estimated 234,600 tons of food in 2018. The study estimated that "39 to 70 percent—approximately 91,300 to 163,400 tons—is edible wasted food, where edible food is defined as any material intended for human consumption, regardless of whether it was spoiled or partially consumed at the time of disposal" (Cascadia Consulting Group, 2019).

There is not a statewide organics characterization study that distinguishes between edible and inedible food in Washington State.

Key Findings

Key findings from our evaluation are outlined below:

- Manufacturing generates the majority of food waste (58%), followed by consumer-facing businesses (24%), and then the residential sector (18%).
    - A high percentage of manufacturing and processing waste is recycled into animal feed and compost products: 96 percent. Much of this quantity is spent grain and other by-products from brewers and distilleries, which could not easily be donated for human consumption.
    - Restaurants generate almost half (46%) of the food waste from consumer-facing businesses. The next largest generator is supermarkets and grocery stores, accounting for a little over a fifth (22%) of Consumer Facing Business food waste.
- Animal feed distributors and direct recipients are receiving the highest percentage of food waste (55%) of the food waste management pathways considered in this evaluation, primarily from manufacturing operations.
- Landfills receive the second highest percentage (34%) of food waste and wasted food.
    - Every generator type we considered, except manufacturing, sends more food waste and wasted food to landfill than any other single destination. Residential sources send approximately 91

percent of all food waste to landfill and consumer-facing businesses send an estimated 67 percent of their food waste to landfill.

  - Different commercial sectors have different levels of recovery. While overall, consumer-facing businesses recover about a third (33%) of food waste, restaurants and institutions send most of their food waste to landfill. Restaurants send an estimated 88 percent of their food waste to landfill and institutions. Grocery retailers send only 39 percent of food waste and wasted food to landfill and most of their food waste and wasted food (61%) goes to hunger relief organizations, compost, and animal feed.

- An estimated six percent of food waste is composted across the state. Most composted food waste is coming from manufacturing and wholesale distributors, 31 percent and 26 percent respectively. Residential food waste contributes only 16 percent of food going to compost.
- Of the food entering the state's food waste management pathways included in this evaluation, only 2 percent is distributed to hunger relief organizations. The main sources of donations are farms and grocery retailers.

Summary of Current and Recommended Reporting Protocols by Entity Type

Throughout this evaluation process, Cascadia found that existing data were overall not easily accessible and were spread out between agencies and other stakeholders. Table 2 provides descriptions of existing data reporting protocols by entity type and recommendations to support data management for HB 1114. Some recommendations will make tracking and reporting more complicated for those submitting it; these recommendations are ideal for supporting HB 1114, but may not be ideal for Ecology to implement in other ways. More detailed summaries of current and recommended tracking and reporting are listed in the Findings by Entity Type section below.

Table 2. Current and Recommended Reporting Protocols and Metrics by Entity Type

Entity Type	Current Entity Data Reporting Protocols	Recommended Changes to Entity Reporting Protocols	Current State Agencies Reporting Metrics	Recommended Additional Metrics for State Agency Reporting
Hunger Relief Organizations	Organizations report annually to large food distribution networks. Reporting to Ecology is optional.	Large distribution networks submit annual reporting to WSDA and/or Ecology.	• List of entities served • Pounds of food distributed and/or served annually • Number of individuals served	• Entity location (zip code) • Pounds of food donated vs. purchased • Donor or seller type • Pounds of food to compost/animal feed/landfill
Animal Feed	**Feed companies** are licensed and submit annual reporting to WSDA. **Pet food companies** that only produce pet food must register and submit semi-annual reports about products to WSDA. Reports do not include ingredients. **Farms** do not report about feed.	**Farms** submit information about food waste used as feed as part of an existing license or reporting process	**Feed companies:** Tons of feed distributed by ingredient category **Pet food companies:** Products sold **Farms:** No metrics systematically tracked	**Feed companies:** • Tons of feed received by ingredient category • Relevant ingredient categories marked for HB 1114 tracking • Specific human by-product ingredients • Wet vs. dry tons **Pet food companies:** Quantity of food waste ingredients used in products **Farms:** Quantity of food waste ingredients used as feed
Compost Facilities	Compost facilities above a certain size threshold require solid waste permits and report to Ecology annually. Compost facilities below the permitting threshold do not submit reports.	None	Feedstocks received by permitted compost facilities by type, including food processing waste, post-consumer food waste, yard debris/food waste, and sometimes, other food waste.	None, but food waste categories should remain the same year by year and ideally be accompanied by definitions for compost facilities for maximum consistency.
Anaerobic Digesters	**Dairy digesters** processing manure as 50% or more and non-manure organics as no more than 30% of feedstock volume submit annual reports to Ecology and local health departments. **Small-scale digesters** with no more than 5,000 gallons or 25 cubic yards of material on-site at a time are permit-exempt and submit no reports.	**Dairy digesters:** None. **Small-scale digesters:** Voluntary annual reporting to Ecology is recommended.	**Dairy digesters:** • Feedstock types and amounts • Digestate amount and analysis	**Small-scale digesters:** • Feedstock types and amounts • Digestate amount and end product(s)

Recommendations for Future Measurement Studies

Most food waste and wasted food metrics available to WSDA and Ecology are measured and reported by individual entities, as described in Table 2. In addition to recommended new metrics to include in these ongoing reporting protocols, there are also opportunities for state agencies to collect data on their own. To bolster the information available and best support HB 1114, agencies could conduct additional primary data collection studies about food waste and wasted food, outlined below:

Hunger Relief Organizations

- Conduct a barriers and opportunities study by entity type and geography to glean insights about unique barriers and opportunities where local, regional, and State agencies could provide support.
- Conduct a generator-based waste characterization study of hunger relief organizations and donors for a more nuanced look at their waste streams without adding strenuous reporting requirements for hunger relief organizations. This data collection should be conducted in collaboration with the Hunger Relief SME Working Group and could result in an adjustable model that WSDA or Ecology could use to track progress going forward.
- Measure edible portions of disposed food in statewide characterization studies via added material categories.

Animal Feed

- Survey farms to understand the extent of direct relationships between food waste generators and farms using food waste as animal feed.

Compost

- **Conduct barriers and opportunities study about compost program participation** to understand low rates of composting in Washington, especially among residences and restaurants.
- **Conduct composter feedstock characterization studies** to track levels of contamination and the success of food waste diversion programs. Support Small- and Community-Scale Compost Systems.

Anaerobic Digestion

- Conduct interviews of on-farm anaerobic digesters to understand their sources of food waste, challenges, and opportunities.
- Offer voluntary reporting for small-scale digester companies or individual sites to collect information about their inputs and outputs.

Challenges and Opportunities for Increasing Capacity

Hunger Relief Organizations

The hunger relief system in Washington State faces siloed organizations competing for resources to accomplish overlapping goals as its main challenges; these challenges and a need for greater flexibility in sourcing and delivering food have been highlighted during the COVID-19 pandemic. The main opportunity to improve capacity is to strengthen channels for communication, collaboration, and resource sharing – both between hunger relief organizations and with donors. This would enable food donors and hunger relief organizations to share food and resources efficiently, distribute food within safety windows, and reduce the amount of food going to compost and landfill.

Animal Feed

This evaluation has found that animal feed pathways may be near their capacity to accept food waste because most food waste appropriate for this use is already sent to commercial feed companies. With microbreweries and distilleries gaining traction in Washington State, there may be additional feedstocks available, especially for farms willing to create individual relationships with generators.

Compost

There are several challenges that compost facilities face to expand capacity in general, such as lengthy permitting processes and NIMBYism due to neighbor concerns about odors. There are also specific challenges for compost facilities to accept more food waste feedstocks, such as a higher need for odor and contamination management. Main opportunities include tapping public sector and agricultural markets, advertising carbon sequestration potential and other environmental benefits, providing upstream education to reduce contamination at the point of food waste disposal, and combining anaerobic digestion with compost facilities.

Industrial Uses

The major challenges facing anaerobic digesters are economic: high up-front costs, costs of operations and maintenance, and unstable natural gas markets that obscure the benefits of renewable natural gas production. In addition, digestate can be difficult to introduce as a soil amendment because there are so many different types of soil amendments on the market already. For small-scale digesters, opportunities include clients interested in keeping the benefits of digestion on-site and an innovative blockchain-based tracking system being piloted by Impact Bioenergy to track digester inputs and outputs. Renewable natural gas and nutrient recovery are both opportunities for on-farm anaerobic digesters to bring in revenue and create a positive environmental impact. Anaerobic digestion at water resource recovery facilities (WRRFs) has been successfully used to manage food waste in some municipalities.

DATA COLLECTION AND MODELING APPROACH

Due to scope, budget, and time constraints, this evaluation was not a primary data collection effort. Rather, it relied on gathering existing data from a small group of representative stakeholders, including Core Team members and subject matter experts who participated in Plan working groups. Below is a summary of the steps we took to compile and augment available quantitative and qualitative data about the four in-scope entity types.

Identify Required Data Elements and Prepare Initial Data Requests

After defining clear system and geographic boundaries for our evaluation, we framed our initial data requests to key project stakeholders using the required data elements outlined in Table 3, including prompting questions and suggested possible data sources for each.

Table 3. Required Data Elements

Data Element	Prompting Questions	Possible Data Source(s)
Entity Listing & Classifications	• Where can we find the most comprehensive listing of these entities in Washington State? • What defining characteristics or metrics are available to classify the entities into similar types, e.g., size in terms of FTEs, operating budget, customers served, materials accepted, pounds processed, geography, etc.? These metrics will inform data collection methods and quotas by entity grouping.	• Ask identified agency to provide available data and/or connect us with someone who can
Quantitative Data	• What is the total quantity of food waste managed by each entity? • What are the sources and destinations of food waste managed—including proportionality of each—by each entity? • What categories of food waste are being measured and how are they being measured? • What is the current estimated operating capacity of each entity, specifically for managing incoming food waste? What quantitative data is available about basic infrastructure such as refrigerated trucks and cold storage?	• Data reported to WSDA, Ecology, Commerce, etc. • Exports from proprietary databases, such as Food Lifeline's Ceres system • Annual reports
Qualitative Data	• What are the greatest challenges to increasing each entity's operating capacity?	• Existing literature • Surveys and/or interviews with representative organizations as identified in Table 4.

Set Data Collection Priorities

Given the project's accelerated timeline, Cascadia worked with the planning Core Team to set data collection priorities within our scope boundaries. In accordance with the Ecology Organic Waste Hierarchy (Figure 3), Cascadia and the Core Team identified hunger relief as our highest priority. Further, because statewide hunger relief data is less readily available via centralized public data sources than other in-scope entity types, we expected that hunger relief data collection would be more labor-intensive than data collection for other entity types. In contrast, animal feed, composting, and industrial uses entities are fewer in number and already have established reporting channels to state agencies, if not at the desired level of detail.

Table 4 summarizes the agreed upon data collection priorities for our evaluation.

Figure 3. Ecology Organic Waste Hierarchy

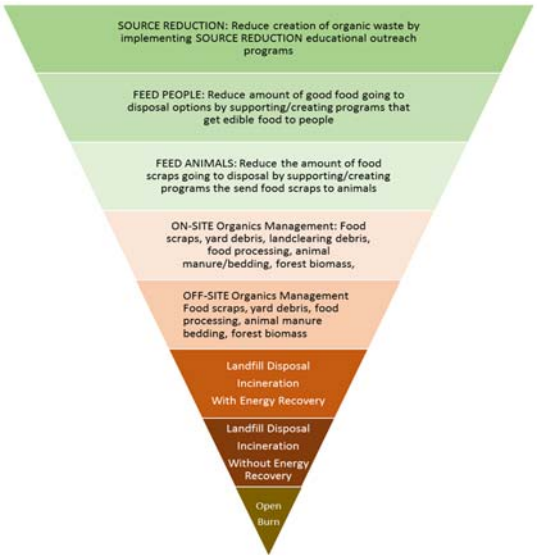


Table 4. Data Collection Priority by Entity Type

Entity Type	In-Scope Entity Classifications	Priority	Primary Agency Partner for Data Collection
Hunger Relief	• Food pantries, food banks, and meal programs, segmented by geography: urban/rural and east/west	High	WSDA
Animal Feed	• Farms • Licensed feed distributors • Pet food companies	Mid-Low	WSDA
Composting	• Commercial composters	Mid-Low	Ecology
Industrial Uses	• On-farm anaerobic digestors • Small-scale digesters	Mid-Low	Commerce

Review Available Data and Literature

Working in partnership with Core Team members and SME workgroup participants, we identified, obtained, and compiled the data sets and literature outlined in Table 5.

Table 5. Evaluation Data and Literature Sources

Entity Type	Sources	Type of Information Provided		
		Entity Lists and/or Number of Entities	Sources, Disposition, Measurement	System Capacity, Challenges, Opportunities
Cross-Cutting	ReFED: A Roadmap to Reduce U.S. Food Waste By 20 Percent (Cirilli, et al., 2016)			✓
	Food Waste Reduction Alliance (FWRA) Analysis of U.S. Food Waste Among Food Manufacturers, Retailers and Restaurants (BSR, 2014)		✓	
	Food Waste Reduction Alliance (FWRA) 2016 Analysis of U.S. Food Waste Among Food Manufacturers, Retailers, and Restaurants (FWRA, 2016)		✓	
	WA Department of Ecology 2015-2016 Washington Statewide Waste Characterization Study (Cascadia Consulting Group, 2018)		✓	
Hunger Relief Organizations	List of EFAP and TEFAP Contractors and Subcontractors (WSDA, 2019)	✓		
	Food Lifeline Food Bank Activity Report (Food Lifeline, 2019)	✓	✓	
	Northwest Harvest Annual Report, 2017-2018 (Northwest Harvest, 2019)	✓	✓	
	Farm to Food Pantry Report (Rotary First Harvest, 2018)	✓	✓	
	Second Harvest Accountability Report 2019 (Second Harvest, 2019)		✓	
	Report: Modeling the Potential to Increase Food Rescue (Natural Resources Defense Council, 2017)		✓	✓
	Draft Report: StopWaste Prepared Food Rescue Study Project Summary (Cascadia Consulting Group, 2019)		✓	✓
	Webinar: Better Together: Rood System Best Practices for Navigating COVID-19: Logistics (ReFED, 2020)		✓	✓

Entity Type	Sources	Type of Information Provided		
		Entity Lists and/or Number of Entities	Sources, Disposition, Measurement	System Capacity, Challenges, Opportunities
	Healthy Food Availability & Food Bank Network Report. Report for City of Seattle and Seattle City Council (Bolt, et al., 2019)			✓
	Report: Food Waste Prevention and Recovery Assessment 2015, SPU and Seattle Office of Sustainability and Environment (Otten, Diedrich, Getts, & Benson, 2015)			✓
	Report: A Tipping Point: Leveraging Opportunities to Improve the Nutritional Quality of Food Bank Inventory (MAZON, 2018)			✓
	Report: Food Waste Intervention Evaluations: A Systematic Review (Hecht & Neff, 2019)			✓
	Excess Food Opportunities Map Version 2.0 – supporting data files (U.S. EPA, 2019)		✓	
	Report: Needs Assessment of the Rural and Remote Member Food Banks of the California Association of Food Banks (Nutrition Policy Institute, University of California, 2017)			✓
Animal Feed Operations	List of licensed feed distributors (WSDA, Animal Feed Distributors Licensees (In-state), 2019)	✓		
	USDA Agricultural Census, WA State (USDA National Agricultural Statistics Service, 2012)	✓		
	Commercial Feed Licensing Information (WSDA, 2020)		✓	
	Animal feed distribution July '18- June '19 (WSDA, 2020)		✓	
	Interview with Leann Krainick of Krainick Dairy (Krainick, 2020)		✓	✓
Industrial Uses	Report: Promoting Renewable Natural Gas in Washington State (WA Department of Commerce and WSU Energy Program, 2018)	✓		✓
	Article: Economics of Dairy Digesters in Washington State (Kennedy, 2013)			✓
	Report: Biogas and Renewable Natural Gas Inventory SB 334 (2017): 2018 Report to the Oregon Legislature (Oregon Department of Energy, 2018)			✓

Entity Type	Sources	Type of Information Provided		
		Entity Lists and/or Number of Entities	Sources, Disposition, Measurement	System Capacity, Challenges, Opportunities
	Anaerobic Digester Project and System Modifications: An Economic Analysis (Washington State University Extension, 2012)			✓
Compost Facilities	2017 WA Composted Materials (WA Department of Ecology, 2019)	✓	✓	
	2018 WA Composted Materials (WA Department of Ecology, 2020)	✓	✓	
	Report: Organic Materials Management in King County (King County Dept. of Natural Resources and Parks, 2019)			✓
	Report: SB 1383 Infrastructure and Market Analysis (CalRecycle, 2019)			✓
	Article: Integrating Anaerobic Digestion with Composting (BioCycle, 2014)			✓
	Report: Value of Compost in Agricultural Uses (Brown, 2019)			✓
	Report: Market Assessment for Organic Materials in King County (Cascadia Consulting Group, 2015)			✓
	Report: Commercial Compost Application in Western Washington Farms (Collins, Harness, & Bary, 2016)			✓
	Report: Organic Materials Management in King County (King County Dept. of Natural Resources and Parks, 2019)			✓
	Report: Yes! In My Backyard: A Home Composting Guide for Local Government, Institute for Local Self-Reliance (Platt & Fagundes, 2018)			✓
	Report: Composting in America: A Path to Eliminate Waste, Revitalize Soil, and Tackle Global Warming (U.S. PIRG and Frontier Group, 2019)			✓
	Report and Toolkit (Washington State Organics Contamination Reduction Workgroup, 2017)			✓
	Report: Advancing Organics Management in Washington State: The Waste to Fuels Technology Partnership (Waste 2 Resources, 2016)			✓

Conduct Interviews and Surveys

After reviewing available data and literature, we conducted interviews and surveys with relevant stakeholder groups to aid in filling data gaps.

- Hunger Relief Organizations. The interview guide, found in Appendix B: Hunger Relief Interview Guide, was developed with input from Katie Rains (WSDA), Kyle Merslich (WSDA), and Trish Twomey (WA Food Coalition). Due to disruptions caused by the COVID-19 pandemic during this evaluation's timeframe, it was never administered. The guide was intended to be administered digitally as an email attachment or verbally as a phone survey.
- Animal Feed Distributors and Farm Recipients. Cascadia conducted one-on-one interviews with staff at WSDA and Krainick Dairy.
- Compost Facilities. The interview guide, found in Appendix C: Compost Facility Interview Guide, was developed with input from Mary Harrington (Ecology). The goal of this guide was to collect information from permitted compost facilities processing food waste. It was sent to composters as an email attachment to be completed digitally, with the option of calling the contact information listed by phone to complete the survey verbally. Cascadia pre-filled the previous year's reporting totals in each category within the survey. Survey responses are included in Appendix D: Compost Facility Survey Responses.
- Anaerobic Digesters. Cascadia conducted one-on-one interviews with staff at Commerce, Ecology, and Impact Bioenergy.
- Emerging Technologies. Cascadia interviewed staff at the biofertilizer company WISErg.

Conduct Data Modeling

To estimate the quantity and quality of food waste and wasted food flowing through each segment of the statewide food handling system by sources and disposition, Cascadia worked with ERG (Eastern Research Group, Inc.) to create a data model.

Twelve generators of food waste are individually evaluated in the model:

Food Waste Generators

- Farms
- Manufacturing
- Residences
- Consumer-facing Businesses*

** Consumer-facing businesses include:*

- Institutions of Higher Education
- Hospitals
- Hotels and Motels
- K-12 Schools
- Nursing Homes
- Prisons
- Restaurants
- Supermarkets
- Wholesale Distributors

Generated food waste and wasted food is allocated among two disposal and seven recovery pathways.

Disposal

- Landfill
- Waste-to-Energy Combustion

Recovery

- Donation
- Agriculture Products
- Anaerobic Digestion
- Animal Feed
- Bio-based Materials
- Composting
- Land Application

To the extent possible, the model relies on data specific to food waste recovery and disposal in Washington State. State specific data was available for seven of the nine food waste and wasted food management pathways shown above. These records are deemed to be of high quality. Recovery of food waste via agricultural and bio-based products recovery pathways was estimated based on national recovery statistics for manufacturers, restaurants, supermarkets and wholesale distributors. The most recently available data were used for all estimates. Model results estimate annual food waste generation, recovery and disposal in Washington State for a representative period between 2016 and 2019.

Washington State data generally provided estimates of food waste recovery and disposal via individual pathways (i.e. landfill, compost, etc.). National sampling study estimates of food waste generation, recovery, and disposal provide more detail and insight into the generation of food waste for the following generating sectors: higher education, hospitals, hotels, K-12 schools, nursing homes, prisons, restaurants, supermarkets and wholesale distributors. Washington State data was used directly to supply food waste generation estimates for farms and residences. A mixture of national sampling estimates and Washington State data was used for the manufacturing sector. Estimation methods based on national sampling data are independent of Washington food waste disposal statistics and do not perfectly match reported data totals for Washington State. An iterative process was used to facilitate convergence of the food waste model with Washington State data totals of food waste management pathways.

