COMPOSTING FEASIBILITY STUDY
FAIRBANKS NORTH STAR BOROUGH, ALASKA

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<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>°C</td>
<td>degrees Celsius</td>
</tr>
<tr>
<td>AD</td>
<td>anaerobic digestion</td>
</tr>
<tr>
<td>ASP</td>
<td>aerated static pile</td>
</tr>
<tr>
<td>AW</td>
<td>Alaska Waste</td>
</tr>
<tr>
<td>C:N</td>
<td>carbon to nitrogen ratio</td>
</tr>
<tr>
<td>CSA</td>
<td>community supported agriculture</td>
</tr>
<tr>
<td>cf</td>
<td>cubic feet</td>
</tr>
<tr>
<td>cy</td>
<td>cubic yards</td>
</tr>
<tr>
<td>FCFB</td>
<td>Fairbanks Community Food Bank</td>
</tr>
<tr>
<td>FNSB</td>
<td>Fairbanks North Star Borough</td>
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<tr>
<td>FS</td>
<td>Facilities Services</td>
</tr>
<tr>
<td>FSWCD</td>
<td>Fairbanks Soil and Water Conservation District</td>
</tr>
<tr>
<td>GHU</td>
<td>Golden Heart Utilities</td>
</tr>
<tr>
<td>MSW</td>
<td>municipal solid waste</td>
</tr>
<tr>
<td>MSWO</td>
<td>municipal solid waste organics</td>
</tr>
<tr>
<td>NOP</td>
<td>National Organics Program</td>
</tr>
<tr>
<td>NRCS</td>
<td>Natural Resources Conservation Service</td>
</tr>
<tr>
<td>OS</td>
<td>Office of Sustainability</td>
</tr>
<tr>
<td>PFRP</td>
<td>processing for further reduction of pathogens</td>
</tr>
<tr>
<td>POP</td>
<td>persistent organic pollutant</td>
</tr>
<tr>
<td>RFP</td>
<td>request for proposal</td>
</tr>
<tr>
<td>SO</td>
<td>Susitna Organics</td>
</tr>
<tr>
<td>STA</td>
<td>Seal of Testing Assurance</td>
</tr>
<tr>
<td>tpy</td>
<td>tons per year</td>
</tr>
<tr>
<td>UAF</td>
<td>University of Alaska Fairbanks</td>
</tr>
<tr>
<td>USCC</td>
<td>US Composting Council</td>
</tr>
<tr>
<td>USDA</td>
<td>United States Department of Agriculture</td>
</tr>
<tr>
<td>USEPA</td>
<td>United States Environmental Protection Agency</td>
</tr>
<tr>
<td>USFDA</td>
<td>United States Food and Drug Administration</td>
</tr>
<tr>
<td>WWTP</td>
<td>wastewater treatment plant</td>
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</table>
FAIRBANKS NORTH STAR BOROUGH
COMPOSTING FEASIBILITY STUDY

EXECUTIVE SUMMARY

This study presents an evaluation of several approaches to increase diversion of municipal solid waste organics (MSWO) through composting. As this is the first study of its kind for the Fairbanks North Star Borough (FNSB), we present a detailed background on the nature of organic waste streams in Fairbanks, an overview of various composting techniques that can be applied on a municipal scale, and important factors to consider in designing a composting program. Included in the background sections are discussions about food waste and hunger, food waste as livestock feed, and vermicomposting (composting with worms). Also included are detailed sections on common MSWO contaminants and testing and certification programs. This background draws from existing literature on municipal composting, and provides context for our review of four major Alaskan composting operations and our analysis of four alternative approaches that could be implemented to increase MSWO diversion from the FNSB landfill.

Case studies are presented for the following Alaskan composting operations: Susitna Organics (SO) in the Matanuska-Susitna Valley, Alaska Waste (AW) in Anchorage, Golden Heart Utilities (GHU) in Fairbanks, and the Smith farm just east of Fairbanks. Each composting operation processes a unique blend of feedstocks, and each employs a different composting technique using equipment tailored to their feedstocks and their process. These operations largely target different markets, each with success. In evaluating the case studies, we look for key elements of success and strategies used by each operation to deal with common composting challenges. Following our presentation of these case studies, we present a brief evaluation of the Fairbanks compost market, specifically looking at different user groups with different quality and price expectations. This section also lists compost products currently available in Fairbanks. We highlight the fact that there is no premium, organic compost available in bulk quantities at a reasonable price, and that the small farm, greenhouse, and community supported agriculture (CSA) markets are currently underserved.