Original model estimates of food waste generation, prior to model fitting, yielded a value 2.7 percent greater than the quantity indicated by Washington State data records. The model fitting procedure reduced this discrepancy to 0.18 percent and aligned estimated disposal and recovery pathways with data available for Washington State filling in gaps with reasonable national estimates.

Detailed documentation of food waste estimation procedures and sources can be found in Appendix A: , and the accompanying MS Excel model (model). Review of the model, particularly the range in documented food waste generation factors, estimation procedures and food waste management pathway distributions, will help give context to the certainty or uncertainty with which individual sector estimates should be viewed.

Key Food Waste Generation Assumptions

- Excess farm production donated to food banks, food pantries, and other donation-based distribution programs is the only source of food waste produced by the farming sector that is considered in this analysis; food purchases and food from federal commodities programs distributed by donation organizations is outside the project's scope and was excluded from the analysis.

- Food waste generated by other minor sources (e.g. office buildings, sports venues), not explicitly calculated by the model. These tons are distributed among the twelve included generators. Based on the model's structure, most of this waste is expected to be distributed among the nine consumer-facing businesses, potentially overestimating food waste generated by these nine sources. Given the quality of the match between the original estimation and reported data for Washington State, prior to model fitting, distortions in model results caused by this procedure are expected to be minor.

Key Food Waste Management Assumptions

- A Washington State waste characterization study for 2015-2016 was used to estimate the quantity of food waste present in disposed MSW (16 to 17 percent depending on region) and the share of disposed MSW from commercial and residential sources (CCG, 2018).
- Generated food waste was allocated to the three common routes of municipal food waste disposal (compost, combustion, and landfill) based on total food waste disposal via these three pathways in Washington State for Institutions of Higher Education, Hospitals, Hotels and Motels, K-12 Schools, Nursing Homes, Prisons, and the non-edible share of donated food.
- Washington State data for 2018 was used to quantify food waste processed at commercial composting facilities. Food processing waste was assumed to be produced by the manufacturing sector. Post-consumer food waste and yard debris/food scraps were allocated among residential and commercial generators based on data provided by the Washington State Department of Ecology. The quantity of food waste present in mixed yard debris/food scraps was assumed to be 10 percent based on limited compost facility survey data.
- Estimates of food waste used as animal feed include animal products, brewers waste, distillers waste, screenings, and human food by-products.
- All food processing waste going to anaerobic digestion and land application was assumed to be produced by the manufacturing sector.

Data Limitations

The most significant limitation of this evaluation was the availability of data, which Cascadia recognized during the data collection process and took steps to address, with varying levels of success. This limitation was attributable to three main factors:

- Some data owners, such as animal feed manufacturers, large hunger relief organizations, and compost facilities, were nonresponsive to multiple requests for information. This could be due to factors such as protectiveness of proprietary data and limited resources.
- Once the need for additional, concerted outreach to hunger relief data holders was identified, the outbreak of the COVID-19 pandemic rendered this impractical and inappropriate given these organizations' important role in meeting basic needs of those impacted during the crisis.
- Where data were available, they were provided in aggregate (i.e., total tons handled) rather than tons disaggregated by sources and dispositions. These data begin to answer the research questions, but several large and significant gaps remain where we will recommend future research in below sections.
- National sampling data was used to estimate food waste generation for higher education, hospitals, hotels, K-12 schools, nursing homes, prisons, restaurants, supermarkets and wholesale distributors having no comprehensive availability at the state level.

- National sampling data was used to estimate food waste disposal and recovery for restaurants, supermarkets and wholesale distributors due to a lack of state specific data. Other institutional food waste generators were assumed to dispose of food waste via the available municipal recovery and disposal system which includes composting, landfill, and controlled combustion.
- As with all models, this model is limited by the quality of the data upon which it is based. The model estimates very specific values but should only be viewed as estimates with one or two significant figures.

FINDINGS BY ENTITY TYPE

Hunger Relief Organizations

Summary of Entities

Using available data from Food Lifeline and WSDA, combined with online impact and activity reports, Cascadia estimates between 652 and 724 unique hunger relief organizations are operating in Washington State (Food Lifeline, 2019; WSDA, 2020; Second Harvest; Northwest Harvest, 2019; Harvest Against Hunger, 2020; WSDA, 2020). These numbers are shown in Table 6. The longest list of entity names came from a list of recipients of food from the Emergency Food Assistance Program (EFAP) and The Emergency Food Assistance Program (TEFAP), which operate at the state level and the federal level, respectively, to provide funding for hunger relief organizations to purchase food. Another entity list was provided by Food Lifeline.

The list of EFAP and TEFAP recipients and the Food Lifeline entity list combined tell us that there are at least 652 unique hunger relief organizations in Washington State, with 112 organizations appearing on both lists. Representatives from WSDA estimate that the 652 entities represent 90 percent of hunger relief organizations in Washington State, but additional research is necessary to verify this estimate. In addition, there are likely small-scale local nonprofits that do not receive food from any of these distributors, although the quantities they receive and distribute are most likely comparatively small.

Table 6. Hunger Relief Organizations Served by Food Distribution Organizations and Programs in Washington State

Organization or Program	Number of Hunger Relief Organizations Served in WA	Data year
EFAP and TEFAP	543	2019
Food Lifeline	221	2019
Second Harvest	227	2019
Northwest Harvest	375	2018
Farm to Pantry	163	2019

These entities can be further classified based on function and location. There are three main types of hunger relief organizations, differing in customers served, products distributed, and associated logistics:

- **Food banks** store and distribute large quantities of food to food pantries with little to no distribution of food directly to individuals.
- **Food pantries** distribute food directly to individuals, particularly shelf-stable items and other types of groceries.
- **Meal programs** serve or distribute one or more meals per day to individuals.

In Washington State, hunger relief organizations can face different challenges depending on geography. Eastern and western Washington differ based on population density and available transportation corridors, providing different operating contexts for hunger relief. Urban and rural hunger relief organizations face different challenges and opportunities related to the density of donors and individual recipients, transportation, etc. (Bolt, et al., 2019) (Nutrition Policy Institute, University of California, 2017).

Flow of Food

Hunger relief organizations obtain food through both donation and purchase. Donations of edible food come from a variety of sources. This food is not considered waste unless it is not served to customers and is subsequently sent to composting, disposal, or some other food waste management pathway. While providing the essential service of feeding hungry people, Washington State's hunger relief system also prevents 49,802 tons of food from entering food waste management pathways each year. Understanding the capacity of hunger relief organizations to handle a potential increase in donated food is important to understanding the effects on the state's food waste management system.

Of the 49,082 tons of food donations managed by Washington hunger relief organizations in 2019, approximately 54 percent was from grocery retail donors, 13 percent was from manufacturers and processors, 20 percent was from restaurants, institutions, and other commercial kitchens, and 13 percent was from farms, as illustrated in Figure 4. Available data do not permit further disaggregation of these numbers by food banks, food pantries, and meal programs, respectively.

Figure 4. Sources and Dispositions of Food for Hunger Relief in Washington State (tons)

Metrics and Reporting Protocols

Washington State's hunger relief system is highly diffuse, with few centralized sources of data. The centralized data sources include: Feeding America affiliates Food Lifeline and Second Harvest, statewide agency Northwest Harvest, and EFAP and TEFAP There are currently no standard protocols for reporting annual tons of donated food managed by hunger relief organizations—outside of EFAP and TEFAP, which distribute federally subsidized food purchases—to WSDA or any other State agency. There is a voluntary process for hunger relief organizations to report pounds of donated food received to Ecology, but the low totals indicate that there are minimal rates of participation in this reporting (WA Department of Ecology, 2017).

The metrics consistently tracked and reported by hunger relief organizations are pounds of food managed and pounds of food distributed (as groceries by food banks and pantries or as meals by meal programs).

Capacity

This section summarizes capacity challenges and opportunities from Cascadia's experience and a review of available literature.

Challenges

Challenges commonly facing hunger relief organizations are numerous and well-documented. Challenges discussed here include limited resources, lack of accurate and robust data across the system, need for nutritious and diverse foods from donors, and better communication with and training for donors.

Limited Resources and Silos

Limited funds, space, and infrastructure, such as vehicles and cold storage, are nearly ubiquitous challenges cited by hunger relief organizations (Hecht & Neff, 2019). These limitations can make it difficult for hunger relief organizations to accept as much nutritious produce and other perishable items as they would like, re-package bulk donations, and spend time on sorting, pickups, and delivery (Otten, Diedrich, Getts, & Benson, 2015). At times, staff report that the time spent seeking grants can limit operations (Hecht & Neff, 2019). Limited funding also means that many organizations must rely on volunteers, which introduces management challenges and some unreliability in operations (Hecht & Neff, 2019).

Specific needs vary among different sizes of organizations, but the theme of resource limitations remains the same. According to a Natural Resources Defense Council (NRDC) survey, the smallest organizations tend to desire funding for paid staff, mid-sized organizations indicate interest in more vehicles and funding to maintain them, and large organizations most frequently ask for larger facilities (Berkenkamp & Phillips, 2017).

In Seattle, the ongoing Food Rescue Innovation Initiative has found that resource limitations, combined with the siloed nature of hunger relief organizations, has led organizations to feel that they are competing for scarce funding, food, storage, transportation, and volunteers. In the Seattle area, each organization is operating separate vehicles, volunteers, staff, and facilities, creating nearly complete silos. There are ways for organizations to work together to share resources and build efficiencies, but the sense of competition between organizations leads to a lack of transparency and trust, which causes low levels of communication and collaboration to pool resources and coordinate logistics, which means that all organizations have insufficient equipment and staffing (Cascadia Consulting Group, 2020).

Communication with Donors

Hunger relief representatives list communication with donating businesses as a challenge, especially around training and coordination. Insufficient communication between donors and recipient organizations can result in missed opportunities and avoidable waste. The NRDC agrees that in the cities their team has studied, coordination and training of donors is important to improve logistical efficiencies and increase the volume of donations (Berkenkamp & Phillips, 2017). When communication channels are strong between donors and or, food donations can be better shared or transferred between organizations within food safety windows.

In addition, there is a need among donors for educational materials about how to donate and handle food safely for donation and what the incentives are (Hecht & Neff, 2019). There is a lack of knowledge among donors of different business types about where, how, and what to donate (Cascadia Consulting Group, 2019).

Lack of Data Across the Hunger Relief System

Resource scarcity, silos, and lack of communication have contributed to a significant data deficit that prevents a complete picture of the recovery of food through hunger relief in Washington State from coming into view. One of the gaps identified in this evaluation has been easily accessible data around the quantity, quality, and type of foods being recovered by hunger relief organizations and where those foods are distributed, consumed, and wasted at various stages. This lack of data creates challenges for the hunger relief system itself, since there is minimal clarity around certain aspects of logistics, inventory management, and patterns and opportunities that could inform decisions about staffing, fundraising, and more, and help organizations attract data-driven funders. In particular, real-time data—or at least data tracked more regularly than quarterly or annually for reporting—would help hunger relief organizations make timely operational decisions (Anzilotti, 2020).

Need for Nutritious Donations

Many organizations report a need for higher quality donations (Hecht & Neff, 2019; Otten, Diedrich, Getts, & Benson, 2015). For example, in Seattle, grocery donation recipients have noted a consistent oversupply of bread (Cascadia Consulting Group, 2020). On average nationally, according to a survey of 196 food banks completed by MAZON, fresh fruits and vegetables comprise nearly one third of food bank inventory distributed, while one quarter is made up of unhealthy beverages and snack foods. Nearly half of food banks do not use a system to track nutritional quality, but those that use a tracking system report healthier inventory than those without tracking systems (MAZON, 2018). It is important to note that an organization's access to cold transportation and storage is linked to their capacity to accept more nutrient-dense foods such as meat, dairy, and fresh produce.

Challenges Highlighted by the COVID-19 Pandemic

During the significant and unprecedented disruptions caused by the COVID-19 pandemic, the challenges discussed above have been exacerbated and new ones have become clear, including a lack of:

Flexibility in sourcing donations: During Washington's statewide Stay-at-Home, all but "essential" businesses have been shuttered, including bars, restaurants, hotels, catering companies and other common and previously reliable sources of food donations (Kim, 2020). Grocery stores are largely still operating, but increased demand for grocery items has reduced the volume of food available for donation. Traditional donation streams to hunger relief dropped suddenly by about 75 percent (ReFED, 2020). Some organizations are equipped with web portals and other logistics solutions to accept donations from new upstream sources, such as distributors and farms, but many are not (ReFED, 2020).

Staffing and capacity: Due to the public health crisis, numbers of volunteers have plummeted, leading to staffing shortages at many hunger relief organizations (Guarente, 2020). At the same time, the business closures and

disruptions have created rapidly rising unemployment rates—a trend not isolated to Washington. Demand for food assistance has risen in parallel, with some hunger relief organizations facing demand three to five times higher than levels before the pandemic (ReFED, 2020).

Flexibility in food delivery: Many of those requiring food assistance are homebound seniors or people with health vulnerabilities who are unable to travel for food. Some meal programs that many people relied on for food are now closed due to health or staffing concerns. As a result, last-mile delivery to individuals is a new and significant need to provide hunger relief (ReFED, 2020).

Opportunities

Prepared Food Rescue

Prepared food rescue has been called the next frontier of food donation (Ambroz, 2017). NRDC's 2017 report, "Modeling the Potential to Increase Food Rescue: Denver, New York City and Nashville," noted that more than one third of all untapped donation potential under an ambitious scenario could consist of prepared food items (Berkenkamp & Phillips, 2017). Cascadia's interviews with businesses in Alameda County, CA also found that prepared food is a common item available for donation at hotels, hospitals, catering companies, and grocery stores (Cascadia Consulting Group, 2019). NRDC's report notes that prepared, ready-to-eat foods can be useful to meal programs at homeless shelters, senior meal services, and similar scenarios that often serve the most acutely food insecure populations (Berkenkamp & Phillips, 2017).

Rescuing prepared food comes with some logistical considerations. Indeed, there is so much remaining potential for this type of food to be rescued because there are logistical challenges for both donors and recipients, including short food safety windows, packaging and chain of custody requirements, and, among donors, fear of liability (Cascadia Consulting Group, 2019). The greatest potential for prepared food rescue could lie in urban locations as there is a concentration of potential donors and recipients of food, and it may be more feasible to deliver and use food within short safety windows than in less dense areas (Berkenkamp & Phillips, 2017).

Communications and Logistics Solutions

The consistent challenge of limited resources, the COVID-19 crisis, and the opportunity of prepared food all reinforce the need to create efficiencies within the hunger relief system. While Food Lifeline and Northwest Harvest play significant roles in connecting business donors to food pantries and meal programs, the subsequent work to transport, store, and redistribute this food is primarily done by last-mile organizations who directly serve individuals and families. For the most part, last-mile organizations operate their own facilities, vehicles, staff, and volunteers. This complex system produces siloed organizations with few incentives or tools for efficient collaboration and pooling of resources. Organizations rely on informal networks, such as email lists and phone calls, to distribute and share food and other supplies. However, these networks do not provide the real-time capacity necessary to effectively redistribute food within the food safety window. A lack of accessible tools for real-time communication among organizations and between organizations and donors contributes to perceived scarcity, missed opportunities, and waste (Cascadia Consulting Group, 2020).

There is a myriad of technology-based logistics solutions, both for-profit and nonprofit, on the market to connect the dots between donors and recipient organizations and to ensure that food is allocated appropriately within the hunger relief system. These systems can also support tracking and reporting, which would enable staff to reduce the steps they take to record food volumes, types, and waste. As they become more widespread and sophisticated, and if it is possible to integrate their results, these tools may be able to give local and/or state agencies a real-time window into the capacity of hunger relief organizations and a better ability to respond to their needs.

Seattle Public Utilities is currently researching a pilot program to use a food recovery logistics app in Seattle. (Cascadia Consulting Group, 2020). We recommend that state agencies seek opportunities to support this work. The pilot aims to:

- Enable food donors and hunger relief organizations to share food and resources efficiently to distribute food within safety windows without adding costs.
- Connect volunteers with organizations when and where they are needed most.
- Provide hunger relief organizations with real-time access to information about the types, quantities, and locations of food available for recovery.
- Reduce the amount of food going to compost and landfill and increase the amount of food delivered to hunger relief organization clients.
- Build on or connect with existing systems that hunger relief organizations use so that implementation is streamlined and scalable.
- Provide information that reduces gaps around transportation logistics and storage.

Recommendations for Filling Data Gaps

While we are loath to propose imposing additional reporting requirements on already overburdened and under-resourced hunger relief staff, the centralized availability of the data described in this section would provide insights that could be used to inform future investments in infrastructure, program development and staffing, and logistics coordination. As mentioned above, we were unable to engage in dialogue with these organizations during this evaluation. We recommend that Ecology and WSDA conduct further dialogue with these stakeholders before instituting any new reporting requirements.

Centralized Annual Reporting of Quantitative Hunger Relief Data

To facilitate consistent, ongoing tracking of the quantity and quality of potentially wasted food being donated to hunger relief organizations in support of HB 1114, we recommend that WSDA expand its annual reporting protocols to include large hunger relief distribution networks in addition to existing EFAP and TEFAP reporting protocols, then forward information to Ecology. Requested data would ideally include:

- A complete list of unique hunger relief organizations served annually. While there are undoubtedly independent, community- and faith-based organizations operating outside of the major hunger relief distribution networks, this approach would go a long way toward obtaining a comprehensive listing of the hunger relief organizations operating in Washington State.
- Tons of food managed annually, disaggregated by source and disposition:
    - Donated vs. purchased. The primary publicly available dataset containing tons of food managed by hunger relief organizations in Washington State is for the EFAP and TEFAP programs, which provide federally subsidized food. Given this, it is difficult to ascertain how much of the food currently entering hunger relief organizations in Washington State would otherwise have been wasted. Tracking how much food is donated versus how much is purchased is one—albeit imperfect—way to reach this understanding. Tracking quantities of donations and purchased food can also provide insights about the extent to which the quantity and quality of food donations are meeting the needs of the state's hunger relief organizations.

- **Donor or seller type.** Understanding the major sources of donated and purchased food can help to prioritize future efforts to improve the quality of food entering the state's hunger relief system. This information can also help to shape future waste prevention efforts.
- **Location (zip code).** Location information can inform future investments in infrastructure, program development and staffing, and logistics coordination.
- **Tons of food distributed and/or served to customers annually.** Tonnage information, when combined with the number of customers served annually, can provide insights into the scalability of current hunger relief infrastructure, staffing, and donation levels.
- **Number of individuals served.** As noted above, this number's changes over time can give insight into the need for any additional hunger relief capacity, including infrastructure, staffing, and donation levels.
- **Tons of food received but not distributed or served to humans annually (food waste and wasted food)**, i.e., sent to composting, disposal, or some other food waste management pathway. There is very limited understanding of how much food received by hunger relief organizations goes to waste, either because food was donated in an unusable state or because logistics or management processes at the organization resulted in waste. Measuring quantities of food wasted is an important step that would shine a light on donation dumping by donors, increase understanding of whether there are categories of food that are difficult to work with or that are donated in excess, and open the black box of food waste drivers in hunger relief organizations.

Conduct Barriers and Opportunities Study by Entity Type and Geography

Numerous reports based nationally and in urban areas of Washington State and case studies from different parts of the country list challenges that are unique to different types of hunger relief organizations such as food banks, food pantries, and meal programs. Cascadia recommends conducting interviews or focus groups with hunger relief organizations of different types and in different locations (urban/rural and eastern/western Washington) to glean insights about unique barriers and opportunities where local, regional, and State agencies could provide support.

Conduct Generator-Based Waste Characterization Study of Hunger Relief Organizations

We also recommend conducting a generator-based waste characterization study of a representative sample of hunger relief organizations and donors to develop a more nuanced look at hunger relief organizations' waste streams. A primary data collection effort of this nature, conducted regularly by a state agency, can fill data gaps with comparatively less intrusion than adding new, more detailed reporting requirements for hunger relief organizations. This data collection should be in collaboration with an advisory committee like the Hunger Relief SME Working Group that has advised the Plan. The methodology for the study should interact with the Barriers and Opportunities study recommended above, if it occurs, and can include:

- **Surveys and interviews** with food donors, intermediaries, and recipients. As part of this evaluation, Cascadia developed a survey guide, which is available in Appendix B: Hunger Relief Interview Guide.
- **On-site weighing** of food donations at food rescue facilities, noting what proportion of donations is usable.
- **On-site counting** of meals served at meal programs.
- **Measurement of hunger relief waste streams** through review of disposal tonnage data from waste hauling bills and/or generator waste characterization studies. Waste characterization studies are more expensive but also provide richer data about what is being disposed that could inform future studies and policies related to drivers of food loss at hunger relief organizations.

After completing local data collection activities, we recommend producing an adjustable model that WSDA or Ecology can use to track food rescue progress going forward. The model could contain and document any primary assumptions; store demographic data; model tons by source and food types rescued; produce sensitivity analyses based on variation in reported tons, participation rates, and rescue efficiency rates; and provide a framework for ongoing data collection and reporting. We also recommend consulting the advisory committee after data collection to identify areas where additional due diligence is warranted.