We then present an analysis of four alternative approaches to increasing MSWO composting in the FNSB. These approaches include an education and outreach campaign (Alternative 1), community composting cooperatives (Alternative 2), a private centralized composting operation (Alternative 3), and diversion to and expansion of GHU’s existing operation (Alternative 4). Alternative 1 has the potential to expand backyard composting, and generally raise awareness of the benefits of composting. Alternative 2 was ruled out as not feasible (at least as a FNSB-coordinated program) due to likely issues with implementation. Alternative 3 was found to be economically feasible, with the greatest chance of success in terms of developing a sustainable program that could divert a large portion of MSWO in the FNSB. Success of this alternative is contingent on the composter being able to produce a premium, bulk product that meets the needs of the underserved markets listed above. Alternative 4 was found to be feasible, but economically undesirable. This alternative has the advantage of building on an already successful operation, but due to the low price set for GHU biosolids-based compost,
would not be economically viable without significant capital investment and ongoing operating expense on the part of the FNSB.

While the economic analysis shows that a private centralized composting operation is likely feasible, there is significant uncertainty in certain critical assumptions, such as the volume of MSWO that would be available to such a program. There is a clear need for further research to inventory the volumes, quality, and recoverability of MSWO in Fairbanks, as well as the costs associated with current means of disposal. This information, combined with a more robust market analysis, is necessary in order to make any confident determination on the feasibility of this alternative. We recommend the FNSB pursue such research prior to starting or incentivizing any sort of municipal composting program.

We further recommend the FNSB pursue an education and outreach program (Alternative 1) regardless of whether a municipal composting program is later implemented, as it may help immediately increase diversion rates and will build public awareness and support for composting in general. We also recommend planning the areawide recycling facility to incorporate MSWO collections, as well as future collections at the transfer sites. This will lay the groundwork for implementing Alternative 3, a private centralized composting operation.
1.0 Introduction

Compostable organics make up a significant fraction of the municipal solid waste (MSW) stream. The United States Environmental Protection Agency (USEPA, 2012) estimates the average composition of MSW in the US includes 14.5% food waste and 13.5% yard waste, for a total of 28% potentially compostable materials. Wood and paper make up an additional 30% of the waste stream; wood is useful as a carbon source and bulking agent in compost, and soiled or otherwise non-recyclable paper can often be composted as well.

Recent efforts to advance recycling in Fairbanks have been focused on recyclable materials that can be exported and sold in commodity markets, such as paper, cardboard, plastics, and metals. A recent study (PDC Inc. Engineers, 2015) provided an economic analysis, recommendations, and a plan for implementing a community-wide recycling program for the FNSB, with a focus on commodity recyclables. However, there are no plans that specifically address the organic component of MSW.

Composting MSWO is an affordable way to increase our diversion rate, while at the same time yielding numerous environmental, social, and economic benefits. Composting is ideally suited to local implementation; in fact, it cannot be outsourced beyond a regional scale. This means that economic benefits of composting are largely retained by the community. MSWO composting programs have been demonstrated to:

- reduce solid waste management costs,
- improve soil health,
- strengthen local food production,
- create local jobs, and
- reduce landfill methane generation and sequester carbon.

When combined with anaerobic digestion (AD), such programs can also produce energy. Compared to recycling or landfiling, composting MSWO takes relatively little capital investment.

The FNSB recycling commission recognizes the potential benefits of composting as a key part of the broader waste management system. This study aims to lay the groundwork for planning and policy-making that will serve to increase composting of MSWO in the FNSB. We first present an overview of the state of composting in Alaska, the volume of organic waste generated in the FNSB, and list some common sources of organic waste. We then review the science and principles of composting, present an overview of composting techniques, and discuss important considerations that any composting program must take into account (e.g. odor and contaminants). Next, we present case studies of four major composting operations in Alaska, with additional information from other programs and sources that we collected during the course of our research. Finally, we present our analysis of several alternatives for pursuing MSWO composting in the FNSB, including increasing education and outreach,
composting MSWO by an independent operation, and diversion to an existing composting operation (GHU). The report concludes with recommendations for planning and policy to increase composting in the FNSB.

1.1 Overview of Composting in Alaska

Composting takes place across the state on various scales, ranging from single-household backyard compost piles to large industrial facilities processing tens of thousands of cubic yards (cy) of biosolids (sewage sludge) annually. In Section 3.0, we present case studies of four of the most successful composting operations in the state, including two in the Fairbanks area.

The largest composting operation in Alaska is at GHU in Fairbanks (Section 3.3), where over 40,000 cy of biosolids and wood chips are composted annually in large aerated static piles (Section 2.3.2) as part of the greater wastewater treatment operation. Susitna Organics (Section 3.1), located in the Matanuska-Susitna Valley, is a moderate-scale (2,500 to 3,000 cy feedstocks per year) private composter processing agricultural waste and selling their quality finished compost in premium markets. Alaska Waste (Section 3.1), located in Anchorage, is a waste-management company with a moderate-scale composting operation processing pre-consumer food waste and agricultural waste, selling most of their product to the landscaping market. Warren Smith (Section 3.4) is a farmer in the Fairbanks area producing an organic compost from nothing but waste straw (about 390 cy per year).