Measure Edible Portions of Disposed Food in Statewide Characterization Studies

Statewide waste characterization studies are the best way to capture a comprehensive picture of disposal and recovery across the state. Ecology commissioned Cascadia to conduct a statewide municipal solid waste (MSW) characterization study in 2009 and 2015 and has enlisted them to conduct another study in 2020. For the 2020 study, Cascadia has recommended updating the material categories to support data collection for food waste reduction and management and has thus defined the material categories to distinguish between edible and inedible food items to assess donation potential. Cascadia has developed and refined applicable material categories during other statewide and local waste characterizations and looks forward to applying them in Washington State.

Animal Feed Distributors and Farm Recipients

Summary of Entities

In Washington State, there are 136 licensed commercial feed distributors that distribute feed in ingredient categories that meet this evaluation's definition of food waste. These categories are:

- Brewers
- Distillers
- Animal Products
- Human Food By-Products
- Screenings

Except for *Human Food By-Products*, all these ingredient categories appear to consist only of food processing waste. The *Human Food By-Products* category also includes some types of food processing waste, as well as restaurant food waste and recovered retail food (WSDA, 2018). There are six commercial feed companies that are licensed to distribute *Human Food By-Products*. Definitions of the ingredient categories considered as food waste for this evaluation are located in Appendix E: Animal Feed Food Waste Categories

Additional entities that create animal feed from food waste are farms and pet food manufacturers (Phillips-Donaldson, 2019; Pope, 2014), but our research did not identify any data about which farms and pet food manufacturers use food waste or how much food waste enters this management pathway, because registration and permitting processes do not require disclosure of this information (WSDA, n.d.).

Krainick Dairy, located in Enumclaw, Washington, is one dairy farm that uses spent grain and bakery items as feed for cows (Krainick, 2020). Krainick Dairy is a very large dairy farm in Washington State with 3,000 heads of cattle. In 2018, the Washington Dairy Nutrient Management Program listed 320 dairy farms in the state, including 106 large dairies, each with over 700 heads of cattle (WSDA- Dairy Nutrient Management Program, 2018).

Flow of Food

Between July 2018 and June 2019, licensed commercial feed companies distributed 1,494,807 tons of food waste ingredients as feed. The vast majority of this amount (92%) was distillery waste, with small percentages composed of *Brewery Waste, Animal Products, Human Food By-Products,* and *Screenings*, as shown in Table 7.

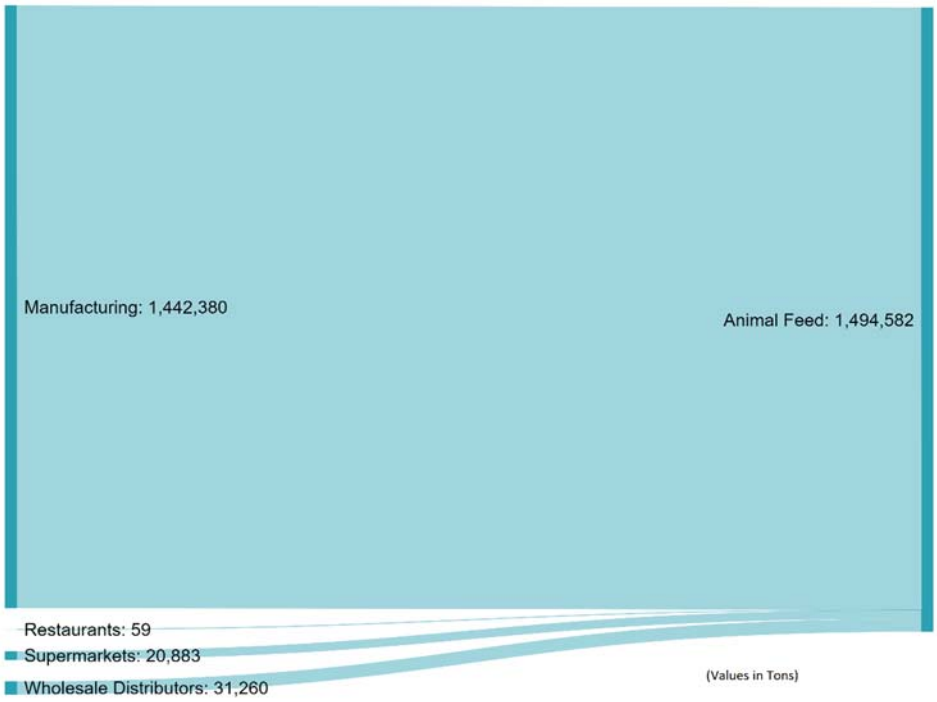
Table 7. Commercial Feed Distributed by Ingredient Category

Food waste ingredient category	Tons distributed July 2018-June 2019	% of total food waste tons distributed
Brewers	7,808.37	0.5%
Distillers	1,373,465.78	92.0%
Animal products	10,832.68	0.7%
Human food by-products	17,077.78	1.1%
Screenings	85,621.98	5.7%
Total	**1,494,806.59**	**100.0%**

As illustrated in Figure 5, the main source of food waste for animal feed is manufacturing, which contributed 1,442,380 tons of food waste to commercial feed companies, or 96.5 percent of the total, in 2018-2019. Out of all food waste categories going to animal feed, "distillers' products" make up 92 percent. These products include molasses dried solubles, potato dried solubles, dried grains with solubles, wet grains, and more. None of the ingredients within this category is appropriate for donation to hunger relief; animal feed may be the highest and best use for these products. In many cases, distillers and brewers build animal feed destinations into their business models, as donating solubles and grain by-products or selling them at a low cost per ton is much cheaper than paying tonnage fees to send them to landfill or compost (Pope, 2014). This is a unique food waste stream in this regard.

Krainick Dairy accepts approximately 1,500 tons of food waste annually to feed its 3,300 cows. Food and beverage manufacturers, including brewers and a large bakery product facility, contribute all the food waste ingredients that Krainick Dairy accepts as feed (Krainick, 2020).

Figure 5. Food Waste and Wasted Food to Animal Feed (tons)



Metrics and Reporting Protocols

Feed companies must be licensed in order to manufacture or distribute commercial feed in Washington State, or act as a guarantor on a commercial feed label (WSDA, n.d.). Licensed distributors must list specific ingredient categories in their applications and report on the quantities of those ingredients distributed in feed annually to WSDA. The ingredient categories include several that fall under this evaluation's definition of food waste: *Human Food By-Products, Distillers Products, Brewers Products, Screenings,* and *Animal Products* (WSDA, 2018). In the *Human Food By-Products* ingredient category, example ingredients include *Restaurant Food Waste, Recovered Retail Food,* and *Food Processing Waste*. Additional detail about the main sources of *Human Food By-Products* and the associated barriers and opportunities would provide a clearer image of the flow of food through animal feed entities as a food waste management pathway. It is possible to see the aggregate quantity of each ingredient category distributed in a given year, but not to see the quantity per feed company.

Pet food companies are similarly required to register prior to distributing products in Washington State. If a company distributes only pet food, it is not required to apply for a commercial feed license. Pet food registrants submit semi-annual reports of all feed distributed within or into Washington State, but registrations and reports do not contain information about ingredients or ingredient categories used (WSDA, n.d.).

Farms and other recipients of food waste for animal feed do not need licenses or registration to give the feed to their own animals, and there is no reporting process (WSDA, n.d.). Farms are required to hold several different licenses, but feed-related licenses are not required (WSDA, 2019).

Capacity

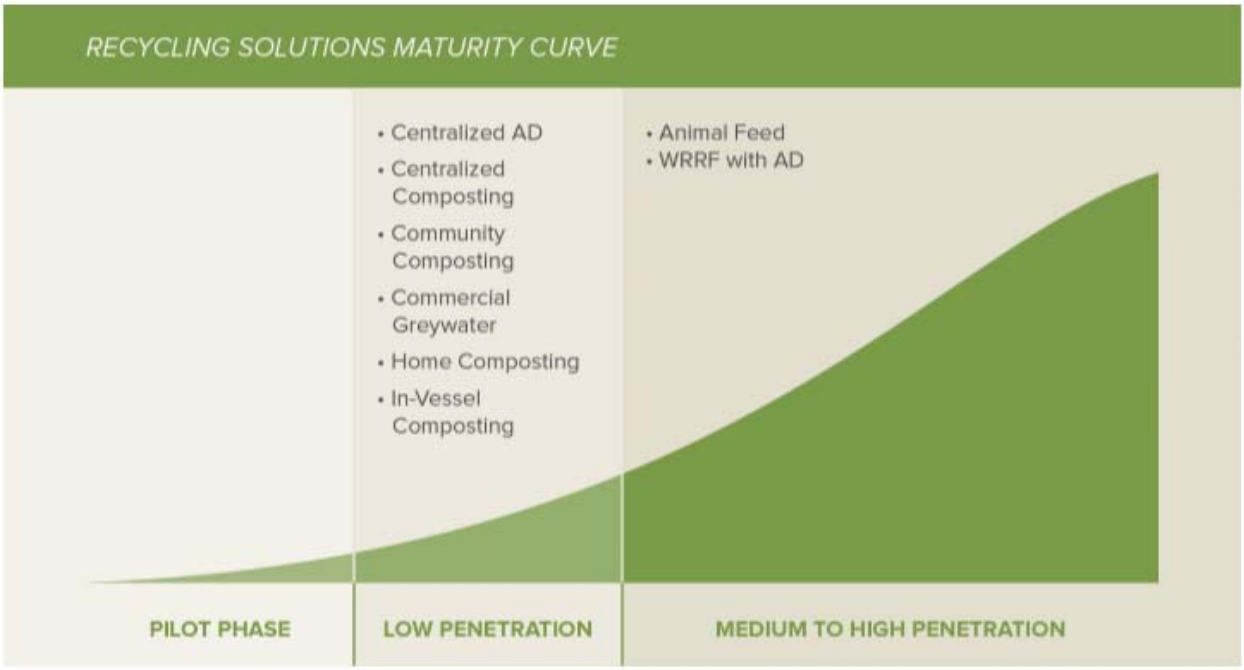
Challenges

The main challenge for expanding animal feed as a food waste management pathway is that, according to the Food Waste Reduction Alliance, the vast majority of food waste appropriate for use in animal feed is already being recovered and used across the United States. Across the country, an estimated 95 percent of industrial food waste is recycled, with 85 percent of this amount being used as animal feed (Food Waste Reduction Alliance, 2013). ReFED notes that this is a relatively successful food waste management pathway due to the predictability of quantity and quality of the waste stream (Cirilli, et al., 2016). Figure 6 shows that, compared to other layers of the organic waste hierarchy, the practice of diverting food waste to animal feed is widespread.

Data used in this evaluation supports the idea that animal feed is near capacity as a food waste management pathway: out of the 1,585,100 tons of food waste generated by the manufacturing sector, 91 percent goes to animal feed. Animal feed is the largest food waste management pathway in Washington State, processing more food waste than all other dispositions combined, including landfill.

According to ReFED, it will be difficult for animal feed distributors to capture the remaining food waste available because the equipment to collect, transport, dry, and treat food waste into a product appropriate for animals is expensive and optimal new locations in proximity to large food waste generators and large animal operations may not exist (Cirilli, et al., 2016).

Figure 6. Comparative Maturity of Animal Feed as Food Waste Management Pathway



(Cirilli, et al., 2016)

At the same time, there are challenges for farms, like Krainick Dairy, that wish to receive food waste directly for their own use as animal feed. Challenges noted in Cascadia's interview with Leann Krainick include:

- De-packaging: Manufacturing is the best source of food waste for animal feed because it does not require de-packaging. Food from grocery stores takes a lot of time and money to de-package.
- Separating meat out of waste: Ruminants cannot have meat in their feed. Some processors cannot or are not willing to separate food waste with meat from food waste without meat, making it unavailable for dairy feed.

- Logistics at manufacturing sites: It can be tricky to negotiate with food manufacturers to find parking for a trailer to collect waste.
- Regulation: Krainick would like to charge manufacturers for the service of collecting and distributing their food waste to other farms but notes that paying for tonnage and feed licensing are a challenge.
- High costs to begin collection: Krainick Dairy has spent over $1 million on trailers and trucks to collect and transport food waste from processors.

Opportunities

The growth of micro-breweries and distilleries in Washington State is promising for farms that would like to directly collect grain for use as animal feed (Forshee, 2015). Over 90 percent of food waste used as feed by both Krainick Dairy and all feed distributors is brewery and distillery spent grain. According to Krainick, it is easiest to begin relationships with small- to mid-sized breweries and distilleries to collect their spent grain.

Opportunities for commercial feed companies are less clear, given that this is a relatively mature pathway and commercial feed companies were not responsive to our requests for information.

Recommendations for Filling Data Gaps

Our evaluation identified several data gaps related to feed distributors, as they were not responsive to our requests for information. Gaps include the specific ingredients within each WSDA food waste feed ingredient category, information about the waste streams of feed distributors, and specific challenges and opportunities faced by feed distributors other than Krainick Dairy. This section offers some recommendations to fill these data gaps.

Augment Annual Reporting of Specific Food Waste Information

To facilitate consistent, ongoing tracking of the quantity and quality of food waste being sent to animal feed in support of HB 1114, we recommend that WSDA update its existing reporting protocols to capture the additional data points outlined below, and forward relevant reporting data to Ecology.

Feed companies: The current reporting protocol is a good starting point. If possible, it would be helpful if the reports also captured:

- The amount of food waste ingredients received by licensees each year, in addition to the ingredients distributed, as this would support more robust state food waste generation estimates.
- Ingredient categories containing food waste clearly marked as "food waste" categories for the purposes of HB 1114. This would benefit data management by maintaining clarity about which ingredient categories are in scope for ongoing measurement and reporting. We recommend that Ecology and WSDA confirm the categories of feed ingredients considered food waste and consistently track relevant metrics for those ingredient categories.
- More detailed information about contents of the human food by-product ingredient category, i.e., what kinds of retail and food processing waste are included. This would provide a clearer image of the flow of food through animal feed as a food waste management pathway by providing information about sources and whether ingredients could be used in higher levels of the EPA waste management hierarchy.
- Whether the weights submitted in reporting are "wet" or "dry." Many feed ingredients, especially grains, go through a drying and powdering process before they are sold as feed, thus removing a high percentage of each ingredient's weight. In order to match distributed feed numbers with food waste generation numbers, the "wet" weight is most relevant (Krainick, 2020; Cirilli, et al., 2016).

Pet food companies: We recommend tracking food waste ingredients in pet food products by including an additional information request on the existing registration and semi-annual reporting forms that define food waste for the purposes of HB 1114. On the registration form, registrants could indicate whether they currently use or plan to use food waste ingredients, and in semi-annual reporting, they could list the amount of food waste ingredients used in the feed distributed within the reporting time frame. As with feed company reporting, it would be helpful if reporting efforts captured the amounts of food waste ingredients received within the report time frame in addition to amounts distributed.

Farms: Although there are currently no required reporting protocols for farms that accept food waste as feed, our evaluation is not recommending adding these, as this may discourage farms from participating in this food waste management pathway. Krainick noted that she views fees and mandatory reporting as a barrier; it is already a major expense for farms to begin collecting spent grain using trailers and trucks, and rigorous reporting would raise barriers higher. From the lack of available, organized information, we believe that this food waste management pathway is based largely on individual relationships between farms and food and beverage processors, and reporting protocols can remain informal.

Waste Data: It is not clear how much, if any, food waste ingredients received by commercial feed distributorsend up in compost or disposal. Information about this waste stream would help with comparing the pounds commercial feed companies report distributing with food waste generated in Washington, since the pounds distributed and pounds to waste should add up to the total amount commercial feed companies receive. and pet food companies

Survey Farms

Our research did not identify data about the number of farms directly receiving food waste as animal feed, likely because individual farms often form direct relationships with nearby food waste generators. We recommend further research into how widespread this practice is by partnering with stakeholders at WSDA to survey animal farms in Washington State. Understanding the extent of direct relationships between generators and farms would clarify how much and what types of food waste is flowing through this pathway.

Compost Facilities

Summary of Entities

In Washington, there are three main types of compost facilities that accept and process food waste: commercial compost facilities, permitted on-site compost facilities, and permit-exempt small-scale composters. Of the 65 permitted compost facilities in the state, 22 of them (34%) accept and process food waste, including eight on-site facilities at universities and correctional centers and 14 commercial facilities (WA State Composted Materials for 2018, 2020). Those 22 facilities processed 46.5 percent of the total food waste feedstocks received by permitted compost facilities in Washington State.

Permitted commercial compost facilities and on-site facilities have different feedstock sources and product end uses, warranting two different sub-entity types for this evaluation.

Flow of Food

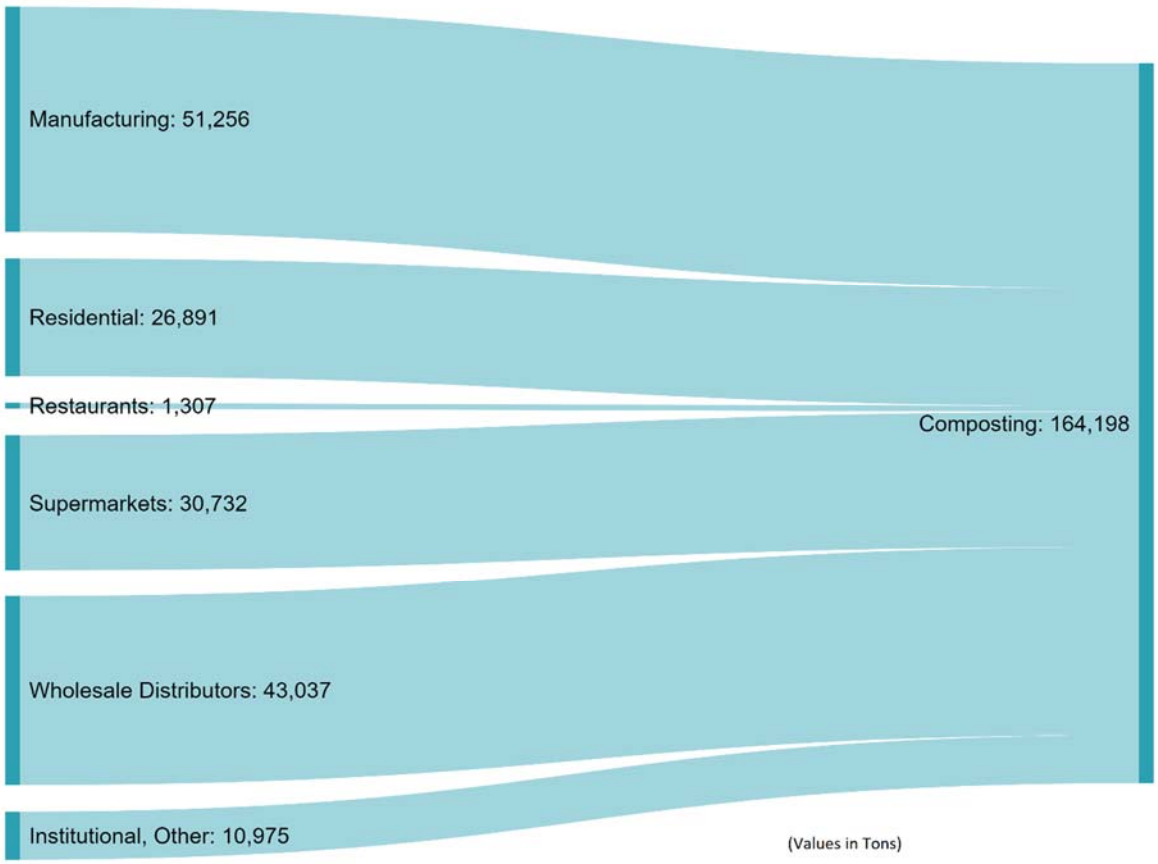
In 2018, permitted compost facilities processed 187,977 tons of food waste. Of this amount, 159,574 tons (85%) came from within Washington State. The in-state food waste tons are 24 percent lower than 2017, when permitted compost facilities processed an estimated 210,865 tons of food waste; this difference appears to be largely due to a

decrease in food waste feedstocks at two compost facilities. One of the two facilities, Boise White Paper, did not accept any food waste feedstocks in 2018; the other, Cedar Grove Maple Valley, dropped from 70,566 tons of food waste feedstocks in 2017 to 49,609 tons in 2018. The data informing our model shows that the combined amount of food waste going to landfill and controlled combustion is six times greater than the amount of food waste going to compost.

The three feedstock categories that permitted facilities must use for reporting to Ecology are *Food Processing Waste* (from manufacturers), *Post-consumer Waste* (from the kitchens included in *Consumer-facing Businesses* for this evaluation, which also includes correctional centers), *Yard Debris/Food Waste* (from residential curbside collection programs). Surveys and WSDA estimates have noted that the *Yard Debris/Food Waste* category is consistently 90 percent yard waste and 10 percent food waste by weight. Our evaluation and model apply this assumption accordingly.

Figure 7 shows the proportion of food waste feedstocks that came from each source to compost facilities in 2018. Most food waste feedstocks came from consumer-facing businesses (52.4%), followed by manufacturers (31.2%) and residences (16.4%).

Figure 7. Food Waste and Wasted Food to Compost in Washington State (tons)



According to the eight facilities that responded to Cascadia surveys, the main outputs of composting are compost and mulch.

Metrics and Reporting Protocols

Compost facilities accepting food waste as a feedstock are required to have solid waste permits if they have "greater than 25 but no more than 250 cubic yards of material on-site at any one time, not to exceed 1,000 cubic yards in a calendar year" (Washington State Legislature, 2018).

Each permitted facility reports the quantity of feedstocks they receive annually by category of feedstock, including food waste categories: *Food Processing Waste, Post-consumer Food Waste, Yard Debris/Food Waste*, and, sometimes, *Other Food Waste* (WA Department of Ecology, 2019) (WA Department of Ecology, 2020).

According to survey responses, facilities may also track (but do not report): contamination levels, moisture levels, and dirt content. They did not inform us about contamination levels of food waste feedstocks.

Capacity

Seven out of eight composter survey respondents indicated that their facilities are currently operating below capacity and could process more food waste than they do now. Among the five permitted facilities that provided their permitted capacities, a comparison with Ecology's 2018 report shows that there is a combined 164,184 tons of excess capacity available (WA Department of Ecology, 2020).[1] Although there is capacity among some composters to accept more food waste, projections indicate that it will fill up quickly, and actual available capacity can be dynamic.

The dynamics behind permitted capacity and real available capacity are complicated. Even if there is capacity available on paper, there may still be challenges to accepting food waste or any additional feedstocks. First, amounts of material entering compost facilities are variable across seasons: some seasons may find facilities with equipment and staff to spare, while others may have them operating at maximum capacity. In addition, factors such as traffic limitations, company affiliations, feedstock quantities, and more can affect daily and seasonal real available capacity (CalRecycle, 2019).

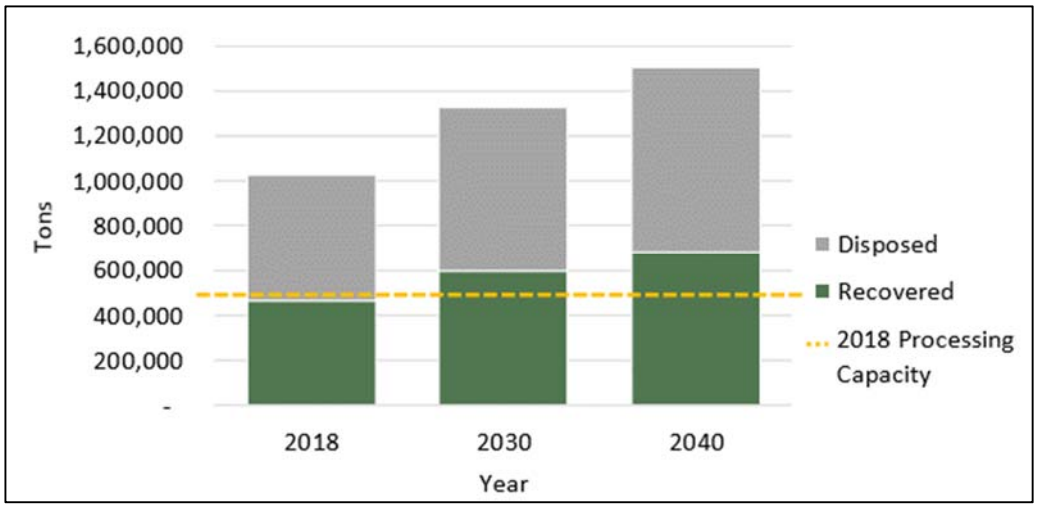
Capacity to receive food waste as a feedstock comes with specific issues and requirements for composters. A statewide survey of composters in California indicated that very few facilities process food waste as more than 30 percent of their feedstocks, though the curbside organics collection program in California is one of the most mature in the country. Despite upcoming statewide mandates for food waste diversion as part of SB 1383, the majority (66 percent) of composters surveyed said they did not have any interest or real capacity to increase the proportion of food scraps received. They cited multiple concerns associated with increasing the amount of food waste received at their facilities, including odors, contamination, the need to amend existing permits, the need to upgrade processing technology, and more (CalRecycle, 2019; Waste 2 Resources, 2016).

Despite this, the supply of food waste feedstocks will grow as streams continue to shift from landfill to compost, making additional permitted capacity at compost facilities critical in the coming years. According to a 2019 projection, organics generation for the region including King and Snohomish Counties is projected to increase 29 percent from 2019 levels by 2030 and 36 percent by 2040, based solely on current per-person generation of organics and available population growth projections. This projection does not assume any future changes in organics diversion behavior, such as increased diversion of organics from disposal to composting (Cascadia Consulting Group, 2019). Figure 8 illustrates projected organics generation increases against current annual

[1] Two respondents listed their permitted capacity in cubic yards; we converted their estimates to tons by assuming that one cubic yard of compost is 1,000 pounds on average (Biernbaum).

permitted capacity at the three composters that accept material from King County and the surrounding region: Cedar Grove (Everett), Cedar Grove (Maple Valley), and Lenz Enterprises. According to these projections, 2018 permitted capacity will be exceeded by 2030 and further capacity will be necessary to capture recovered organics. If diversion rates from landfill to compost increase as expected, the need for additional capacity will be even greater (Cascadia Consulting Group, 2019).

Figure 8. Regional disposal and recovery projections through 2040 in King County, Seattle, and Snohomish County



(Cascadia Consulting Group, 2019)

Challenges

A major statewide survey of respondents in roles throughout the organics management industry noted three main challenges to expanding composting: eliminating contamination, overcoming reluctance by residents to having new facilities near their homes, and controlling odors and air pollution (Waste 2 Resources, 2016). Survey responses collected for this evaluation echoed these challenges, as listed in Table 8. These responses support several known challenges for compost facilities that anticipate receiving an increased amount of food waste, described in the sections below.

Table 8. Challenges Noted by Composter Survey Respondents

Specific Challenge	Commercial Composters (out of 5 respondents)	On-site Composters (out of 3 respondents)	Total
Worried about odor	3	1	4
Solid waste permitting too costly to obtain or difficult to get approval for facility improvements	3	0	3
Contaminated feedstocks	3	0	3
Getting loans for new equipment is difficult	2	1	3
Need to expand markets	2	0	2
Acquiring feedstocks is challenging	1	1	2
Space is limited	1	1	2

Specific Challenge	Commercial Composters (out of 5 respondents)	On-site Composters (out of 3 respondents)	Total
The availability of cheap mulch makes it harder to sell compost	0	1	1
Need for different type of feedstock	0	1	1

Permitting and Approval

Expanding composting processing capacity is challenging for reasons that include land use restrictions for potential new or expanded sites, the cost of land, concerns from neighboring residents about odors from a compost facility, and what could be a lengthy time frame to complete permitting (Cascadia Consulting Group, 2019). Three composter survey respondents indicated that permitting and approvals are barriers to expansion.

Contamination

Three commercial composters—60 percent of commercial survey respondents—indicated that contamination is a challenge for processing and selling more compost. Contamination refers to items that are not compostable and should go to a different waste stream.

Contamination is a persistent issue for composters. Of the material collected for organics processing in King County in 2018, 3.9 percent by weight was contamination (Cascadia Consulting Group, 2019). This contamination included non-compostable plastic, glass, and non-compostable papers, such as aseptic and polycoated papers.

While 3.9 percent is a low amount by weight, it is noticeable visually in finished compost and impacts customer perceptions and available markets (Cascadia Consulting Group, 2019). The Washington State Department of Transportation (WSDOT), a major compost buyer in Washington, has variable demand for compost based on the number of road projects in the state, but since 2015, its demand has substantially decreased and shifted to finer compost to minimize contamination, since compost contamination on roadways can be considered litter (Maurer, 2020; Batjiaka, 2016).

Increased recovery of food waste for compost is linked with higher levels of contamination in compost, as residents and commercial businesses mischaracterize food waste and include contaminants with their scraps. Thirty eight percent of facilities surveyed by CalRecycle in 2019 indicated that their main strategy to minimize contamination is avoiding accepting food scraps (CalRecycle, 2019). Compost facilities in the Bay Area, California, where curbside compost collection is more widespread than in other parts of the state, face higher contamination rates than other facilities. Because of this, finished compost and mulch make up a smaller percentage of outputs from compost facilities in the Bay Area than from compost facilities in other parts of the state. Approximately 41 percent of products from facilities in the Bay Area are not compost or mulch, but rather become Alternative Daily Cover (ADC) at regional landfills (CalRecycle, 2019; Cascadia Consulting Group, 2019). Washington composter survey respondents for this evaluation reported that high percentages of their main products are finished compost and mulch, but as compost collection expands and more food waste is recovered from the landfill stream, contamination is likely to remain an issue.

There are some available solutions for removing contamination, but there are also barriers to adopting them. In the CalRecycle survey, 50 percent of respondents reported using screens or other equipment to remove contamination, and 32 percent reported using a picking line. In King County, composters cited costs and hesitancy to invest in unproven technologies as current barriers to these solutions, and Cascadia did not obtain data on the effectiveness

or cost of these systems (Cascadia Consulting Group, 2019). Educating residential and commercial customers about what items can and cannot be placed in curbside organics will be crucial to minimizing contamination upstream. At the same time, education can reassure buyers of compost that very small amounts of inert contamination are expected, allowed within specifications, and not detrimental, thereby re-shaping buyers' expectations (Cascadia Consulting Group, 2019).

Markets

Most of Washington's compost is produced in the western part of the state, which presents challenges for markets in eastern Washington. The top ten facilities, which are mainly in western Washington, produce 80 percent of finished compost (Waste 2 Resources, 2016; WA Department of Ecology, 2020). Agricultural markets and public projects in eastern Washington could absorb more compost—agriculture only makes up five percent of the demand for compost in Washington State—but the high costs of transporting compost from western to eastern Washington and the difficulty of marketing in non-local areas may be prohibitive. Representatives from WSDOT have reported that compost can cost up to two to three times more in eastern Washington than western Washington (Cascadia Consulting Group, 2019). More research into this area is needed to determine whether serving this market is economically feasible.

An additional barrier to transporting compost from west to east is the apple maggot, a problematic contaminant in western Washington green waste. WSDA requires special permits for organizations wishing to transport green waste and municipal solid waste out of apple maggot quarantine areas in western Washington. Those organizations must grind and heat treat the green waste and clean trailers extensively. Permits are also required for facilities outside of quarantine areas wishing to receive green waste from apple maggot quarantine areas. When the City of Leavenworth in central Washington (at the eastern edge of the apple maggot quarantine area) found itself newly inside the apple maggot quarantine area, it faced the option of an arduous process to figure out how to treat green waste and transport it to a permitted eastern Washington facility or pay a western Washington compost facility. The city previously paid $8,000-12,000 per year to bring waste to an eastern Washington facility but its quote for composting in western Washington added up to $85,000 (WSDA W. D., 2018).

Odors and NIMBYism

A Washington survey of nearly 300 organics management professionals found that the other two most frequently cited barriers to organics management were NIMBYism (neighbor opposition, sometimes referred to by this acronym which stands for "not in my back yard") and odors (Waste 2 Resources, 2016). Three composter survey respondents in our evaluation listed odors as a concern. NIMBYism related to compost facilities is most frequently associated with odors, rather than any other risks, so these two issues are most appropriately combined (Waste 2 Resources, 2016).

Concerns about odor tend to be related to compost facility size and the extent to which it manages food scraps and other wet organic materials. Some researchers note that odor issues have "grown more problematic as compost facilities, particularly those in municipal zones, are pushed towards the higher flow rates containing the more putrescent organic materials (i.e., food scraps and lawn clippings) that result from increased diversion programs" (Ma, Wilson, Zhao, Yorgey, & Frear, 2013).

Opportunities

Our research shows that the amount of food waste entering composting facilities in Washington State is still dwarfed by the amount entering landfills and waste-to-energy; there is six times more food waste entering landfill and waste-to-energy from mixed municipal solid waste streams than there is being composted. This section

describes some of the greatest areas of opportunity for increasing the amount of food waste being composted in Washington.

Restaurants and Institutional Kitchens as Feedstock Source

Our analysis shows that, by far, most food waste from residential curbside collection, restaurants, and institutional kitchens goes to landfill. As a first step to capture more food waste from these streams while minimizing contamination, we recommend research into collection programs for back-of-house commercial streams that could better recover food waste from restaurants and institutional kitchens. Back-of-house waste tends to have lower levels of contamination than front-of-house waste and residential waste, and since compost facilities are wary of the contamination associated with collecting food waste in general, this could be a good place to start. This waste stream would be appropriate for either compost or high-solids anaerobic digestion; since our research has indicated that Washington does not have plans to build a high-solids digester, compost is the most viable option to capture this curbside waste (Maurer, 2020).

Integration of Anaerobic Digestion

When anaerobic digestion and compost are combined, some synergies are created that improve the performance of both. Some of the outputs from digestion become inputs to the composting process, and vice versa, leading to a process that efficiently manages different types of feedstock, digester effluent, and biogas with minimal increase in facility footprint. This type of system could mitigate odors and create more valuable products, such as renewable natural gas, bioplastics, or flavorants, than a compost facility alone (Waste 2 Resources, 2016).

There are successful case studies of this concept, such as JC Biomethane in Eugene, Oregon, which processes 6,000 tons of food processing waste per year, 12,000 tons of commercial food waste per year, and small amounts of manure. The facility uses a windrow compost system and a wet Entec digestion system (BioCycle, 2014).

One of the composter survey respondents reported that they use anaerobic digestion on-site, noting that negotiated permit conditions “made compliance possible.” Other respondents commented that barriers to implementing anaerobic digestion at their facilities include insufficient feedstock volume, variable feedstock amounts and types, anticipated odors, and the high cost of investment.

Agricultural Markets

Agricultural applications represent a small portion of current compost markets but have high potential for growth. In the 2015 King County Recycling Market Assessment, surveyed processors stated that agriculture demand for compost ranged from five to ten percent of their compost sales. Residential demand reportedly ranged from 15 to 50 percent and the remainder is used by government agencies or landscapers (Cascadia Consulting Group, 2015). The Compost Outreach Project—an initiative by the WSU Cooperative Extension in Snohomish County—has collaborated with local compost producers, county offices and local conservation districts since 2011 to promote and evaluate the use of commercial food scraps and yard trimmings as compost on farms in Snohomish and northern King County through compost use trials; to date, these trials have demonstrated positive effects. A report published on the project found that agricultural markets made up less than five percent of the total compost market in Washington State (Collins, Harness, & Bary, 2016). There is likely the opportunity to expand this approach, particularly for compost application in agricultural areas in central and eastern Washington, though more research into the economics of transporting compost from facilities in western Washington to these areas is needed (Brown, 2019). A survey of farmers in California found that barriers to increased compost use include: costs of compost (including transportation); a lack of understanding for how compost affects nutrient management plans; and need for better enforcement around pathogen and weed management in finished product (BioCycle, 2018).

Municipal Purchasing Programs

There are opportunities to include compost in more municipal projects, which would provide valuable markets and demonstrate local leadership. There is interest from compost facility representatives in seeing local governments lead in the use of locally produced compost from locally generated organic waste (Cascadia Consulting Group, 2019). Two composter survey respondents for this evaluation indicated that municipal buy-back of compost products would benefit their compost facilities. Agency contracts and procurement policies can state specifications and preferences for locally produced compost (Cascadia Consulting Group, 2019).

Public projects with the potential for increased compost use include green infrastructure installations and other stormwater management and erosion control projects, habitat and site rehabilitation, park landscaping, and turf and tree maintenance (Cascadia Consulting Group, 2019; Waste 2 Resources, 2016).

Carbon Sequestration and Other Environmental Benefits

There is a growing body of research about the value of compost to store carbon in soil in the form of organic matter, to the benefit of climate action and soil health. As the ability to map soil and account for soil carbon continues to systematize, it will become easier for farmers, ranchers, and open space stewards to justify compost application in certain amounts. It is also likely to become more common as a best practice for state and local governments to add compost application into climate action planning and land stewardship plans, and for the carbon offsets gained in compost application efforts to be independently verified and traded in carbon markets (Waste 2 Resources, 2016). The Marin Carbon Project in California has already developed a carbon accounting protocol for compost use on grazed grasslands for carbon sequestration, enabling ranchers to have their practices verified and generate carbon offsets (Cascadia Consulting Group, 2019).

In addition to carbon sequestration, compost application can benefit soil biodiversity, water quality, nutrient availability, pest mitigation, and resilience to fire and drought. These qualities have been recognized and tracked extensively, including by Ecology (Waste 2 Resources, 2016; U.S. PIRG and Frontier Group, 2019). King County already uses the lens of climate change as a way to show the benefits of using Loop® biosolids, estimating that their use offsets the majority of the greenhouse gas emissions from the Wastewater Treatment Division's operations (Cascadia Consulting Group, 2019). Continuing to communicate and quantify these benefits will indirectly expand markets and use of compost in a range of settings.

Small-Scale and Community-Scale Compost

Small-scale and community-scale compost systems provide the opportunity to manage food waste and other residuals closer to the source, reducing greenhouse gas emissions from transportation and processing, creating opportunities for education, and eliminating some costs. A 2018 report by the Institute for Local Self-Reliance found that nationally, for every 10,000 households composting at home, between 1,400 and 5,000 tons per year could be diverted from curbside collection, with potential savings in avoided disposal costs alone ranging from $72,000 to $250,000 (Platt & Fagundes, 2018). They may be especially well-suited for demonstration areas at schools and in other public spaces, where education can connect the products of compost back to their source (U.S. PIRG and Frontier Group, 2019). Campus composting programs can be effective forms of environmental education in schools (American Society for Horticultural Science, 2016).

While the benefits of small- and community-scale compost systems have been documented, there is little data about the quantity of organics they currently manage and the extent of their growth potential is uncertain (Cascadia Consulting Group, 2019).

Recommendations for Filling Data Gaps

Conduct Barriers and Opportunities Study About Compost Program Participation

A major data gap is understanding the barriers and opportunities to increasing composting rates, especially among residential, restaurant, and institutional generators. Limited capacity at compost facilities in the state is one known barrier, but additional factors include the lack of curbside collection programs and low participation rates among programs that exist. Curbside cart studies and generator studies are tools that could be used to better understand household and commercial site-level participation and recovery opportunities. Both of these types of studies have been used in King County – generator studies in 2017 and 2019, and a curbside study in 2018 – to better understand regional and site-specific trends (King County Solid Waste Division, n.d.). Greater insights into participation levels in organics collection programs would inform next steps related to incentives and/or mandates for curbside programs and educational initiatives among compost customers.

Conduct Composter Feedstock Characterization Studies

Better knowledge of the contents of material collected, especially from residential and customer-facing businesses, would be useful to track levels of contamination and the success of food waste diversion programs. Composter survey responses did not contain information about quantities of food or contamination levels. This Information is not readily available to composting facilities, while they will typically have an anecdotal estimate. A more quantitative approach, such as formal waste characterization studies to quantify materials entering compost facilities, would provide more reliable information sources of contamination and quantities of food waste.

Support Small- and Community-Scale Compost Systems

Some cities in western Washington, like Seattle, have implemented programs to give away free or discounted home compost bins, but have since stopped those programs or discontinued tracking the bins (Platt & Fagundes, 2018). It is important to note that small-scale and community-scale are valuable food waste recovery pathways and should still be supported.

Establish and Maintain Consistent Feedstock Reporting Categories

We recommend maintaining consistent feedstock categories across reporting years and providing clear definitions of feedstock categories to ensure that the reporting process is as clear as possible for compost facilities. A category called *Other Food Waste* was included in reporting from 2014-2017. Amounts of feedstock reported as *Other Food Waste* grew steadily from 2014-2017 (WA Department of Ecology, n.d.). In 2018, when the *Other Food Waste* category was removed, feedstocks reported as *Post-consumer Food Waste* rose by a factor of 70, from 906 tons to 63,492.47 (WA Department of Ecology, 2020; WA Department of Ecology, 2019). The survey results collected during this evaluation indicate that much of the food waste processed by compost facilities is correctly categorized as *Post-consumer Food Waste.* The shift in the food waste feedstock categories used in reporting indicates that there may be confusion about how to report different categories, and that some sources of food waste may provide more than one category of food waste. We recommend reviewing the categories provided and adding clear definitions of each for facilities to reference.

Industrial Uses

Summary of Entities

Industrial uses, for the purpose of this evaluation, refers to anaerobic digestion. Other types of industrial uses for food waste include management pathways for fats, oils, and grease, such as rendering and biodiesel. However, these are out of scope for this evaluation because management pathways for them are well-established and specific, and there is extremely limited opportunity for them to be recovered for a higher use in the EPA food waste hierarchy (U.S. EPA, n.d.).

There are three main types of anaerobic digesters in Washington State: on-farm digesters, water resource recovery facility (WRRF) digesters, and smaller, on-site digesters. On-farm digesters and small, on-site digesters are within the scope of this evaluation; WRRF digesters are not in scope for quantification purposes but will be discussed in the Opportunities section.

There are five active on-farm anaerobic digesters in Washington State that process food waste out of nine total dairy digesters. Only two of these are operating as of the writing of this report; the other three are undergoing facility repairs (Maurer, 2020). Most of the on-farm digesters were built in 2012 and 2013 and have done most of the anaerobic digestion in Washington since then. The majority use a hybrid plug-flow complete mix digester system, while one uses a complete mix digester system (Dairy Nutrient Management Program, WSDA, 2011). Eight dairies in Washington use their biogas to produce renewable electricity (WA Department of Commerce and WSU Energy Program, 2018).