There are also thousands of individuals and households across the state that engage in composting on a small scale, generally in backyard static piles. Many individuals with their own livestock compost the manure as a means of disposing and reusing this valuable waste product. Owners of livestock are always on the lookout for more-affordable feed, and food waste is a common supplemental food when it is available. There are also many who feed their vegetable waste to worms year round, practicing vermicomposting (Section 2.5). Most of these household-scale operations process less than 1 cy of feedstocks annually.

Between the backyard operations and the larger operations are numerous farms, greenhouses, and community gardens where composting is conducted on a slightly larger scale. There is also at least one community composting program in the state (e.g. Gustavus) that engages in composting as part of the community’s solid waste management program. The scale of these operations is generally in the 10 cy to 100 cy range.

Despite the fact that the practice of composting is fairly widespread, the scale of most operations is quite small, and the larger programs (with the exception of AW) do not process MSWO. Overall diversion rates for MSWO, especially in Fairbanks, are minimal.

1.2 Organics in the Waste Stream

MSWO is commonly broken out into the subcategories of food waste and yard waste. However, as noted above, wood and paper can also be utilized in a composting operation.
For this study, we consider EPA (2012) waste composition and recycling recovery rates as applied to fiscal year 2014 MSW tonnage for the FNSB (PDC Inc. Engineers, 2015), presented in Table 1.

### Table 1 – Potential Recyclable Volumes in the FNSB

<table>
<thead>
<tr>
<th>Material</th>
<th>% of MSW</th>
<th>Estimated annual tonnage in FNSB</th>
<th>Recycling recovery rates</th>
<th>Recoverable tonnage in FNSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper/paper board</td>
<td>27.4</td>
<td>22,035</td>
<td>64.6</td>
<td>14,235</td>
</tr>
<tr>
<td>Glass</td>
<td>4.6</td>
<td>3,699</td>
<td>27.7</td>
<td>1,025</td>
</tr>
<tr>
<td>Steel</td>
<td>6.7</td>
<td>5,388</td>
<td>33.0</td>
<td>1,778</td>
</tr>
<tr>
<td>Aluminum</td>
<td>1.4</td>
<td>1,126</td>
<td>19.8</td>
<td>223</td>
</tr>
<tr>
<td>Other nonferrous metals</td>
<td>0.8</td>
<td>643</td>
<td>68.0</td>
<td>437</td>
</tr>
<tr>
<td>Plastics</td>
<td>12.7</td>
<td>10,213</td>
<td>8.8</td>
<td>899</td>
</tr>
<tr>
<td>Rubber, leather, textiles</td>
<td>8.7</td>
<td>6,997</td>
<td>33.6</td>
<td>2,351</td>
</tr>
<tr>
<td>Wood</td>
<td>6.3</td>
<td>5,066</td>
<td>15.2</td>
<td>770</td>
</tr>
<tr>
<td>Other</td>
<td>3.4</td>
<td>2,734</td>
<td>28.3</td>
<td>774</td>
</tr>
<tr>
<td>Food wastes</td>
<td>14.5</td>
<td>11,661</td>
<td>4.8</td>
<td>560</td>
</tr>
<tr>
<td>Yard trimmings*</td>
<td>13.5</td>
<td>10,857</td>
<td>57.7</td>
<td>6,264*</td>
</tr>
<tr>
<td>Organic waste totals</td>
<td>34.3</td>
<td>27,584</td>
<td>27.5</td>
<td>7,594*</td>
</tr>
</tbody>
</table>

Notes: * see adjustment for yard trimmings, below

The high nation-wide recovery rate for yard trimmings is due in large part to numerous statewide landfill disposal bans on yard waste implemented as early as the 1990s. Twenty five states had bans in effect as of 2010 (van Haaren, Themelis, & Goldstein, 2010); thus it is not surprising that the recovery rate for yard waste is over 50%. However, without a statewide disposal ban in Alaska, and with our short growing season, it is unlikely that we would achieve the estimated tonnage listed in the table above. For this project, we conservatively assume a total recoverable tonnage for yard waste of 3,100 tons (a recovery rate of about 30%). This reduces the total recoverable tonnage of organic waste to 4,330 tons.

Food waste is more difficult to handle than yard waste, more prone to physical contamination (contamination by other MSW; see Section 2.7.1), and has not benefitted from policy mandates in the form of disposal bans (except recently in California, Connecticut, Massachusetts, Rhode Island, and Vermont). There is significant room to improve recovery rates for food waste. While the nationwide average food waste recovery rate is low at 4.8%, many municipal composting programs are making gains in this area.

The economic analyses presented in this report (Section 5.0) assume the above tonnage for food waste, yard waste (less our adjustment), and wood waste would be available to a municipal composting program. This assumption is made with a significant degree of uncertainty. EPA recovery rates are nation-wide averages of communities with and without MSWO composting programs. While most communities in the US have recycling programs, MSWO composting programs are less common, and thus averages are less reflective of the potential
of any given individual community. It is possible that communities with robust MSWO composting programs achieve much higher diversion rates, but these isolated cases are masked in the nationwide averages.