There are also four small-scale, on-site anaerobic digesters operated by Impact Bioenergy at a brewery, cidery and farm, commercial kitchen, and tofu producer, respectively. These are permit-exempt digesters built to process materials generated at each site. They are relatively new—the first was built in 2016—and in the coming years may provide lessons around feasibility and considerations for replicability of community-scale decentralized anaerobic digestion projects in Washington.

There are currently no high-solids anaerobic digesters in Washington State and there are no plans to build one (Maurer, 2020).

Flow of Food

Anaerobic digesters processed approximately 5,765 tons of food waste in 2017 (WA Department of Ecology, 2017). In subsequent years, this number has fluctuated due to dairy digester closures for repair and the arrival of Impact Bioenergy's Vashon Island digester (Maurer, 2020).

The quantities of food waste flowing through anaerobic digestion that are included in this evaluation all come from on-farm digestion because quantities of food waste disposed by small-scale anaerobic digesters are not known. They received all food waste inputs from the manufacturing sector, as this is the only type of food waste allowed through their permits (WSDA, n.d.). They are also a valuable way for farms to process manure.

Impact Bioenergy's on-site digesters came online beginning in 2013 and are now able to process a combined 1,637 tons of food waste per year. Most of that amount comes from the digester on Vashon Island, which can process 1,500 tons per year, which is more than some dairy digesters in Washington State. It operates using pre-consumer food waste generated on-site at a brewery, commercial kitchen, cidery, and tofu processor (Kumar & Patel, 2020).

Outputs from anaerobic digestion include liquid digestate, solid digestate, biogas, and electricity sales. Our evaluation did not trace the destinations of the digestate, but generally the liquid fraction of digestate can be

applied to fields seasonally as a biofertilizer, and the solid fraction can be used as bedding for cows, composted, or processed as a different soil amendment. Impact Bioenergy sells the liquid as a soil amendment product. Biogas is the main economic byproduct and can be used a few different ways depending on a given site's economics (WA Department of Commerce and WSU Energy Program, 2018), including:

- Minimally treated and used to generate heat on-site, offsetting natural gas
- Treated to remove contaminants and fed into a natural gas pipeline
- Treated and converted to compressed natural gas (CNG) as a renewable vehicle fuel
- Converted to electricity and heat with a combined heat and power (CHP) system

Metrics and Reporting Protocols

On-farm anaerobic digesters generally process 50 percent or more animal manure and up to 30 percent pre-consumer organics not collected via a solid waste collection program. These digesters must submit reports to Ecology that include type and quantity of feedstocks and a digestate analysis but do not require solid waste permits (WSDA, n.d.). Dairies in Washington are required to operate under a nutrient management plan and are regularly inspected by WSDA.

As of the writing of this report, one on-farm digester was applying for a solid waste permit in order to process a higher percentage and greater diversity of food waste feedstocks.

Small-scale anaerobic digesters below a threshold of 5,000 gallons or 25 cubic yards of material on-site at any one time are not required to have permits or to conduct any reporting (WSDA, n.d.).

Capacity

The throughput of individual digesters is reported to Ecology annually; we were not able to obtain access to these reports for this evaluation, so are unsure how close each currently operating digester is to capacity. With three digesters that have the ability to accept food waste currently offline, as a whole, dairy digesters in Washington are operating below capacity (Maurer, 2020).

There is much remaining opportunity to build both new dairy digesters and new small-scale digesters in Washington State, in terms of appropriate food waste feedstocks and available sites (WA Department of Commerce and WSU Energy Program, 2018).

Washington State has 443 commercial dairy farms, totaling more than 250,000 dairy cows. Roughly 100 of these dairies, or 23 percent, can be considered large production facilities with 700 or more mature animals (Washington State University Extension, 2012). Siting requirements are specific, as pipeline infrastructure is limited and there are a finite number of large organics generators and dairy farms within an allowable radius, but Commerce and the WSU Energy Program have identified 27 potential dairy sites for renewable natural gas that could begin construction in the near-term (WA Department of Commerce and WSU Energy Program, 2018).

Challenges

There are many recognized barriers to developing anaerobic digestion facilities for food waste processing and biogas and renewable natural gas use. Major barriers discussed here are related to costs and markets.

High Up-Front Costs

High up-front costs were listed almost universally among interviewees for this evaluation and anaerobic digestion literature as a challenge to building anaerobic digesters. Nearly 50 percent of our composter survey respondents listed high costs as the main reason why they are not considering adding a digester to their compost facility sites. Representatives at Impact Bioenergy listed up-front capital expenditures as a major challenge for the company, which relies on grant funding for much of its work (Kumar & Patel, 2020).

Costs to build digesters are varied and depend on several factors including the size and type of the project, end use for biogas, and ownership. The George DeRuyter and Sons dairy digester near Outlook, Washington was completed in 2006 and cost $3.9 million to build (Kennedy, 2013), and it has since undergone repairs and improvements to produce renewable natural gas (RNG). The report "Promoting Renewable Natural Gas in Washington State" in 2018 found in its analysis that a dairy digester producing refined biogas as RNG for pipeline injection would cost $7.5 million up-front for a project serving 2,000 cows or over $18 million for a digester just over twice that size (WA Department of Commerce and WSU Energy Program, 2018). Overall, for a set of 27 new dairy digesters across the state, the report estimated a capital investment of $400 million (WA Department of Commerce and WSU Energy Program, 2018). RNG-enabled digesters are more expensive than other types, such as digesters with Combined Heat and Power (CHP) systems or boiler systems, but typically generate better returns (Washington State University Extension, 2012).

Operations and Maintenance

Operating costs are similarly crucial to the profitability of an anaerobic digester project. Digesters producing RNG can cost upwards of $300,000 per year to operate (Washington State University Extension, 2012). RNG systems can benefit from the U.S. EPA's Renewable Fuel Standard (RFS) credits, which helps increase revenue to offset the costs (Oregon Department of Energy, 2018).

One particular repair effort, replacing digester lids, has been a costly and time-consuming effort for digesters in Washington. Most dairy digesters in the state were constructed using the same design and within a similar time period, starting in 2004 and ending in 2013. In 2018, the lids on digesters began to fail due to corrosion; by 2020, four have failed and one more digester's operation has been paused to assess the lid and the cost of replacing it. One lid so far has been replaced and there are four digesters offline. The lids are expensive to replace, especially in a period when electricity and demand for dairy products are both relatively low (Maurer, 2020).

Unstable Renewable Natural Gas Markets

For anaerobic digestion projects producing RNG in Washington, the volatility of natural gas market prices, utility policies, and low electricity pricing make it challenging to finance projects that require stable, long-term cash flows (Cirilli, et al., 2016; Dairy Nutrient Management Program, WSDA, 2011; WA Department of Commerce and WSU Energy Program, 2018). According to the Northwest Gas Association's 2020 Gas Outlook, fossil fuel natural gas prices are projected to rise steadily through the next decades, creating an opportunity for RNG, since RNG costs are expected to decline. In the short term, however, fossil fuel natural gas prices can be remarkably volatile (Northwest Gas Association, 2019). A perception of risk due to these fluctuating costs and unfamiliarity with the technology can affect digesters' ability to secure financing (Oregon Department of Energy, 2018).

Reluctant Markets for New Soil Amendments

An interviewee from Impact Bioenergy noted the difficulty of introducing new liquid fertilizer product into the market due to the cost of testing to prove its effectiveness and the strategizing required to effectively differentiate the product from the many available types of fertilizers and organic soil amendments (Kumar & Patel, 2020). There

are many organic amendments on the market: bark, wood mulch, biochar, worm castings, and engineered hydro-mulch, among others. Buyers are inundated with options to choose from and may not know which amendment is best for them (Cascadia Consulting Group, 2019).

Opportunities

There is much attention focused on developing anaerobic digestion in Washington. Washington State University is propelling these efforts by continuing to support robust research and development efforts around improved efficiency of conversion at various scales, nutrient recovery, biogas conditioning, and integration of other organic wastes, especially food waste and wasted food. The opportunities listed here are grouped by type of digester.

Small-scale Digesters

Small-scale digesters have been successful outside of Washington. HomeBiogas, located in Israel, has developed a digester for household use that can process six liters of food waste per day and provide energy for cooking, heating, and lighting. HomeBiogas has installed systems in 90 countries since 2015 (Biogas World, 2019). Like Impact Bioenergy representatives, HomeBiogas clients see value in keeping the benefits of anaerobic digestion on-site. The cidery that Impact Bioenergy partners with can use the digestate and the biogas can be used as vehicle fuel or on-site heating. Impact Bioenergy is currently planning a digester that would support a food bank roof garden, with the digester providing fertilizer, saving water, and providing a valuable educational opportunity (Kumar & Patel, 2020).

Impact Bioenergy is developing a blockchain ledger system to track digester inputs and outputs that could greatly benefit tracking and impact measurement for small-scale digesters. This new system would make it possible to track feedstock variables and respond to problems in real-time. The development of this system is an important learning opportunity for distributed digester systems and, Impact Bioenergy representatives hope, will clearly illustrate the business case for distributed digesters (Kumar & Patel, 2020).

Dairy Digesters

Solid Waste Processing

One on-farm digester is currently applying for a solid waste permit to process a higher proportion of food waste and additional food waste types (Maurer, 2020). We were not able to obtain access to individual digester reports, so the real impact of this change is not clear. Depending on the food waste sources this digester will process, it may face challenges of de-packaging food waste and maintaining a slurry consistency within the digester. If the application is successful, it may result in more food waste being recycled through anaerobic digestion and provide some useful learnings.

Renewable Natural Gas

Renewable natural gas (RNG) is a promising opportunity for dairy digesters and other new digesters. RNG is produced by removing carbon dioxide, other gases, and contaminants from the biogas output of anaerobic digesters. It can be used as a direct substitute for fossil natural gas in applications from power generation to heating and transportation (WA Department of Commerce and WSU Energy Program, 2018).

In Washington, RNG can provide better returns to digesters than electricity sales, particularly due to RFS credits (Washington State University Extension, 2012). In addition, there are several new programs and incentives to support digesters producing RNG, including:

- A newly adopted requirement that the four natural gas utilities in Washington offer voluntary “green gas” programs to retail customers, which should spur the market for RNG from multiple sources.

- Energy Transformation Projects established under the Clean Energy Transformation Act offer a different pathway for obligated electrical utilities to invest in RNG development.

Nutrient Recovery

An anaerobic digestion project is usually more sustainable when it has multiple sources of revenue, such as energy, fiber and nutrients, and environmental incentives (Washington State University Extension, 2012).

WRRF Digesters

Anaerobic digestion is a widespread standard wastewater treatment protocol and is a well-developed technology for water resource recovery facilities (WRRF). Some WRRFs accept food waste with high potential energy or fats, oils, and greases (FOG) to increase their production of biogas and collect tipping fees for disposing of organic waste products, though none of Washington's WRRFs are known to do this (Oregon Department of Energy, 2018). Our research did not identify any organized data indicating how many WRRFs in Washington State have anaerobic digesters, but previous research indicates that there are at least 37 in the state, most likely located in larger communities (Moulton, 2018). Nationwide, ReFED estimates that there are over 1,200 AD facilities installed at WRRFs (Cirilli, et al., 2016).

Including food waste as an input to WRRFs is under active exploration in King County. The King County Wastewater Treatment Division estimates that co-digesting a food waste slurry with wastewater would increase energy production by about 50 percent, enabling the Wastewater Treatment Division to offset a larger portion of its current energy use with its own biogas (Cascadia Consulting Group, 2019).

Anaerobic digestion of food waste at WRRFs is a promising solution for the City of Tacoma as well. Since it would reduce emissions and divert waste using existing infrastructure, the City commissioned an evaluation, which showed that food waste sent to anaerobic digestion at the WRRF could fuel 50 refuse haulers at net-zero cost. A demonstration project was performed in which food waste was collected from 66 commercial generators, processed with a de-packager to pulp the material and create a slurry, then digested. The project created a digestate of normal quality, but it did highlight some challenges around contamination from metals, plastics, and fibrous or dense organic waste (Cirilli, et al., 2016). Commercial food waste collected in the City of Tacoma now goes either to compost or the WRRF (City of Tacoma, n.d.).

Recommendations for Filling Data Gaps

Conduct Interviews of On-Farm Anaerobic Digesters

Knowledge of specific sources of food waste inputs to on-farm digesters and a summary of challenges and opportunities at the digester level would add clarity to the overall flow of food and future projections related to digestion. For instance, it is unknown whether the four dairy digesters currently not processing food waste may begin accepting it (or in some cases, resume accepting it) (Maurer, 2020). One Ecology representative believes that some dairy digesters may not re-open at all, though others assess that they will likely come back online because digestion is the most cost-effective option dairies have for managing excess nutrients, especially for large operations in the south-central part of the state (Kennedy, 2013).

Offer Voluntary Reporting for Small-Scale Digesters

Impact Bioenergy's multiple facilities provide a valuable case study of digesters of varying sizes, from one processing about 25 tons per year to one processing 1,500 tons per year. However, Impact Bioenergy is still a relatively new

company and the extent of other small-scale digesters is not known. We recommend offering voluntary reporting for small-scale digesters to begin establishing a dataset for this emerging food waste management pathway.

EMERGING SOLUTIONS

Fertilizer Technologies

WISErg offers a small-scale, on-site management system for food waste and nutrient recovery based on fast aerobic digestion. The company has installed food waste "harvesters" at 13 supermarkets in Washington. Supermarket staff add pre-consumer food waste to each harvester, and the harvester maintains a constant temperature and tracks the amount and type of food waste entering the system at a high level. Then the food waste is sent to a centralized facility in Redmond, Washington, where the aerobic digestion process takes place and turns the food waste into a nutrient-dense biofertilizer. WISErg staff did not disclose the amount of food waste processed each year and predicted that no additional harvesters will be installed in Washington in the near-term, but the company hopes to expand to different regions of the United States. WISErg's existence and success in Washington speaks to the potential for similar on-site solutions to spread in Washington (Rehmat & Lugo, 2020).

Bio-Based Materials

A few small companies are beginning to create plastics and packaging out of anaerobic digestion by-products. Corumat is an early-stage startup creating packaging made from solids sourced from anaerobic digesters, which can then be placed back into anaerobic digesters for recovery (Corumat Inc.). Mango Materials creates biopolymers out of methane from WRRF digesters, oxygen, and bacteria (Joyce, 2019). When the bacteria feeds on methane and oxygen, it produces PHAs (polyhydroxyalkoanoates), which are separated from the bacteria and made into plastics. Materials produced by Corumat and Mango Materials are biodegradable even in marine environments (Helmer, 2019).

These and other companies are still working to commercialize PHAs. Barriers include costs and infrastructure to produce the materials. PHAs are still more expensive to produce than conventional plastics. If they do become more widespread, they may promote the concept of distributed, small-scale digesters to produce plastics. If they are able to scale up, they could make a significant impact on plastic waste in the environment (Helmer, 2019).

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APPENDICES

Appendix A: Washington State Food Waste Flow Model Methodology

Written by Franklin Associates, A Division of ERG (Eastern Research Group)

Model Introduction

A Microsoft Excel-based spreadsheet model was developed to estimate the quantity of food waste and wasted food that is recovered and disposed in Washington State, termed food waste management pathways. The primary goal of the model is to quantify the amount of food waste and wasted food that is or could be diverted from disposal in landfills and combustion facilities. Twelve potential generators of food waste are included in the model[2]:

Food Waste Generators

- Farms
- Manufacturing
- Residences
- Consumer-facing businesses
    - Institutions of higher education
    - Hospitals
    - Hotels and motels
    - K-12 schools
    - Nursing homes
    - Prisons
    - Restaurants
    - Supermarkets[3]
    - Wholesale distributors

Generated food waste and wasted food is allocated among two disposal and seven recovery pathways. A small portion of non-edible donated food, approximately 1.4 percent, is ultimately distributed among the other eight disposal/recovery pathways.

Recovery

- Donation
- Agriculture products
- Anaerobic digestion
- Animal feed

[2] Other generators of food waste, expected to be minor contributors to State totals, were not included in the analysis. Such potential generators include office buildings, sports venues, etc.
[3] Supermarkets include both supermarkets and supercenters.

- Bio-based materials
- Composting
- Land application

Disposal

- Landfill
- Waste-to-energy combustion

The analysis is intended to help Washington State assess opportunities for expanded food waste recovery and to target efforts at specific generators with low food waste recovery rates.

Methods

To the extent possible, the model relies on data specific to food waste recovery and disposal in the State of Washington. State specific data was available for seven of the nine management pathways shown above. Recovery of food waste via agricultural and bio-based products recovery pathways was estimated based on national recovery statistics for manufacturers, restaurants, supermarkets and wholesale distributors. The most recently available data were used for all estimates. Model results estimate annual food waste generation, recovery and disposal in Washington State for a representative period between 2016 and 2019.

Washington State data generally provides estimates of food waste recovery and disposal via individual pathways (i.e. landfill, compost, etc.). National sampling study estimates of food waste generation, recovery and disposal provide more detail and insight into the generation of food waste for the following generating sectors: higher education, hospitals, hotels, K-12 schools, nursing homes, prisons, restaurants, supermarkets and wholesale distributors. Washington State data was used directly to supply food waste generation estimates for farms and residences. A mixture of national sampling estimates and Washington State data was used for the manufacturing sector. These estimation methods are independent of food waste disposal statistics and do not perfectly match reported data totals for Washington State. An iterative process was used to facilitate convergence of the food waste model with Washington State data totals of food waste managed.

The following sub-sections describe available data and procedures used to estimate the quantity of food waste processed by each of the nine recovery and disposal pathways. A separate sub-section is provided for each of the twelve generation sectors, describing relationships to recovery/disposal pathways and procedures used to estimate sector food waste generation when State specific data was not available.

Donation

State specific data was identified for three of the primary food donation distribution networks operating in Washington State. Reported quantities of donated food from these organizations include food sourced from all generation sectors, purchased food and food from federal commodity programs. Food purchases and food from federal commodities programs is outside the scope of this project and was excluded from the analysis. The distribution in Table A-1 was used to allocate donated food waste among the various generating sectors based on data reported by Food Lifeline and 2nd Harvest. The same distribution was applied to all three distribution organizations. 1.4 percent of donated food was assumed to be composted or disposed of based on average food losses reported by Food Lifeline and 2nd Harvest (U.S. EPA, 2019a). Generated food waste was allocated to the three common routes of municipal food waste disposal (compost, combustion and landfill) based on total food waste disposal via these three pathways in Washington State.

Table A-1. Sources of Donated Food

Source of Donated Food	Share of total incoming food
Grocery store[1]	45%
Restaurants and Retail	17%
Farmers	11%
Manufacturers	11%
Federal Commodities (TEFAP)	11%
Purchases	5%
Total	100%

[1] Food donation from grocery stores is assumed to include food donated by wholesale distributors.

Landfill

Records of landfill MSW disposal in Washington State were available for 2017. A Washington State waste characterization study for 2015-2016 was used to estimate the quantity of food waste present in disposed MSW. The waste characterization study indicates that food waste comprises 17.3 percent of MSW by mass. The waste characterization study documents the quantity of disposed food waste from residential and commercial generators and self-hauling. Self-hauled waste comprises less than 5 percent of total MSW disposed and was assumed to share the same split between residential and commercial generators as municipally hauled MSW. In Washington State 51 percent of landfill disposed food waste is from commercial sources (including manufacturing) with the remainder from residences (CCG, 2018).

National statistics were used to separate out the quantity of landfilled food waste from the manufacturing sector. Only 3.4 percent of food waste from the manufacturing sector is estimated disposed of in landfills (BSR, 2014; FWRA, 2016).

Waste-to-Energy Combustion

Records of MSW combustion in Washington State were available for 2017. The Washington State waste characterization study from 2015-2016 was used to estimate the quantity of food waste present in combusted MSW. The waste characterization study indicates that food waste comprises 16.2 percent of MSW by mass in Eastern Washington, where the combustion facility is located. In Eastern Washington State 49.6 percent of landfill disposed food waste is from commercial sources (including manufacturing) with the remainder from residences (CCG, 2018).

National statistics were used to separate out the quantity of combusted food waste from the manufacturing sector. Only 0.68 percent of food waste from the manufacturing sector is estimated combusted (BSR, 2014; FWRA, 2016).

Composting

Washington State collects data on food processing waste, post-consumer food waste and yard debris/food scraps sent to permitted composting facilities. Data for the year 2018 was used in this analysis. Food waste from out-of-state sources was excluded from the analysis. Food processing waste was assumed to be produced by the manufacturing sector. Post-consumer food waste and yard debris/food scraps were allocated among residential and commercial generators based on data provided by the Washington State Department of Ecology. The quantity of food waste present in mixed yard debris/food scraps was assumed to be 10 percent w/w based on limited compost facility survey data provided by the Cedar Grove Composting Company.

Animal Feed

The Washington State Department of Agriculture collects data on waste products that serve as inputs to animal feed production. Data for the year 2019 was used in this analysis. The following waste categories were included in the analysis: animal products, brewers waste, distillers waste, screenings and human food by-products. National statistics were used to estimate the portion of food waste going to animal feed from restaurants, wholesale distributors and supermarkets. The remainder of food waste going to animal feed was assumed to be generated by the manufacturing sector.