It is also important to note that while a portion of the paper waste could also be incorporated into a composting program, paper waste is not considered in economic calculations due to uncertainty in what portion would be available for composting.

1.2.1 **Sources of Organic Waste**

While the EPA breaks down the MSW stream into categories including yard waste, food waste, and wood, these are fairly broad categories and are of limited usefulness when developing a composting program. It is worth considering different sources of organic wastes at different levels of quantity and quality, as these factors have important implications for the collection program and composting process. It is also worth considering accepting and processing non-municipal organic waste, such as agricultural waste, to increase the scale of a potential municipal program and to help balance municipal feedstocks in the process. The following list presents a breakdown of organic waste into more detailed categories; for each category we list a number of significant potential sources in the Fairbanks area:

- **Agricultural green waste** (e.g. moldy hay, moldy straw, crops compromised by pest or frost damage)
  - Farms
  - Greenhouses

- **Manure**
  - Farms
  - Stables

- **Fish waste**
  - Fish processors (e.g. Interior Alaska Fish Processors, Inc.)

- **Pre-consumer food waste**
  - Grocery stores
  - Restaurants
  - Other commercial kitchens (e.g. campus, post, schools, hospital)

- **Post-consumer food waste**
  - Restaurants
  - Other commercial kitchens
  - Residences

- **Yard waste** (lawn clippings, leaves)
  - Residences
  - Commercial landscapers

- **Wood waste**
  - Wildfire fuel reduction projects
  - Clearing/landscaping
• Soiled paper and compostable cutlery
  o Community recycler (paper not suitable for commodity recycling)
  o Restaurants
  o Other commercial kitchens

Understanding sources, volumes, and fate of organic waste in the FNSB is a key step in designing an effective MSWO composting program. For example, it is important to differentiate between pre-consumer vs. post-consumer food waste as it is much easier to control quality for the pre-consumer category. Likewise, it is also important to know how much yard waste is currently left in place on lawns (grass-cycling), composted in backyard piles, or landfilled. Also, agricultural waste, wood waste, and paper waste may be useful for balancing the high-nitrogen, high-moisture stream of food waste, and the potential supply of these waste streams should be evaluated.

1.3 Food Waste and Hunger

While many municipalities have begun to pursue composting as a way to keep food waste out of landfills, the redistribution of food to the hungry should be the highest priority of any program handling food waste. Much of the pre-consumer food waste generated by grocery stores, institutional cafeterias, and private restaurants is perfectly edible, if redistributed before it spoils. Currently, the Fairbanks Community Food Bank (FCFB) collects food approaching its use-by date from all local grocery stores on a regular basis. This source represents about 90% of the food collected by the FCFB. According to FCFB chief executive officer Anne Weaver (personal communication, November 20, 2015), very little edible food is wasted by the local grocery stores, largely due to FCFB’s collection program. FCFB in turn is quick to redistribute this food before it spoils; if it does (they estimate less than 10% spoils before redistribution), they give it to local goat and pig farmers for feed.

While the FCFB operates a very successful collection program, ensuring that most of the pre-consumer food waste from local grocers goes to those in need, there are many restaurants, other commercial kitchens, and households that allow food to go bad and then dispose of it in the landfill. An effort should be made to expand programs like the FCFB’s (as well as food-waste-to-livestock programs; see Section 2.4) before potentially-edible food waste becomes a feedstock in composting.
2.0 Background

The following sections provide a background on composting and its relationship to other aspects of the waste management system; present common composting techniques; identify some alternative approaches; and discuss some important considerations and key challenges for the composting industry. This background provides context for the alternatives we present and analyze in Section 5.0. It also serves to educate the reader on the wide array of technical approaches to composting and certain critical factors to address when developing a successful composting program.

2.1 Science and Principles of Composting

The science of composting is relatively basic, though the variability inherent in organic feedstocks make successful implementation of composting somewhat of an art. Composting is essentially the controlled and accelerated aerobic decomposition of organic matter by a succession of different microorganisms. The fact that it is controlled and accelerated is what differentiates it from natural decay (be it on the forest floor, or deep in a landfill). According to Environment Canada (2013): “Composting differs significantly from the decay process that occurs in nature; it is monitored and controlled, aerobic conditions are maintained, and it includes a high-temperature phase (e.g., above 55 degrees Celsius [°C]) that reduces or eliminates pathogens and weed seeds.”

The process of composting involves the following stages:

1. Collecting and inspecting feedstocks (contaminant control)
2. Preparing feedstocks (e.g. chipping, screening, blending)
3. Active composting (active management; typically weeks to months)
4. Curing (passive management; typically months to years)
5. Final screening (including recovering any bulking agents)

Collecting and Inspecting Feedstocks

A robust collection and quality control system is critical to a successful operation, for without quality feedstocks one may have a hard time producing a marketable finished product. In addition to the challenge of preventing and removing physical contamination (e.g. trash mixed in with feedstocks), composters must protect against trace chemical contamination of their feedstocks as well. Section 2.6.1 provides additional discussion of the risks of chemical contamination. Also, collection of food waste must occur on a frequent enough basis to avoid odors and other nuisances associated with spoilage.