Anaerobic Digestion

The Department of Ecology tracks the quantity of food processing waste (pre-consumer) that is anaerobically digested in the state. Data for the year 2017 was used in the analysis. The manufacturing sector was assumed to be the sole source of this waste stream, which comprises 0.36 percent of total manufacturing food waste.

Land Application

The Washington State Department of Ecology tracks the quantity of food processing waste that is land applied in the state. Data for the year 2017 was used in the analysis. The manufacturing sector was assumed to be the sole source of this waste stream, which comprises 0.17 percent of total manufacturing food waste.

Agricultural Products

National statistics on food waste recovery for manufacturing, restaurants, supermarkets and wholesale distributors were used to estimate the quantity of food waste recovered in agricultural products (BSR, 2014; FWRA, 2016). No data specific to Washington State was available to quantify food recovered via this pathway. WISErg, a Washington-based fertilizer company, is known to use recovered food waste in the production of agricultural inputs (WISErg, 2018).

Bio-based Products

National statistics on food waste recovery for manufacturing, restaurants, supermarkets and wholesale distributors were used to estimate the quantity of food waste recovered in bio-based products (BSR, 2014; FWRA, 2016).

Farms

Excess farm production donated to food banks, food pantries and other donation-based distribution programs is the only source of food waste produced by the farming sector that is considered in this analysis. Other farm-based food waste will typically be composted onsite or directly incorporated back into agricultural lands and has not historically been disposed of in landfills. This waste falls outside the scope of the MSW disposal system. The donation distribution listed in Table A-1 was used to allocated records of food distribution to the farming sector based on 2019 data from Food Lifeline.

Manufacturing

Manufacturing food waste generation is based partly on Washington State disposal/recovery data, with data gaps filled in using relevant national statistics on food waste disposal in the manufacturing sector. Washington State reported data was used for anaerobic digestion, animal feed, composting, donations and land application. National disposal statistics were used to estimate recovery/disposal via bio-based materials, agricultural products, controlled combustion and landfill (BSR, 2014; FWRA, 2016).

Institutions of Higher Education

Food waste generated by institutions of higher education was estimated using EPA estimates for pounds of food waste disposed of per meal served in post-secondary schools, 0.4 lbs/meal (U.S. EPA, 2019b). The number of students enrolled in post-secondary institutions in Washington State was drawn from national education statistics (NCES, 2018). The number of meals consumed per student was based on 2017 food sales from the University of Washington (HFS UW, 2018) assuming an average price of $9 per meal (Mathewson, 2017). Food sales at the University of Washington were assumed to be representative of other state institutions on a per student basis. Generated food waste was allocated to the three common routes of municipal food waste disposal (compost, combustion and landfill) based on total food waste disposal via these three pathways in Washington State.

Hospitals

Food waste generated by hospitals was estimated based on average food waste production per hospital bed, 653 lbs/bed/year (U.S. EPA, 2019b). The Department of Homeland Security reports that there were 15,657 beds at open facilities in Washington State in 2017 (DHS, 2019a). Of the 124 open facilities in Washington State ten did not include a bed count in DHS statistics. The median bed count, 77, of facilities reporting bed numbers was assumed for these ten facilities and was added to the reported total. Generated food waste was allocated to the three common routes of municipal food waste disposal (compost, combustion and landfill) based on total food waste disposal via these three pathways in Washington State.

Hotels and Motels

Food waste generated by hotels and motels was estimated based on average food waste generated per employee at hotels and motels, 1138 lbs/employee/year (U.S. EPA, 2019b). The US Economic Census reports that 40,554 persons were employed in hotels and motels in Washington State in 2017 (US Census, n.d.). The employee count includes casino hotels. Generated food waste was allocated to the three common routes of municipal food waste disposal (compost, combustion and landfill) based on total food waste disposal via these three pathways in Washington State.

K-12 Schools

Food waste generated in K-12 schools was estimated using an annual estimate of food waste produced per student in Washington State, 43.7 lbs/student/year (limited survey) (WWF, 2019). Washington State enrollment records indicate that 1,102,695 students were enrolled in K-12 institutions during the 2018-2019 school year (Wa State, 2020). Generated food waste was allocated to the three common routes of municipal food waste disposal (compost, combustion and landfill) based on total food waste disposal via these three pathways in Washington State.

An alternate method of estimating sector food waste generated was calculated based on food waste generation per meal (0.52 lbs/meal) and the number of meals served annually at K-12 institutions. The estimation based on the number of students was preferred as both the number of students and the waste generation factor are specific to Washington State. The alternate method relies on national statistics. Both methods are presented for comparison in the accompanying Excel model.

Nursing Homes

Food waste generated in nursing homes was estimated based on average food waste generated per bed at nursing and assisted living facilities, 1.8 lb/bed/day (Draper/Lennon Inc., 2002). The Department of Homeland Security reports that there were 36,654 beds available in nursing homes and assisted living facilities in Washington State in

2017 (DHS, 2019b). Generated food waste was allocated to the three common routes of municipal food waste disposal (compost, combustion and landfill) based on total food waste disposal via these three pathways in Washington State.

Prisons

Food waste generated in prisons was estimated based on average food waste generated per inmate at Washington State correctional facilities, 1.12 lbs/inmate/day (U.S. EPA 2019b). The average number of inmates in federal and state correctional facilities was determined to be 19,590 inmates for the period from 2017-2018 (Bronson & Carson, 2019; Carson, 2020). The number of inmates in local and city jails in Washington State (11,254 persons) was estimated based on the number of individuals in such facilities nationally assuming similar incarceration ratios (Washington/National) across facility types. See the accompanying Excel workbook for further details.

Restaurants

Food waste generated in restaurants was estimated using food waste generation factors based on the number of employees at full and limited service restaurants in Washington State. Food waste generation at full and limited service restaurants is 3,392 and 2,494 lbs/employee/year, respectively (CCG, 2006). The US Economic Census indicates that 116,957 and 108,063 persons were employed at full and limited service restaurants in Washington State in 2017 (US Census, n.d.). National statistics on food waste disposal pathways for the restaurant sector were used to allocate generated food waste among the potential disposal/recovery pathways (BSR, 2014; FWRA, 2016).

Adjustments were made to the national statistics based on Washington specific data, as described on the Restaurants tab in the accompanying Excel workbook.

An alternate method of estimating sector food waste generated was calculated based on sector revenue. The estimation based on the number of employees was preferred as it differentiates between limited and full-service restaurants.

Supermarkets

Food waste generated in supermarkets was estimated using the average of two methods based on sector revenue and sector employees. Food waste generation per unit revenue was assumed to be 0.01 lbs/dollar/year (BSR, 2014). Food waste generation per employee is differentiated between supermarkets and supercenters being 2.0 and 0.39 tons/employee/year respectively (U.S. EPA, 2019b). The US Economic Census indicates that 111,776 persons were employed at food retailers and supercenters in 2017. Total revenue for the associated establishments was 34.9 billion dollars (US Census, n.d.).

The quantity of food donated by supermarkets was derived from data available for food distribution agencies in Washington State. The estimation of food donations made by supermarkets is expected to include food from wholesale distributors. Allocation of food waste to other disposal and recovery routes was based on national survey data (BSR, 2014; FWRA, 2016), which were adjusted to estimate disposal based on assumptions described on the Supermarkets tab of the accompanying Excel workbook.

An alternate method was considered for food waste generation based on food waste produced per establishment per year. Due to the wide variability in the size of retail establishments this method was not considered in the final calculation.

Wholesale Distributors

Food waste generated by wholesale distributors was estimated based on annual revenue assuming 0.01 lbs food waste/dollar/year (U.S. EPA, 2019b). The US Economic Census indicates Washington wholesale distributors had a total revenue of 29.3 billion dollars in 2017 (US Census, n.d.). Allocation of food waste to other disposal and recovery routes was based on national survey data (BSR, 2014; FWRA, 2016), which were adjusted to estimate disposal based on assumptions described on the Wholesale Distributors tab of the accompanying Excel workbook.

Residential

Food waste disposal from residential generators is based on Washington State records of waste disposed at landfills, controlled combustion facilities and composting sites.

Model Fitting Procedure

The sections above on food waste generators and recovery/disposal pathways describe secondary data and national sampling study estimation procedures used to estimate food waste generated in Washington State and the recovery and disposal routes currently used to manage that food waste. National sampling study estimation procedures are independent of Washington

State records of food waste disposal and do not perfectly match the available records. An iterative model fitting procedure was used to correct this estimation of food waste managed to fit the available data for Washington State.

Excluding agricultural products and bio-based material recovery pathways, for which no Washington State data were available, the national sampling estimation methods indicate that 2,755,752 tons of food waste will be generated in Washington State annually during the period from 2016-2019. This value has a percent difference of 2.6 percent when compared to the quantity of waste represented in Washington State records (2,683,971 tons/year).

Sector specific estimates of food waste generation based on national sampling calculations were adjusted downwards to account for the difference between reported and estimated food waste generation as shown in Table A- 2. The adjustment is equivalent to a ten percent decrease in sector food waste generation for each of the listed sectors.

Table A- 2. Adjustments Made to Bottom-Up Food Waste Generation Estimates, Sector Totals

Sector Name	Food Waste Generation, Original Estimate	Food Waste Generation, Adjusted Estimate
Higher education	5,721	5,148
Hospitals	5,364	4,828
Hotels	23,075	20,766
K-12 schools	24,094	21,682
Nursing homes	12,049	10,843
Prisons	6,290	5,660
Restaurants	333,114	299,774
Supermarkets	160,564	144,494
Wholesale distributors	146,924	132,219
Total	717,196	645,414

Following these adjustments, the percent difference between estimated and recorded food waste generation in Washington State was reduced to 0.2 percent. Table A- 3 shows estimated recovery and disposal totals for each pathway and compares them against totals from Washington State data sources. Use of national statistics accounts for the discrepancies. Based on national statistics recovery and disposal via anaerobic digestion, controlled combustion and land application are overestimated, while animal feed, composting and landfill are underestimated. National statistical profiles for food waste disposal and recovery were redistributed to correct for the noted differences. Details and linked calculations can be found in the accompanying Excel workbook.

Table A- 3. Disposal and Recovery Route Estimates following Adjustment of Sector Total Food Waste Generation

Recovery/Disposal Pathway	Recovery and Disposal Totals, Estimated	Recovery and Disposal Totals, WA Data
Agriculture products	2,928	NA
Anaerobic digestion	21,368	5,765
Animal feed	1,489,363	1,494,807
Bio-based materials	48,576	NA
Composting	135,754	159,574
Controlled combustion	58,830	40,833
Food donation	49,082	49,082
Landfill	927,287	931,293
Land application	7,105	2,618
Totals, excluding agriculture and bio-based materials	2,688,790	2,683,971

Table A- 4 presents a similar table to that included in Table A- 3 following the redistribution. Further iteration could bring the figures into closer alignment but would yield little or no additional insight.

Table A- 4. Final Disposal and Recovery Route Estimations following Model Fitting

Route	Recovery and Disposal Totals, Model Estimate	Recovery and Disposal Totals, WA Data
Agriculture products	2,914	NA
Anaerobic digestion	5,765	5,765
Animal feed	1,494,582	1,494,807
Bio-based materials	48,414	NA
Composting	164,198	159,574
Controlled combustion	39,792	40,833
Food donation	49,082	49,082
Landfill	930,254	931,293
Land application	2,618	2,618
Totals, excluding agriculture and bio-based materials	2,686,291	2,683,971

Summary Model Interpretation and Limitations

Where possible, the model prioritizes use of data specific to waste recovery and disposal in Washington State. The model fitting procedure described constrains the model such that sector specific estimates of food waste generation based on national or Washington-based statistics and food waste generation factors are not allowed to produce estimates that exceed reported food waste recovery and disposal totals available for Washington State. Prior to the model fitting procedure, estimation of food waste generation in the State of Washington was overestimated by 2.7 percent. The model fitting process reduced food waste generation estimates bringing estimated quantities in line with reported data. National sampling estimates for specific disposal and recovery routes were redistributed to match the available data, adjusting quantities estimated for other disposal and recovery pathways such that 100 percent of waste was accounted for.

The model fitting procedure also ensures that 100 percent of reported food waste disposal reported for Washington State is accounted for in the generation estimates produced by the twelve generation sectors. Food waste generated by other minor sources, not explicitly included in the model, is distributed among the twelve included generators. Based on the model's structure, the majority of this waste is expected to be distributed among the nine consumer facing businesses, potentially overestimating food waste generated by these nine sources. Given the quality of the match between the original estimation and reported data for Washington State, prior to model fitting, distortions in model results caused by this procedure are expected to be minor.

It is believed that the model fitting procedure reasonably allocates known food waste generation in the State of Washington amongst the 12 primary generating sectors. Amended national statistical profiles of food waste recovery and disposal for manufacturing, supermarkets, restaurants and wholesale distributors were amended to reflect the available disposal data for Washington State, filling in data gaps with reasonable national values.

As with all models, this model is limited by the quality of the data upon which it is based. As described above, priority is given to records or estimates of food waste recovery and disposal in Washington State. These records are deemed to be of high quality. The model estimates very specific values but should only be viewed as estimates with one or two significant figures. Review of the accompanying spreadsheet model, particularly the range in documented food waste generation factors, estimation procedures and management pathway distributions will help give context to the certainty or uncertainty with which individual sector estimates should be viewed.

Model References

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Appendix B: Hunger Relief Interview Guide

This interview guide received revisions from Katie Rains (WSDA), Kyle Merslich (WSDA), and Trish Twomey (WA Food Coalition) in February 2020. Due to disruptions caused by the COVID-19 pandemic during this evaluation's timeframe, it was never administered. The goal behind creating this guide was to collect information about the three core research areas of this evaluation from a sample of hunger relief organizations of each function (food bank, food pantry, and meal program) and geography (urban and rural, east and west) in Washington State. It is intended to be administered digitally as an email attachment or verbally as a phone survey.

Background

The State of Washington is preparing a Wasted Food Reduction and Food Waste Diversion Plan. My team is helping with an evaluation of the surplus food and food waste landscape to inform that plan. For this evaluation, we're studying different types of businesses and organizations that manage food after its primary intended consumption point. These include hunger relief organizations, anaerobic digesters and other industrial processors, compost facilities, and animal feed operations.

We're studying three main areas to build a picture of the state's food waste management system:

- Flow of Food: How much food is currently flowing through facilities in the food waste management system, i.e., hunger relief, animal feed, compost, and industrial uses?
- Metrics & Protocols: What is being measured and how is it being measured? What opportunities exist to harmonize metrics and protocols across the system?
- System Capacity: What is the capacity of each entity? What are the barriers to increasing capacity of each entity?

Respondent Information

Name: Business/Org Name:

Role: Business/Org Location:

Questions

Flow of Food and Metrics Questions

I'm going to start out by asking you about where your food comes from, what you do with it, and the end destinations where it goes. This will help us get a picture of current food waste pathways and the factors that matter in determining where food waste ends up.

1. How many pounds of food does your organization receive in total, from all sources including TEFAP?

   Pounds of food:

   Time frame:

2. How what amount of that food is donated to you, and how much is food you buy?

Donated pounds or percent:

Bought pounds or percent:

3. **Besides the number of pounds, what type of information do you track about the food you receive?**
   - Prepared food vs. other types?
   - Packaging type?
   - Proportion of usable food?
   - Other?

4. **What specific sources does your food (donated and purchased, if applicable) come from? Ex. From food banks, grocery donations, individual donations, gleaning, wholesale purchasing agreements, etc.**

Source 1: _____

i. What pounds (or %) of food comes from this source? _____

ii. Over what time frame – per week, month, year, etc.? _____

iii. What type(s) of food come from this source?
_____

iv. How do you handle food from this source? _____

Source 2: _____

i. What pounds (or %) of food comes from this source? _____

ii. Over what time frame – per week, month, year, etc.? _____

iii. What type(s) of food come from this source?
_____

iv. How do you handle food from this source? _____

Source 3: _____

i. What pounds (or %) of food comes from this source? _____

ii. Over what time frame – per week, month, year, etc.? _____

iii. What type(s) of food come from this source?
_____

iv. How do you handle food from this source? _____

Source 4: _____

i. What pounds (or %) of food comes from this source? _____

ii. Over what time frame – per week, month, year, etc.? _____

iii. What type(s) of food come from this source?

_____

iv. How do you handle food from this source? _____

5. Is food handled the same way from all sources, or does food from some sources get processed differently?

6. Destinations: Where does the food go when you're done handling it?

Check box	Destination	Quantity of food	Percent of food	Time frame	Notes
☐	Meals served (meal program)				
☐	Food given to clients or customers				
☐	Other food given directly to people				
☐	Donated/sent to another food program				
☐	Compost (on-site)				
☐	Compost (off-site)				
☐	Animal feed				
☐	Anaerobic digestion				
☐	Landfill				
☐	Other				

7. Are there any other ways in which you track the food donations that come into and out of your organization?

Capacity Questions

Next, I'm going to ask some questions about your capacity and the barriers and opportunities for your organization to expand your work. I recognize that your ability to process a higher volume of food is not the only important factor here and that we need to maintain a high quality of food and high level of respect for recipients. With that in mind…

8. Does the amount of food donations flowing through your program represent the maximum you can handle with your current resources? Why or why not?

9. Do you anticipate any upcoming opportunities to increase your capacity, such as new funding, specific policies, or anything else? If so, what are they?

10. What factors limit the amount of food you can distribute to clients or customers?

Barriers			Notes
Administrative	☐ Scheduling difficulties ☐ Staff time on certain tasks	☐ Other	
Limited resources	☐ Funds ☐ Space – refrigerated ☐ Space – other ☐ Space – equipment	☐ Time ☐ Space – freezer ☐ Other	
Staffing challenges	☐ High turnover ☐ Low motivation ☐ Reliance on volunteers: inconsistency	☐ Training challenges ☐ Other	
Other	☐ Need for more information ☐ Need for different type of foods ☐ Need for different technology or equipment	☐ Other	

11. Which of those factors are the most significant for you?

12. If you could ask for 1 or 2 things that would enable your organization to expand the volume of food (waste) you can handle, what would they be?

13. The goal of this interview is to provide a picture of surplus food and food waste management systems to inform a state plan to prevent and manage food waste.

    Given that goal, is there anything else you would like to share with us?

Appendix C: Compost Facility Interview Guide

This interview guide received revisions from Mary Harrington (Ecology) in April 2020. The goal behind creating this guide was to collect information about the three core research areas of this evaluation from all permitted compost facilities processing food waste (including *Food Processing Waste, Post-consumer Food Waste, and Yard Debris/Food Waste*) in Washington State. It was sent to composters as an email attachment to be completed digitally, with the option of calling the contact information listed by phone to complete the survey verbally. Cascadia pre-filled the previous year's reporting totals in each category within the survey.

Letter of Introduction

The State of Washington is preparing a Wasted Food Reduction and Food Waste Diversion Plan. As part of this evaluation, we're reaching out to different types of businesses and organizations that manage food after its primary intended consumption point. These include hunger relief organizations, anaerobic digesters and other industrial processors, compost facilities, and animal feed operations.
We're studying three main areas to build a picture of the state's food waste management system:

- Flow of Food: How much food waste is currently flowing through facilities in the food management system, including compost facilities?
- Metrics & Protocols: What is being measured and how is it being measured? What opportunities exist to harmonize metrics and protocols across the system?
- System Capacity: What is the available capacity of each entity? What are the barriers to increasing capacity of each entity?

Participating in this study is voluntary. The study team will not publish your facility's name or address or any staff names in our report. The report will benefit state decision-making around food waste management planning.

If you can, please help us by filling out the survey on the following pages. It should only take up to 15 minutes to complete. We can also schedule a phone call so that you can talk through your answers if you'd like.

For questions and scheduling, please contact <insert contact information>.

Thank you,
<insert signature block>

Respondent Information

Name:

Position:

Business Name:

Business Location:

Questions

1. **Please fill out the tables below, which are based on Department of Ecology reporting categories.** What are the sources of your food waste feedstocks (ex. food processors, grocery, farms, curbside collection)?

Food processing waste

In 2018, your facility reported: _____ tons of food processing waste

Food processing waste source 1:	
What percent of food processing waste comes from this source?	_____ %
What types of items are in feedstock from this source?	

Food processing waste source 2:	
What percent of food processing waste comes from this source?	_____ %
What types of items are in feedstock from this source?	

Food processing waste source 3:	
What percent of food processing waste comes from this source?	_____ %
What types of items are in feedstock from this source?	

Post-consumer food waste

In 2018, your facility reported: _____ tons of post-consumer food waste

Post-consumer food waste source 1:	
What percent of post-consumer food waste comes from this source?	_____ %
What types of items are in feedstock from this source?	

Post-consumer food waste source 2:	
What percent of post-consumer food waste comes from this source?	_____ %
What types of items are in feedstock from this source?	

Yard debris/food waste

In 2018, your facility reported: _____ tons of yard debris/food waste

Yard debris/food waste source 1:	
What percent of yard debris/food waste comes from this source?	_____ %
What percentage of this category is yard debris vs. food waste?	_____% yard debris _____ % food waste
What other types of items are in feedstock from this source, if any?	