Preparing Feedstocks

Feedstocks must be prepared and balanced to yield the correct particle size, structure, and carbon to nitrogen (C:N) ratio to allow for active composting. Beyond these basic criteria, feedstock preparation is an art. Most composting operators rely heavily on experience and intuition in this stage.
Active Composting

Active composting is where a majority of the action takes place, both in terms of human management and microbial activity. Management parameters critical to the active composting phase include oxygen concentration, free air space (particle size and structure), C:N ratio, moisture, temperature, and pH. The composter manipulates these parameters through physical means (e.g. turning, watering, blowing air) or chemical means (e.g. adding amendments). Exactly how these parameters are managed during the active phase depends highly on the composting technique in use.

Curing

Once the active composting stage is complete, the compost should be cured (aged) to allow conversion of carbon into carbon dioxide and humus, nitrogen into nitrate (via ammonium, nitrite), and to allow stability (decrease of microbial activity) and maturity (general absence of phytotoxic effects) criteria to be met. Curing generally takes place in large static piles or windrows; oxygen demand and temperature are much lower than for active composting. This stage is often avoided or minimized in an attempt to get product on the market sooner, for obvious economic reasons. However, curing is critical, and an “unstable” or “immature” compost can actually be detrimental to plant growth.

Final Screening

Finally, most composting operations include a final processing stage where compost is screened and bulking agents are removed and reused. Screening improves the consistency and appeal of the final product, and is an important step when producing a premium compost for certain markets.

2.2 Composting, Anaerobic Digestion, and Landfill Methane Capture

When organic waste decomposes over time in the oxygen-depleted environment of a landfill, it generates methane, carbon dioxide, and other trace gases. Methane is a potent greenhouse gas (over 20 times more effective than carbon dioxide at trapping infrared radiation) and landfills are the third largest human-related source of atmospheric methane. The USEPA established the Landfill Methane Outreach Program in 1994 in an attempt to curb these emissions, and larger landfills are required by law to monitor and capture methane.

The FNSB is currently evaluating the closed Cell 1 of the South Cushman Landfill for its potential for landfill gas capture. During its closure in 2008, a landfill gas collection system was installed in conjunction with the top liner. The overall closure project expenditures exceeded $6,000,000 in combined borough, state, and federal funds. Following closure, the FNSB began a monitoring program to evaluate the quantity and quality (methane content) of landfill gas being captured. The FNSB has not yet seen methane concentrations high enough to warrant use of the landfill gas in energy production. Over $1,000,000 was recently spent designing and installing a leachate recirculation system that will increase anaerobic decomposition. This resulted in cost savings to the FNSB in terms of reduced leachate disposal costs, and is anticipated to increase methane content of the landfill gas.
coming off Cell 1. However, it is too early to tell whether this will be successful and whether Cell 1 will ever produce gas with the required methane content for energy production.

This is not a unique situation for a municipality to be in. Landfill cell closure is expensive, and potential future methane capture must be accounted at the time of closure in order to comply with USEPA regulations. Still, for any given landfill it is difficult to predict when, if ever, methane will be generated in sufficient quantities and concentrations to make the sophisticated collection systems worth the cost.

Organics will continue to be placed in landfills until there is a viable alternative, and efforts should be made to collect methane from cells where organics have been placed, including cells active today. However, the potential for landfill gas collection and energy production should not be used to justify placing more organics in a landfill (as was proposed recently in some states with landfill bans on yard waste), or to justify not pursuing alternatives. According to the US Composting Council (USCC, 2011, p. 3):

> The USEPA estimates that over the life of a landfill 25% of the methane generated in a landfill with gas collection will escape. Some advocates of bioreactors put that number as low as 10%, while some critics put it as high as 80%. The overall efficiency of the methane collection will vary depending on many factors, including the waste composition, the climate and the management of the landfill. However, by endeavoring to put more organic wastes in a landfill in order to increase methane production, a bioreactor landfill may be emitting more methane than its conventional counterpart, especially in the near term.

Also, a large portion of organic wastes (particularly less-stable food and yard waste) decompose quickly and release methane during the active life of the landfill cell, long before closure takes place and this methane can be captured. A more sustainable, reliable, and cost-effective approach to reducing landfill methane generation in the long run is diverting the organic component of MSW from the landfill altogether.

Composting and anaerobic digestion present two alternative approaches to organic waste reuse and recycling, each with their own advantages. As stated by the USCC, “Composting, while not perfectly aerobic, will generate very little, if any, methane. Composters work to maintain an aerobic environment in their piles. The very management parameters that make for good composting, like proper carbon:nitrogen ratio, adequate moisture and good airflow, also minimize methane generation.” (USCC, 2011, p. 3) Composting is easy to implement and takes relatively little infrastructure; other advantages of composting are discussed throughout this paper. AD, on the other hand, allows for efficient energy capture while sharing many of the benefits of composting.

AD accomplishes the same basic process of anaerobic decomposition that takes place slowly in a landfill, but allows the process to be optimized and the methane to be captured with much greater efficiency. Essentially, organic wastes are placed in a sealed reactor vessel and allowed to digest (decompose anaerobically) at optimum conditions. The methane generated through AD is captured with essentially 100% efficiency, burned in boilers for heat, or used to generate electricity that can be fed back into the grid. AD also allows for reuse of the finished byproduct: the digestate (solids) produced in the AD process can be aerobically composted, much like
biosolids from wastewater treatment. AD generates energy (often at a lower cost than landfill gas capture), yields a valuable byproduct for reuse, and saves landfill space.

While AD holds potential for the efficient capture of energy from organic waste, it is a capital-intensive endeavor for a community of any size to pursue. When the MSWO stream is relatively small, as is the case in Fairbanks, economies of scale make it less feasible. This is not to say that it can't be done cost-effectively in the FNSB, as there are some factors such as high energy costs working in favor of such a program. However, it is beyond the scope of this study to explore the potential for AD in Fairbanks. If energy capture from MSWO is a priority for the FNSB, we encourage the FNSB to conduct further research into this alternative.

2.3 Aeration and Agitation

Composting systems fall under two general categories based on their means of maintaining aerobic conditions: passive aeration vs. active aeration. Typically only those systems with a high surface area to volume ratio (e.g. windrows or small static piles) can rely on passive aeration without going anaerobic. There are two basic approaches to active aeration: positive aeration (blowing air in) or negative aeration (sucking air out). Negative aeration can be advantageous if odor control is critical, as air can then be passed through an odor-control system (see Section 2.8).

Composting systems also fall under two general categories based on their material handling principles: agitated systems vs. non-agitated systems. Agitated systems include mechanical means for mixing or breaking up the compost during the active phase; non-agitated systems do not. Both can be combined with either active or passive aeration, as described below, though in agitated systems the agitation itself is often the means of introducing air. Agitated systems are preferable for composting operations with heterogeneous feedstocks, including food waste – the agitation helps physically break up large particles during the active phase, and the mixing action makes for a more consistent finished compost. Feedstocks in non-agitated systems should be thoroughly prepared by shredding or grinding as no further particle-size reduction occurs during the process. Agitated systems also allow for more precise moisture control, as it is much easier to add moisture evenly while mixing.

2.4 Composting Techniques

This section provides a brief overview of the various composting techniques that have been demonstrated effective for MSWO. The summary of composting techniques draws heavily on the Technical Document on Municipal Solid Waste Organics Processing published by Environment Canada (2013). Note that all of these technologies (with the exception of passively aerated static piles) can be applied to MSWO, but feedstock preparation in the form of shredding or other particle size reduction may be necessary (see above). Each of the techniques described below addresses the active composting phase; curing typically takes place in static piles or windrows regardless of the active composting technique used.
2.4.1 Static Pile

The static pile is perhaps the simplest composting technique. It involves simply placing feedstocks in large, outdoor piles. Static piles can be aerated passively or actively. Passively aerated static piles are only suitable for feedstocks with high C:N ratios (e.g. waste straw), and the composting process proceeds slowly (2-3 years). Passively aerated static piles should be turned occasionally to assist with aeration and to ensure all feedstocks are subjected to active composting and high temperatures. Passively aerated static piles are the approach most often used in backyard composting, though small static piles may not generate enough heat to achieve adequate temperatures for pathogen and weed-seed reduction.

When actively aerated, static piles can be scaled up to an almost unlimited size. Aerated static piles (ASPs) generally involve laying a bed of porous material (e.g. wood chips) over aeration piping and placing feedstocks over this bed to a depth of 5 to 10 feet. Greater depths can be achieved depending on the feedstock, but problems with compression of materials at the base of the pile can be encountered. ASPs can be expanded horizontally as long as piping runs can be installed. Air is supplied with blowers through the aeration piping during the active composting phase. Compost in ASP systems is generally capped with insulating material (e.g. finished compost or wood chips) or turned partway through the active phase to ensure all material reaches adequate temperatures. Some ASP systems utilize an engineered cover to maintain heat and moisture. Cover systems or capping are particularly useful when composting food waste as they minimize scavenging by birds. Covers of finished compost can help control odor because they act as biofilters (Section 2.8).

One downside to static piles is the inability to control moisture content during the active phase. It is critical to have adequate moisture content at the start of the process, as adding water is difficult once the pile is constructed unless the pile is turned partway through the active phase.