2. What qualities of food waste feedstocks do you track at your facility, if any? Ex. level of contamination.

3. What are your facility's main outputs?

Check	Type of output	Quantity / % of total output
□	Finished compost	
□	Mulch	
□	Landfill: ADC	
□	Other (please specify)	

Capacity Questions

4. What is your facility's permitted capacity?

5. Could your facility process more total feedstock than it does currently?

6. Could your facility process more food scraps than it does currently?

7. Do you have any plans to expand your facility or to build a new one?

8. Have you considered adding anaerobic digestion on-site? Why or why not?

9. What factors limit your ability to process additional food scraps?

Barriers		Notes
Regulatory	□ Solid waste permitting too costly to obtain □ Other	
Economic	□ Acquiring feedstocks is challenging □ Competition from other facilities □ Hard to get loans for new equipment □ Other	

Barriers			Notes
Markets	☐ Need to expand markets ☐ Contaminated feedstocks ☐ Availability of cheap mulch ☐ Limited markets for contaminated products	☐ Other	
Land use	☐ No available land ☐ Cost of land too high	☐ Other	
Other	☐ Need for different type of feedstock ☐ Worried about odor	☐ Other	

10. Which of those factors are the most significant for you?

11. If you could wave a magic wand and wish for 1 or 2 things that would help you be able to handle more food waste feedstocks, what would they be, if different than above?

12. The goal of this interview is to provide a picture of food waste management systems to inform a state plan to manage food waste.

Given that goal, is there anything else you would like to share with us?

Appendix D: Compost Facility Survey Responses

Out of 22 facilities we sent the survey to in April 2020, 8 responded. Their responses are below.

Cedar Grove (Everett)

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

Letter of introduction

The State of Washington is preparing a Wasted Food Reduction and Food Waste Diversion Plan. As part of this evaluation, we're reaching out to different types of businesses and organizations that manage food after its primary intended consumption point. These include hunger relief organizations, anaerobic digesters and other industrial processors, compost facilities, and animal feed operations.
We're studying three main areas to build a picture of the state's food waste management system:

A. **Flow of Food:** How much food waste is currently flowing through facilities in the food management system, including compost facilities?
B. **Metrics & Protocols:** What is being measured and how is it being measured? What opportunities exist to harmonize metrics and protocols across the system?
C. **System Capacity:** What is the available capacity of each entity? What are the barriers to increasing capacity of each entity?

Participating in this study is voluntary. The study team will not publish your facility's name or address or any staff names in our report. The report will benefit state decision-making around food waste management planning.

If you can, please help us by filling out the survey on the following pages. It should only take up to 15 minutes to complete.

We can also schedule a phone call so that you can talk through your answers if you'd like.

For questions and scheduling, please contact Maddie Seibert at maddie@cascadiaconsulting.com or 781-850-6545.

Thank you,

Heather Levy
Director of Consulting Operations
Cascadia Consulting Group, Inc.

Respondent information

Name: Ron Westmoreland

Position: General Manager

Business Name: Cedar Grove Composting Co. Maple Valley

Business Location: Everett, WA

CASCADIA

1

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

1. **Please fill out the tables below, which are based on Department of Ecology reporting categories.**
   What are the sources of your food waste feedstocks (ex. food processors, grocery, farms, curbside collection)?

Post-consumer food waste **In 2018, your facility reported: 11,331 tons of post-consumer food waste**

Post-consumer food waste source 1:	Commercial business sources including but not limited to restaurants, cafeterias, schools, stadiums, grocery stores etc.
What percent of post-consumer food waste comes from this source?	100 %
What types of items are in feedstock from this source?	Post-Consumer food waste, Pre-Consumer food waste, Compostable Packaging/Cutlery and food soiled paper

Post-consumer food waste source 2: No Other sources	
What percent of post-consumer food waste comes from this source?	_____ %
What types of items are in feedstock from this source?	

Post-consumer food waste source 3: No Other sources	
What percent of post-consumer food waste comes from this source?	_____ %
What types of items are in feedstock from this source?	

Yard debris/food waste **In 2018, your facility reported: 102,925 tons of yard debris/food waste**

Yard debris/food waste source 1:	Residential Curbside Collection programs that allow Food waste
What percent of yard debris/food waste comes from this source? General estimate as material is collected co-mingled and variable.	100 %
What percentage of this category is yard debris vs. food waste?	90 % yard debris 10 % food waste (this is a general estimate that includes seasonal and other variability)
What other types of items are in feedstock from this source, if any?	No compostable packaging allowed in residential stream except approved compostable bags in a majority of programs.

Yard debris/food waste source 2:	No other source.
What percent of yard debris/food waste comes from this source?	_____ %
What percentage of this category is yard debris vs. food waste?	_____ % yard debris _____ % food waste

CASCADIA

2

What other types of items are in feedstock from this source, if any?	

2. **What qualities of food waste feedstocks do you track at your facility, if any? Ex. level of contamination, etc.** **We inspect for unacceptable material and contaminants upon arrival.**

3. **What are your facility's main outputs? Compost**

Check box	**Type of output**	**Quantity / % of total output**
x	**Finished compost**	123,548 cu.yds. / 100%
☐	**Mulch**	
☐	**Landfill: ADC**	
☐	**Other (please specify)**	

Capacity Questions

4. **What is your facility's permitted capacity?** 228,000 tons/annual

5. **Could your facility process more total feedstock than it does currently?** Yes

6. **Could your facility process more food scraps than it does currently?** Yes

7. **Do you have any plans to expand your facility or to build a new one?** No expansion planned for this facility. Cedar Grove is always exploring opportunities in regards to new facilities.

8. **Have you considered adding anaerobic digestion on-site?** Why or why not? Yes. Cedar Grove submitted an application for a 30-50k digestor but ultimately had to withdraw the application due to a required EIS that made the project no longer economically feasible. Economics are very challenging when compared to existing organic processing fees and solid waste disposal fees.

9. **What factors limit your ability to process additional food scraps?**

	Barriers	**Notes**
Regulatory	☐ Solid waste permitting too costly to obtain X Other	None other than physical and permitted capacity of facility. Inability to get approvals for facility improvements. Punitive enforcement environment with PSCAA.

Economic	☐ Acquiring feedstocks is challenging ☐ Competition from other facilities ☐ Hard to get loans for new equipment ☐ Other		
Markets	x Need to expand markets X Contaminated feedstocks ☐ Availability of cheap mulch ☐ Limited markets for contaminated products	☐ Other	Municipal contracts should include minimum buyback provisions. State and local agencies should prioritize use of food waste compost in government projects. See recently passed legislation HB2713.
Land use	☐ No available land ☐ Cost of land too high	☐ Other	
Other	☐ Need for different type of feedstock ☐ Worried about odor	X Other	Worried about the perception of odors from composting.

10. **Which of those factors are the most significant for you?** Expanding end markets through buyback programs and use in government projects. Additionally, the organics processor does not create contamination—this comes from the generator. Increased education and enforcement at the generator level, therefore, would significantly help.

11. **If you could wave a magic wand and wish for 1 or 2 things that would help you be able to handle more food waste feedstocks, what would they be, if different than above?** Statewide mandate for every week composting service (where provided).

12. **The goal of this interview is to provide a picture of food waste management systems to inform a state plan to manage food waste.**

    Given that goal, is there anything else you would like to share with us? We want to emphasize the importance of keeping processing local and in-state. This maintains the sustainability of the programs and provides environmental benefits.

Cedar Grove (Maple Valley)

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

Letter of introduction

The State of Washington is preparing a Wasted Food Reduction and Food Waste Diversion Plan. As part of this evaluation, we're reaching out to different types of businesses and organizations that manage food after its primary intended consumption point. These include hunger relief organizations, anaerobic digesters and other industrial processors, compost facilities, and animal feed operations.
We're studying three main areas to build a picture of the state's food waste management system:

A. **Flow of Food:** How much food waste is currently flowing through facilities in the food management system, including compost facilities?
B. **Metrics & Protocols:** What is being measured and how is it being measured? What opportunities exist to harmonize metrics and protocols across the system?
C. **System Capacity:** What is the available capacity of each entity? What are the barriers to increasing capacity of each entity?

Participating in this study is voluntary. The study team will not publish your facility's name or address or any staff names in our report. The report will benefit state decision-making around food waste management planning.

If you can, please help us by filling out the survey on the following pages. It should only take up to 15 minutes to complete.

We can also schedule a phone call so that you can talk through your answers if you'd like.

For questions and scheduling, please contact Maddie Seibert at maddie@cascadiaconsulting.com or 781-850-6545.

Thank you,

Heather Levy
Director of Consulting Operations
Cascadia Consulting Group, Inc.

Respondent information

Name: Ron Westmoreland

Position: General Manager

Business Name: Cedar Grove Composting Co. Maple Valley

Business Location: Maple Valley, WA

CASCADIA

1

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

1. **Please fill out the tables below, which are based on Department of Ecology reporting categories.**
   What are the sources of your food waste feedstocks (ex. food processors, grocery, farms, curbside collection)?

Post-consumer food waste **In 2018, your facility reported: 49,609 tons of post-consumer food waste**

Post-consumer food waste source 1:	Commercial business sources including but not limited to restaurants, cafeterias, schools, stadiums, grocery stores etc.
What percent of post-consumer food waste comes from this source?	100 %
What types of items are in feedstock from this source?	Post-Consumer food waste, Pre-Consumer food waste, Compostable Packaging/Cutlery and food soiled paper

Post-consumer food waste source 2: No Other sources	
What percent of post-consumer food waste comes from this source?	_____ %
What types of items are in feedstock from this source?	

Post-consumer food waste source 3: No Other sources	
What percent of post-consumer food waste comes from this source?	_____ %
What types of items are in feedstock from this source?	

Yard debris/food waste **In 2018, your facility reported: 149,166 tons of yard debris/food waste**

Yard debris/food waste source 1:	Residential Curbside Collection programs that allow Food waste
What percent of yard debris/food waste comes from this source? General estimate as material is collected co-mingled and variable.	100 %
What percentage of this category is yard debris vs. food waste?	90 % yard debris 10 % food waste (this is a general estimate that includes seasonal and other variability)
What other types of items are in feedstock from this source, if any?	No compostable packaging allowed in residential stream except approved compostable bags in a majority of programs.

Yard debris/food waste source 2:	No other source.
What percent of yard debris/food waste comes from this source?	_____ %
What percentage of this category is yard debris vs. food waste?	_____ % yard debris _____ % food waste

CASCADIA

2

What other types of items are in feedstock from this source, if any?	

2. **What qualities of food waste feedstocks do you track at your facility, if any? Ex. level of contamination, etc.**
   We inspect for unacceptable material and contaminants upon arrival.

3. **What are your facility's main outputs? Compost**

Check box	**Type of output**	**Quantity / % of total output**
x	**Finished compost**	140,460 cu.yds. / 100%
☐	**Mulch**	
☐	**Landfill: ADC**	
☐	**Other (please specify)**	

Capacity Questions

4. **What is your facility's permitted capacity?** 250,000 tons/annual

5. **Could your facility process more total feedstock than it does currently?** Yes

6. **Could your facility process more food scraps than it does currently?** Yes

7. **Do you have any plans to expand your facility or to build a new one?** No expansion planned for this facility. Cedar Grove is always exploring opportunities in regards to new facilities.

8. **Have you considered adding anaerobic digestion on-site? Why or why not?** Yes. 5000 tons A.D. Permit application was submitted in 2016 to Public Health and PSCAA. PSCAA proposed permit conditions made compliance impossible.

9. **What factors limit your ability to process additional food scraps?**

	Barriers	**Notes**
Regulatory	☐ Solid waste permitting too costly to obtain X Other	Physical and permitted capacity of facility dictate limits. Inability to get approvals for facility improvements. Punitive enforcement environment with PSCAA.

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

Economic	☐ Acquiring feedstocks is challenging ☐ Competition from other facilities ☐ Hard to get loans for new equipment ☐ Other		
Markets	x Need to expand markets ☐ Contaminated feedstocks ☐ Availability of cheap mulch ☐ Limited markets for contaminated products	☐ Other	Municipal contracts should include minimum buyback provisions. State and local agencies should prioritize use of food waste compost in government projects. See recently passed legislation HB2713.
Land use	☐ No available land ☐ Cost of land too high	☐ Other	
Other	☐ Need for different type of feedstock ☐ Worried about odor	X Other	Worried about the perception of odors from composting.

10. **Which of those factors are the most significant for you?** Expanding end markets through buyback programs and use in government projects. Additionally, the organics processor does not create contamination—this comes from the generator. Increased education and enforcement at the generator level, therefore, would significantly help.

11. **If you could wave a magic wand and wish for 1 or 2 things that would help you be able to handle more food waste feedstocks, what would they be, if different than above?** Statewide mandate for every week composting service (where provided).

12. **The goal of this interview is to provide a picture of food waste management systems to inform a state plan to manage food waste.**

    Given that goal, is there anything else you would like to share with us? We want to emphasize the importance of keeping processing local and in-state. This maintains the sustainability of the programs and provides environmental benefits.

CASCADIA

4

JBLM Composting

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

Letter of introduction

The State of Washington is preparing a Wasted Food Reduction and Food Waste Diversion Plan. As part of this evaluation, we're reaching out to different types of businesses and organizations that manage food after its primary intended consumption point. These include hunger relief organizations, anaerobic digesters and other industrial processors, compost facilities, and animal feed operations.
We're studying three main areas to build a picture of the state's food waste management system:

A. **Flow of Food:** How much food waste is currently flowing through facilities in the food management system, including compost facilities?
B. **Metrics & Protocols:** What is being measured and how is it being measured? What opportunities exist to harmonize metrics and protocols across the system?
C. **System Capacity:** What is the available capacity of each entity? What are the barriers to increasing capacity of each entity?

Participating in this study is voluntary. The study team will not publish your facility's name or address or any staff names in our report. The report will benefit state decision-making around food waste management planning.

If you can, please help us by filling out the survey on the following pages. It should only take up to 15 minutes to complete.

We can also schedule a phone call so that you can talk through your answers if you'd like.

For questions and scheduling, please contact Maddie Seibert at maddie@cascadiaconsulting.com or 781-850-6545.

Thank you,

Heather Levy
Director of Consulting Operations
Cascadia Consulting Group, Inc.

Respondent information

Name:

Position:

Business Name: JBLM PCSS Storage + Treatment Facility & Composting Facility

Business Location: Fort Lewis, WA

CASCADIA

1

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

1. **Please fill out the tables below, which are based on Department of Ecology reporting categories.**
   What are the sources of your food waste feedstocks (ex. food processors, grocery, farms, curbside collection)?

Post-consumer food waste **In 2018, your facility reported: 876 tons of post-consumer food waste**

Post-consumer food waste source 1:	Commissaries (JBLM Groceries)
What percent of post-consumer food waste comes from this source?	15 %
What types of items are in feedstock from this source?	Perished food items.

Post-consumer food waste source 2:	Dining Facilities and Child Development Centers
What percent of post-consumer food waste comes from this source?	49 %
What types of items are in feedstock from this source?	Perished food items, food scraps, and post-consumer food waste.

Post-consumer food waste source 3:	Fast Food/Restaurants
What percent of post-consumer food waste comes from this source?	35 %
What types of items are in feedstock from this source?	Perished food items, food scraps, and post-consumer food waste.

2. **What qualities of food waste feedstocks do you track at your facility, if any? Ex. level of contamination, etc.**

   JBLM only tracks the amount by weight of foodwaste brought in by each building that has collection containers. Contamination can be traced back by load to the building of origin and corrected on site.

3. **What are your facility's main outputs?**

Check box	**Type of output**	**Quantity / % of total output**
☒	**Finished compost**	**60%**
☒	**Mulch**	**36%**
☐	**Landfill: ADC**	
☒	**Other (please specify): Top Soil Blend**	**4%**

Capacity Questions

4. **What is your facility's permitted capacity?**

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2

6,252 cubic yards of material in the active composting operation.

5. **Could your facility process more total feedstock than it does currently?**

   Potentially yes. We are limited by manpower and equipment.

6. **Could your facility process more food scraps than it does currently?**

   JBLM has the capacity to compost up to 1000 tons of foodwaste annually.

7. **Do you have any plans to expand your facility or to build a new one?**

   There are plans to upgrade the facility's aeration system to an in-floor aeration system.

8. **Have you considered adding anaerobic digestion on-site? Why or why not?**

   No. The quantity of foodwaste generated at JBLM would not meet the required capacity to remain financially viable.

9. **What factors limit your ability to process additional food scraps?**

	Barriers		Notes
Regulatory	☐ Solid waste permitting too costly to obtain	☐ Other	
Economic	☐ Acquiring feedstocks is challenging ☐ Competition from other facilities ☐ Hard to get loans for new equipment ☒ Other		JBLM is limited by manpower and equipment.
Markets	☐ Need to expand markets ☐ Contaminated feedstocks ☐ Availability of cheap mulch ☐ Limited markets for contaminated products	☐ Other	
Land use	☐ No available land ☐ Cost of land too high	☒ Other	JBLM is limited to only four aerated static bays for active composting.
Other	☐ Need for different type of feedstock ☐ Worried about odor	☐ Other	

10. **Which of those factors are the most significant for you?**

    Having only four aerated bays places a cap on the amount of feedstocks that can be composted.

11. **If you could wave a magic wand and wish for 1 or 2 things that would help you be able to handle more food waste feedstocks, what would they be, if different than above?**

    Having a tub grinder to process the foodwaste to improve active compost processing times.

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3

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

12. The goal of this interview is to provide a picture of food waste management systems to inform a state plan to manage food waste.

    Given that goal, is there anything else you would like to share with us?

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4

Ovenell Farms

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

Letter of introduction

The State of Washington is preparing a Wasted Food Reduction and Food Waste Diversion Plan. As part of this evaluation, we're reaching out to different types of businesses and organizations that manage food after its primary intended consumption point. These include hunger relief organizations, anaerobic digesters and other industrial processors, compost facilities, and animal feed operations.
We're studying three main areas to build a picture of the state's food waste management system:

A. **Flow of Food:** How much food waste is currently flowing through facilities in the food management system, including compost facilities?
B. **Metrics & Protocols:** What is being measured and how is it being measured? What opportunities exist to harmonize metrics and protocols across the system?
C. **System Capacity:** What is the available capacity of each entity? What are the barriers to increasing capacity of each entity?

Participating in this study is voluntary. The study team will not publish your facility's name or address or any staff names in our report. The report will benefit state decision-making around food waste management planning.

If you can, please help us by filling out the survey on the following pages. It should only take up to 15 minutes to complete.

We can also schedule a phone call so that you can talk through your answers if you'd like.

For questions and scheduling, please contact Maddie Seibert at maddie@cascadiaconsulting.com or 781-850-6545.

Thank you,

Heather Levy
Director of Consulting Operations
Cascadia Consulting Group, Inc.

Respondent information

Name: Kyle Ovenell

Position: Controller

Business Name: Ovenell Farms, Inc

Business Location: Quincy, WA

CASCADIA

1

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

1. **Please fill out the tables below, which are based on Department of Ecology reporting categories.**
   What are the sources of your food waste feedstocks (ex. food processors, grocery, farms, curbside collection)?

Food processing waste **In 2018, your facility reported: 4,977.93 tons of food processing waste**

Food processing waste source 1:	Brown Boy Onion
What percent of food processing waste comes from this source?	75 %
What types of items are in feedstock from this source?	Onions

Food processing waste source 2:	Blue Sky Onion
What percent of food processing waste comes from this source?	17 %
What types of items are in feedstock from this source?	Onions

Food processing waste source 3:	Double Diamond
What percent of food processing waste comes from this source?	6 %
What types of items are in feedstock from this source?	Cherries, Apples, Apricots

2. **What qualities of food waste feedstocks do you track at your facility, if any? Ex. level of contamination, etc.**

   Level of contamination, moisture, dirt content

3. **What are your facility's main outputs?**

Check box	**Type of output**	**Quantity / % of total output**
x	**Finished compost**	**34%**
☐	**Mulch**	
☐	**Landfill: ADC**	
x	**Other (please specify)**	**66%, reselling materials and providing services**

Capacity Questions

4. **What is your facility's permitted capacity?** 204,600 yards
5. **Could your facility process more total feedstock than it does currently?** Yes

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2

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

6. **Could your facility process more food scraps than it does currently?** If the source is a food processor providing a contaminant free feedstock, yes.

7. **Do you have any plans to expand your facility or to build a new one?** We are well within our capacity, so expansion is unlikely. However, adopting alternative methods to process feedstocks is possible.

8. **Have you considered adding anaerobic digestion on-site? Why or why not?** Yes. Feedstocks are seasonal so proving a consistent mix to the AD would be difficult. Also, if the main output from the AD is electricity it has a difficult time competing with Grant Count PUD rates. It is expensive.