2.4.2 Bunker

Bunker systems are essentially semi-contained static piles. Bunkers are usually constructed with concrete, including concrete lock-blocks or Jersey barriers, but can be constructed with wood (e.g. pallets) in smaller systems. Bunkers allow for slightly more efficient use of space, and are typically built with three compartments. Active composting takes place as the material is moved from one compartment to the next; the action of moving and mixing the materials between compartments helps with aeration. Bunker systems can also be actively aerated, allowing for larger volumes to be processed. However, bunker systems are not generally cost effective or practical for facilities handling volumes over 500 tons per year (tpy).

2.4.3 Windrow

Windrow systems involve composting feedstocks in long, low piles known as windrows. Windrows are turned frequently to mix and break up feedstocks, provide aeration, and introduce moisture. Windrow systems typically rely on passive aeration, though they can be actively aerated as well, allowing for a larger windrow and less-frequent turning. While windrows take up a greater footprint for a given feedstock volume, these operations can process more material per unit area than passively aerated static piles, as the active composting phase
progresses much more quickly (months instead of years). Turning a windrow is a more streamlined process than turning a static pile due to the advent of specialized turning equipment.

One key advantage of windrow systems is the relatively small infrastructure requirement. Specialized windrow-turning attachments for tractors are available at reasonable cost from suppliers such as Midwest Biosystems (see photo, Section 3.1), allowing for efficient composting at small scales. Larger, self-propelled straddle turners are also available and are suited for larger facilities, allowing for larger windrows and less space between them. Windrow turners are generally fitted with water tanks to allow moisture management during the turning process.

Passively aerated windrow systems are the most commonly used composting technique in North America, due to their low infrastructure requirements and efficiency. The primary disadvantage of the windrow technique is the relatively high space requirement; enough space must be left on either side of each windrow for a tractor to run. Actively aerated windrow systems are uncommon, as the infrastructure requirements are similar to aerated static piles but space requirements are significantly greater. Windrows also make odor control more difficult due to the large surface areas. Engineered fabric covers are often used to help with moisture retention and heat distribution; if food waste is processed in windrows, covers also help prevent bird scavenging. Heat retention is another downside to windrows; due to their high surface area, windrows cool down quickly in the winter, and eventually active composting ceases.

### 2.4.4 Turned mass bed

Turned mass bed takes the principles of the windrow technique, and with a specialized turner, increases efficient use of space. This specialized turner casts compost to the side as it works through a “windrow” (in principle the windrows can be touching), much like a snowblower. This allows it to work from one end of the mass bed to the other in a series of passes, eliminating the need for space between windrows. Decreasing the pile’s surface area also allows for better heat retention and allows for operation later in the season. Turned mass bed systems have most of the same advantages and disadvantages as windrow systems; they are generally only worth investing in when space is limited.

### 2.4.5 Enclosed Systems

A wide variety of enclosed systems exist for composting; naturally, all are actively aerated. Enclosed systems involve significant capital expense, but can typically process material quicker as composting conditions can be more carefully controlled and optimized. Enclosed systems also allow for much greater odor control, leachate control, and even heat capture. Due to their high capital costs, enclosed systems are generally suitable for large facilities processing more than 15,000 tpy.

Enclosed systems can be agitated or not. Non-agitated systems operate on a batch basis, with no mixing or breaking up feedstocks once loaded. Agitated systems include mechanisms for mixing the compost during the
active phase (e.g. conveyors or augers). Some agitated systems are designed for continuous operation – feedstocks are loaded in the receiving end, and finished compost exits the discharge end.

Enclosed systems also allow for consistent year-round operation in cold climates, though some non-enclosed systems have been proven effective year-round as well (e.g. ASPs).

### 2.4.6 Rotating Drum

Rotating drums are enclosed systems, but are different enough in design and scale that they are presented separately here. Rotating drum systems involve placing feedstocks in a drum that rotates slowly; agitation and aeration are achieved by fixed paddles or ribs on the interior of the drum that facilitate mixing as the drum turns. These systems can be as small as 50-gallon units suitable for backyard composting, up to massive 100,000 tpy models. Larger systems are usually set at a slight incline so that feedstocks migrate from one end to the other during the active composting phase, allowing for continuous operation.

Composting times are short for rotating drum systems. Most are designed for an active phase of 7 days or shorter. Drums can be designed to run longer, but due to the volume constraints, this dramatically slows down throughput. Given the short time in the drum, compost is often still in the active phase as it exits, and needs further treatment before curing. Given this disadvantage and the relatively high capital cost of such systems, they have fallen out of favor in the past couple decades.

### 2.5 Livestock and Composting

One approach that has gotten little attention in research and development of MSWO composting programs is the potential for animals to process food waste. Of course, food still fit for human consumption should be redistributed to those in need (Section 1.3) before feeding livestock or composting. Still, there are large volumes of food waste on the brink of spoilage (or just past) that finds its way into landfills each year that may make suitable animal feed.