9. **What factors limit your ability to process additional food scraps?**

	Barriers		Notes
Regulatory	☐ Solid waste permitting too costly to obtain	☐ Other	
Economic	x Acquiring feedstocks is challenging ☐ Competition from other facilities ☐ Hard to get loans for new equipment ☐		Processors and growers have inexpensive alternatives
Markets	☐ Need to expand markets x Contaminated feedstocks ☐ Availability of cheap mulch x Limited markets for contaminated products	Other	
Land use	☐ No available land ☐ Cost of land too high	☐ Other	
Other	☐ Need for different type of feedstock ☐ Worried about odor	☐ Other	

10. **Which of those factors are the most significant for you?** Acquiring feedstocks is challenging as the processors and growers have cheap alternatives for handling their biproducts. However, directing feedstocks alternative routes may become more difficult, opening possibilities. Also, if the feedstock is contaminated the grower will likely pass on the risk of using the finished compost

11. **If you could wave a magic wand and wish for 1 or 2 things that would help you be able to handle more food waste feedstocks, what would they be, if different than above?** Gasification technology would provide a product for a local market. Additionally, some sort of biochar manufacturing process to take advantage of the woody biomass created from grinding orchards and to have the product on hand for mitigating odors from food waste handling processes.

12. **The goal of this interview is to provide a picture of food waste management systems to inform a state plan to manage food waste.**

    Given that goal, is there anything else you would like to share with us? We do not handle commercial food waste but have experience. Food safety guidelines have little tolerance for contamination which makes marketing compost from those feedstocks to agriculture, difficult. In some cases, private industry has more stringent guidelines than WSDA and conduct their own audits on growers. The market is demanding increased attention and care towards how food is grown. There is capacity in agriculture for all the compost

produced in the state if it is in the right condition. Compost applied to crops can promote an environment so that soil is sequestering carbon and mitigating climate change. I would urge the state to separate commercial food waste from green waste as food waste hinders the quality of green waste compost due to the level of contamination. Without commercial food waste, composters would have a shot at getting the finished compost clean enough for some agriculture. Commercial food waste can then be pre-processed for an anerobic digester.

Stafford Creek Corrections Center

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

Letter of introduction

The State of Washington is preparing a Wasted Food Reduction and Food Waste Diversion Plan. As part of this evaluation, we're reaching out to different types of businesses and organizations that manage food after its primary intended consumption point. These include hunger relief organizations, anaerobic digesters and other industrial processors, compost facilities, and animal feed operations.

We're studying three main areas to build a picture of the state's food waste management system:

A. **Flow of Food:** How much food waste is currently flowing through facilities in the food management system, including compost facilities?
B. **Metrics & Protocols:** What is being measured and how is it being measured? What opportunities exist to harmonize metrics and protocols across the system?
C. **System Capacity:** What is the available capacity of each entity? What are the barriers to increasing capacity of each entity?

Participating in this study is voluntary. The study team will not publish your facility's name or address or any staff names in our report. The report will benefit state decision-making around food waste management planning.

If you can, please help us by filling out the survey on the following pages. It should only take up to 15 minutes to complete.

We can also schedule a phone call so that you can talk through your answers if you'd like.

For questions and scheduling, please contact Maddie Seibert at maddie@cascadiaconsulting.com or 781-850-6545.

Thank you,

Heather Levy
Director of Consulting Operations
Cascadia Consulting Group, Inc.

Respondent information

Name:

Position:

Business Name: Stafford Creek Corrections Center

Business Location: Aberdeen, WA

CASCADIA

1

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

1. **Please fill out the tables below, which are based on Department of Ecology reporting categories.**
   What are the sources of your food waste feedstocks (ex. food processors, grocery, farms, curbside collection)?

Post-consumer food waste **In 2018, your facility reported: 134 tons of post-consumer food waste**

Post-consumer food waste source 1: Correctional Industries	
What percent of post-consumer food waste comes from this source?	75 %
What types of items are in feedstock from this source? Meat, Fruits, Dairy Products, Vegetables, Bread	

Post-consumer food waste source 2: Charlie's Produce	
What percent of post-consumer food waste comes from this source?	25 %
What types of items are in feedstock from this source? Vegetables & Fruits	

Post-consumer food waste source 3:	
What percent of post-consumer food waste comes from this source?	%
What types of items are in feedstock from this source?	

2. **What qualities of food waste feedstocks do you track at your facility, if any? Ex. level of contamination, etc.**

   Do not track.

3. **What are your facility's main outputs?**

Check box	**Type of output**	**Quantity / % of total output**
X	**Finished compost**	**100%**
☐	**Mulch**	
☐	**Landfill: ADC**	
☐	**Other (please specify)**	

Capacity Questions

4. **What is your facility's permitted capacity?**

   Unlimited capacity but for onsite use only.

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2

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

5. **Could your facility process more total feedstock than it does currently?**

   Yes

6. **Could your facility process more food scraps than it does currently?**

   Yes

7. **Do you have any plans to expand your facility or to build a new one?**

   No

8. **Have you considered adding anaerobic digestion on-site? Why or why not?**

   No, we produce compost that's used on site as a local soil amendment. Composting is less expensive and meets our current needs as well as reduces all food waste from our facility from going to the landfill. Our current infrastructure does not support installing an anaerobic digestion and would require a costly investment.

9. **What factors limit your ability to process additional food scraps?**

	Barriers		Notes
Regulatory	☐ Solid waste permitting too costly to obtain	☐ Other	
Economic	X Acquiring feedstocks is challenging ☐ Competition from other facilities X Hard to get loans for new equipment ☐ Other		
Markets	☐ Need to expand markets ☐ Contaminated feedstocks X Availability of cheap mulch ☐ Limited markets for contaminated products	☐ Other	
Land use	☐ No available land ☐ Cost of land too high	☐ Other	
Other	X Need for different type of feedstock X Worried about odor	☐ Other	

10. **Which of those factors are the most significant for you?**

    Acquiring feedstocks is challenging.

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3

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

11. If you could wave a magic wand and wish for 1 or 2 things that would help you be able to handle more food waste feedstocks, what would they be, if different than above?

    Larger composting facility with additional food waste feedstock sources. Also incorporate an exhaust bio filter system to reduce unwanted odors.

12. The goal of this interview is to provide a picture of food waste management systems to inform a state plan to manage food waste.

    Given that goal, is there anything else you would like to share with us?

    Not at this time.

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4

Stemilt World Famous Compost Company

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

Letter of introduction

The State of Washington is preparing a Wasted Food Reduction and Food Waste Diversion Plan. As part of this evaluation, we're reaching out to different types of businesses and organizations that manage food after its primary intended consumption point. These include hunger relief organizations, anaerobic digesters and other industrial processors, compost facilities, and animal feed operations.

We're studying three main areas to build a picture of the state's food waste management system:

A. **Flow of Food:** How much food waste is currently flowing through facilities in the food management system, including compost facilities?
B. **Metrics & Protocols:** What is being measured and how is it being measured? What opportunities exist to harmonize metrics and protocols across the system?
C. **System Capacity:** What is the available capacity of each entity? What are the barriers to increasing capacity of each entity?

Participating in this study is voluntary. The study team will not publish your facility's name or address or any staff names in our report. The report will benefit state decision-making around food waste management planning.

If you can, please help us by filling out the survey on the following pages. It should only take up to 15 minutes to complete.

We can also schedule a phone call so that you can talk through your answers if you'd like.

For questions and scheduling, please contact Maddie Seibert at maddie@cascadiaconsulting.com or 781-850-6545.

Thank you,

Heather Levy
Director of Consulting Operations
Cascadia Consulting Group, Inc.

Respondent information

Name: Patrick Jordan

Position: Compost Operations Manager

Business Name: Stemilt World Famous Compost Facility

Business Location: 4471 Stemilt Hill Rd, Wenatchee, WA

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WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

1. **Please fill out the tables below, which are based on Department of Ecology reporting categories.**
   What are the sources of your food waste feedstocks (ex. food processors, grocery, farms, curbside collection)?

Food processing waste **In 2018, your facility reported: 1994.8 tons of food processing waste**

Food processing waste source 1:	Fruit warehouse (pre consumer)
What percent of food processing waste comes from this source?	_____ %
What types of items are in feedstock from this source?	Apples, pears, cherries

Food processing waste source 2:	
What percent of food processing waste comes from this source?	_____ %
What types of items are in feedstock from this source?	

Food processing waste source 3:	
What percent of food processing waste comes from this source?	_____ %
What types of items are in feedstock from this source?	

2. **What qualities of food waste feedstocks do you track at your facility, if any? Ex. level of contamination, etc.**

   Contamination/ odors

3. **What are your facility's main outputs?**

Check box	**Type of output**	**Quantity / % of total output**
x	**Finished compost**	**15,000 tons**
☐	**Mulch**	
☐	**Landfill: ADC**	
☐	**Other (please specify)**	

Capacity Questions

4. **What is your facility's permitted capacity? 15,000 finished compost annually**
5. **Could your facility process more total feedstock than it does currently? Space wise, yes. Permitting wise, no.**
6. **Could your facility process more food scraps than it does currently? No**

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2

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

7. **Do you have any plans to expand your facility or to build a new one? No plans for expansion. Maybe in the future but don't want to deal with title V**

8. **Have you considered adding anaerobic digestion on-site? Why or why not? No- doesn't meet our needs.**

9. **What factors limit your ability to process additional food scraps?**

	Barriers		Notes
Regulatory	x Solid waste permitting too costly to obtain	☐ Other	
Economic	☐ Acquiring feedstocks is challenging ☐ Competition from other facilities x Hard to get loans for new equipment ☐ Other		
Markets	☐ Need to expand markets x Contaminated feedstocks ☐ Availability of cheap mulch ☐ Limited markets for contaminated products	☐ Other	
Land use	☐ No available land ☐ Cost of land too high	☐ Other	
Other	☐ Need for different type of feedstock x Worried about odor	☐ Other	

10. **Which of those factors are the most significant for you? Odors/contamination/permitting**

11. **If you could wave a magic wand and wish for 1 or 2 things that would help you be able to handle more food waste feedstocks, what would they be, if different than above? Transporting waste feedstock**

12. **The goal of this interview is to provide a picture of food waste management systems to inform a state plan to manage food waste.**

    Given that goal, is there anything else you would like to share with us?

    Educate on what is acceptable.

    Educate what contamination is and how difficult it is to manage.

    Facility risks in regard to odors when taking food waste (compost facilities)

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3

Washington Corrections Center

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

Letter of introduction

The State of Washington is preparing a Wasted Food Reduction and Food Waste Diversion Plan. As part of this evaluation, we're reaching out to different types of businesses and organizations that manage food after its primary intended consumption point. These include hunger relief organizations, anaerobic digesters and other industrial processors, compost facilities, and animal feed operations.

We're studying three main areas to build a picture of the state's food waste management system:

A. **Flow of Food:** How much food waste is currently flowing through facilities in the food management system, including compost facilities?
B. **Metrics & Protocols:** What is being measured and how is it being measured? What opportunities exist to harmonize metrics and protocols across the system?
C. **System Capacity:** What is the available capacity of each entity? What are the barriers to increasing capacity of each entity?

Participating in this study is voluntary. The study team will not publish your facility's name or address or any staff names in our report. The report will benefit state decision-making around food waste management planning.

If you can, please help us by filling out the survey on the following pages. It should only take up to 15 minutes to complete.

We can also schedule a phone call so that you can talk through your answers if you'd like.

For questions and scheduling, please contact Maddie Seibert at maddie@cascadiaconsulting.com or 781-850-6545.

Thank you,

Heather Levy
Director of Consulting Operations
Cascadia Consulting Group, Inc.

Respondent information

Name: Dan McKenzie

Position: Construction and Maintenance Project Supervisor. Recycling and Compost.

Business Name: Washington Corrections Center Composting Facility

Business Location: Shelton, WA

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1

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

1. **Please fill out the tables below, which are based on Department of Ecology reporting categories.**
   What are the sources of your food waste feedstocks (ex. food processors, grocery, farms, curbside collection)?

Post-consumer food waste **In 2018, your facility reported: 93.02 tons of post-consumer food waste**

Post-consumer food waste source 1:	All coming from the institution
What percent of post-consumer food waste comes from this source?	____100_____ %
What types of items are in feedstock from this source?	Kitchen waste, plate scrapings, some garden waste.

Post-consumer food waste source 2:	
What percent of post-consumer food waste comes from this source?	_____ %
What types of items are in feedstock from this source?	

Post-consumer food waste source 3:	
What percent of post-consumer food waste comes from this source?	_____ %
What types of items are in feedstock from this source?	

2. **What qualities of food waste feedstocks do you track at your facility, if any? Ex. level of contamination, etc.**

Weights of food scraps, chips, and shavings. Do some testing to determine contamination. Someone else has the permit. Eric Heinitz: Environmental Planner for all of DOC. Phone 360-725-8397. efheinitz@doc1.wa.gov.

3. **What are your facility's main outputs?**

Check box	**Type of output**	**Quantity / % of total output**
x	**Finished compost**	**100%**
☐	**Mulch**	
☐	**Landfill: ADC**	
☐	**Other (please specify)**	

Capacity Questions

4. **What is your facility's permitted capacity?** Eric has this.

5. **Could your facility process more total feedstock than it does currently?** Could process more – originally planned to take waste from local schools, but that never happened.

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WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

6. **Could your facility process more food scraps than it does currently?**

7. **Do you have any plans to expand your facility or to build a new one?**

Used to have plans to build another facility. Drum has run through and hasn't composted in months. Not since August. Barrel rotted through and wasn't reparable. Plan to get a different type of composter. Food waste is currently going to a transfer station → landfill.

8. **Have you considered adding anaerobic digestion on-site? Why or why not?**

No, not enough volume and handling solid food waste items.

9. **What factors limit your ability to process additional food scraps?**

	Barriers		Notes
Regulatory	☐ Solid waste permitting too costly to obtain	☐ Other	
Economic	☐ Acquiring feedstocks is challenging ☐ Competition from other facilities ☐ Hard to get loans for new equipment ☐ Other		• COVID-19 impacting sourcing • Currently at the end of the fiscal year • No problem acquiring feedstocks.
Markets	☐ Need to expand markets ☐ Contaminated feedstocks ☐ Availability of cheap mulch ☐ Limited markets for contaminated products	☐ Other	No market, so this isn't an issue. All compost is used on-site in the fields and vegetable garden and flower beds.
Land use	☐ No available land ☐ Cost of land too high	☐ Other	Could use more space.
Other	☐ Need for different type of feedstock ☐ Worried about odor	☐ Other	Broken barrel: equipment

10. **Which of those factors are the most significant for you?**

Could always say funding as a barrier. If I had my choice, the compost facility is on the property but non-fenced area. If it were in the fenced area, would be much more convenient. This does mean that the kitchen disposes some compostable items to the garbage – it's more convenient. Could probably handle more compost if it were inside the fence.

There is no building inside the fence for the pile. It would be expensive to build a new building. Recommendation for the new guy would move everything inside.

11. **If you could wave a magic wand and wish for 1 or 2 things that would help you be able to handle more food waste feedstocks, what would they be, if different than above?**

12. **The goal of this interview is to provide a picture of food waste management systems to inform a state plan to manage food waste.**

Given that goal, is there anything else you would like to share with us?

Nothing coming to mind. We don't make that much compost. Goal could be to expand and use more feedstocks. Schools, etc. Could go to other public agencies.

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Washington Corrections Center for Women

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

Letter of introduction

The State of Washington is preparing a Wasted Food Reduction and Food Waste Diversion Plan. As part of this evaluation, we're reaching out to different types of businesses and organizations that manage food after its primary intended consumption point. These include hunger relief organizations, anaerobic digesters and other industrial processors, compost facilities, and animal feed operations.

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A. **Flow of Food:** How much food waste is currently flowing through facilities in the food management system, including compost facilities?
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C. **System Capacity:** What is the available capacity of each entity? What are the barriers to increasing capacity of each entity?

Participating in this study is voluntary. The study team will not publish your facility's name or address or any staff names in our report. The report will benefit state decision-making around food waste management planning.

If you can, please help us by filling out the survey on the following pages. It should only take up to 15 minutes to complete.

We can also schedule a phone call so that you can talk through your answers if you'd like.

For questions and scheduling, please contact Maddie Seibert at maddie@cascadiaconsulting.com or 781-850-6545.

Thank you,

Heather Levy
Director of Consulting Operations
Cascadia Consulting Group, Inc.

Respondent information

Name: Mark Blatman

Position: Construction Maintenance Supervisor Recycle & Compost

Business Name: Washington Corrections Center for Women Composting Facility

Business Location: Gig Harbor, WA

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1

WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

1. **Please fill out the tables below, which are based on Department of Ecology reporting categories.**
   What are the sources of your food waste feedstocks (ex. food processors, grocery, farms, curbside collection)?

Post-consumer food waste **In 2018, your facility reported: 71.87 tons of post-consumer food waste**

Post-consumer food waste source 1:	WA DEPT OF CORRECTIONS WA CORRECTIONS CENTER FOR WOMEN
What percent of post-consumer food waste comes from this source?	100 %
What types of items are in feedstock from this source?	All meals served by WCCW/DOC Food service.

Post-consumer food waste source 2:	
What percent of post-consumer food waste comes from this source?	_____ %
What types of items are in feedstock from this source?	

Post-consumer food waste source 3:	
What percent of post-consumer food waste comes from this source?	_____ %
What types of items are in feedstock from this source?	

2. **What qualities of food waste feedstocks do you track at your facility, if any? Ex. level of contamination, etc.**

   NONE, OTHER THAN EXCESSIVE WATER CONTENT

3. **What are your facility's main outputs?**

Check box	**Type of output**	**Quantity / % of total output**
x	**Finished compost**	**85%**
x	**Mulch**	**15%**
☐	**Landfill: ADC**	
☐	**Other (please specify)**	

Capacity Questions

4. **What is your facility's permitted capacity? WCCW is an exempt facility. Not open to the public.**

5. **Could your facility process more total feedstock than it does currently? unknown**

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WASHINGTON STATE FOOD WASTE MANAGEMENT STUDY

6. **Could your facility process more food scraps than it does currently? yes**

7. **Do you have any plans to expand your facility or to build a new one? no**

8. **Have you considered adding anaerobic digestion on-site? Why or why not? No, too much odor. Very close to residential area**

9. **What factors limit your ability to process additional food scraps? State owned facility. Operated by Dept. of Corrections. Not open to the public**

	Barriers		Notes
Regulatory	☐ Solid waste permitting too costly to obtain	☐ Other	
Economic	☐ Acquiring feedstocks is challenging ☐ Competition from other facilities ☐ Hard to get loans for new equipment ☐ Other		
Markets	☐ Need to expand markets ☐ Contaminated feedstocks ☐ Availability of cheap mulch ☐ Limited markets for contaminated products	☐ Other	
Land use	☐ No available land ☐ Cost of land too high	☐ Other	
Other	☐ Need for different type of feedstock ☐ Worried about odor	☐ Other	

10. **Which of those factors are the most significant for you? N/A**

11. **If you could wave a magic wand and wish for 1 or 2 things that would help you be able to handle more food waste feedstocks, what would they be, if different than above? N/A**

12. **The goal of this interview is to provide a picture of food waste management systems to inform a state plan to manage food waste.**

    Given that goal, is there anything else you would like to share with us?

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Appendix E: Animal Feed Food Waste Categories

The following lists of ingredients are those that the WSDA includes in its ingredient categories for commercial feed distributors' reporting (WSDA, 2018). This appendix includes all ingredient categories that this evaluation considers to be food waste under the HB 1114 definition.

Animal Products

- Meat (if ground, artificially dried, and/or mixed with other feeds)
- Meat by-products
- Animal liver
- Poultry by-product meal
- Poultry hatchery by-product
- Dried meat solubles
- Poultry by-products
- Hydrolyzed poultry feathers
- Fleshings hydrolysate
- Animal serum
- Serum albumin
- Serum globulin
- Spray dried animal blood cells
- Meat meal
- Meat and bone meal
- Meat meal tankage
- Hydrolyzed hair
- Hydrolyzed leather meal
- Spray dried animal blood
- Poultry
- Hydrolyzed whole poultry
- Hydrolyzed poultry by-products aggregate
- Egg shell meat
- Blood meal
- Blood meal, flash dried
- Blood protein
- Glandular meal and extracted glandular meal
- Unborn calf carcasses
- Animal digest
- Cooked bone marrow
- Mechanically separated bone marrow
- Poultry meal
- Animal plasma
- Ensiled paunch
- Egg product
- Leather hydrolysate

- (Mammalian or poultry) stock/broth
- Meat protein isolate
- Air dried animal blood cells (air swept tabular drying)
- Hydrolyzed whole swine

Brewers Products

- Brewers dried grains
- Malt sprouts
- Malt cleaning
- Malt hulls (if ground, artificially dried, and/or mixed with other feeds)
- Dried spent hops
- Brewers wet grains
- Brewers condensed solubles

Distillers Products

- Molasses distillers dried solubles
- Molasses distillers condensed solubles
- Potato distillers dried residue
- Distillers dried solubles
- Distillers dried grains
- Distillers dried grains with solubles
- Condensed distillers solubles
- Distillers wet grains
- Deoiled corn distillers dried grains with solubles, solvent extract

Human Food By-products

- Dried apple pomace
- Dried apple pectin pulp
- Dried tomato pomace
- Cereal food fines
- Dried potato products
- Gelatin by-products
- Dried beans
- Sugar foods by-products
- Past product
- Food processing waste
- Restaurant food waste
- Recovered retail food
- Mixed feed nuts
- Other fruit pomace

Screenings

- Grain screenings
- Mixed screenings
- Chaff and/or dust