Feeding food scraps to livestock was a part of daily life in the agrarian societies of pre-industrial times. However, as farming was industrialized and small family farms became scarce, this practice largely fell away. One of the biggest obstacles to implementing this practice in the current economy is the scale of meat and dairy farms and the increasing distance between concentrations of meat and dairy production (rural farms, increasingly focused “concentrated animal feeding operations”) and consumption (cities).

Pigs and chickens are particularly equipped to consume food waste from humans, as they are omnivorous. In our research for this study, we learned of numerous individuals feeding food waste to chickens kept for egg-laying, as well as some small pig farms that also utilized food waste. Our scope did not include a review of the scale of this practice in the FNSB, but it is anticipated to be limited to a small portion of the food waste generated locally. This practice could be expanded, with efforts made to divert a portion of food waste from the MSWO stream to local farmers. Reducing the proportion of food waste in MSWO entering a composting operation (and instead adding the manure from livestock fed the food waste) can be beneficial, as food waste
presents certain operational challenges due to its high moisture content and perishability. However, there are rigorous US Department of Agriculture (USDA) and US Food and Drug Administration (USFDA) standards for animal feed that may limit small farmers’ ability to engage in this practice. Additional research should be done to explore this option.

2.6 Vermicomposting

No discussion of composting is complete without talking about worms. Vermicomposting is the process of using worms to convert organic wastes into compost. Vermicomposting is a good alternative for individuals who want to compost year-round inside their house. It has been scaled up successfully in some cases, but is rarely employed on municipal scales. Worms are “picky” eaters; they have a specific diet that you must learn and be consistent with. Put the wrong food in their bin, and they may avoid it, leaving it to rot or grow flies. It is not very well suited for MSWO. That said, it does hold potential for individuals with the desire to compost but without the space or the volume of waste to support a backyard pile. Like traditional composting, it reduces pathogens and converts nutrients to more available forms. The compost produced is of a very high quality, and the leachate from the process (worm tea) can be used as liquid fertilizer.

2.7 Quality Considerations

The quality of finished compost is determined by the starting materials, the management of the composting process, and the storage of the finished product. Compost quality is a somewhat subjective term. Depending on the end use of the product, different characteristics may be more or less important in determining quality. For example, nutrient content could be very important in cases where no additional fertilizer will be applied, such as a reforestation project. In other cases where both compost and fertilizer will be added, the nutrient content of the compost is not an important factor. Despite these differences, there are some clear indicators and parameters for a high quality compost that bridge most uses.

**Weed Seed Content:** A high quality compost will have a very low weed seed content. Feedstocks for making the compost should be low in weed seeds, and the compost should reach a high enough internal temperature that weed seeds are killed.

**Soluble Salts:** If compost production is not managed well, salts can accumulate. A salinity above 5 mhos/centimeter can be damaging to plants. This is of particular concern in greenhouses, high tunnels, and indoor gardening because there is no precipitation to wash out the salts. Manual watering typically only soaks into the top several inches of soil, failing to leach excess salts. This is a common problem with the application of manures and composts.

**Pathogens:** A pathogen is any organism that can cause disease. This includes bacteria, viruses, and fungi. Consistent heating of the compost pile improves the chances of it being pathogen-free. Maturity of the compost is important because regrowth of pathogens has been observed in composts that were not fully stabilized (Cronin, n.d.).
pH: pH is measured on a scale from 1-14, with the ideal pH range for most crops from 6 to 7.5. Values outside of this range can cause problems with nutrient uptake or micronutrient toxicity.

**Nutrient Value:** Compost typically has a low nutrient content of between 1-5% each of nitrogen (N), phosphorous (P), and potassium (K), and other macro and micro nutrients. Feedstocks are a major determining factor for nutrient content. Biosolids and manures provide a larger proportion of nutrients, whereas feedstocks like straw or wood chips provide almost none. Generally a higher nutrient content is considered better.

**Organic Matter Content:** The preferred range of organic matter content for compost is between 30-60%. Levels higher than this can indicate lack of maturity or stabilization of the product. Below 30%, a large quantity of compost must be added in order to improve the soil.

**Maturity of Compost:** A high quality compost must have decomposed enough to promote plant growth. C:N ratio is a good indicator of the maturity of a compost. A range of 10:1 to 20:1 is considered ideal because within this range compost is not likely to immobilize plant-available nitrogen. Maturity of compost also affects other properties, such as the presence of pathogens.

### 2.7.1 MSWO Contaminants

In addition to basic quality considerations related to compost as a soil amendment, there are very real risks related to feedstock contamination. These fall into two basic categories: physical contamination and chemical contamination.

Physical contaminants in MSWO are primarily other types of MSW: for example plastic forks in post-consumer food waste; packaging in pre-consumer food waste; and trash bags, dog toys, etc. in yard waste. Physical contamination is a much greater issue for MSWO than other organic feedstocks (e.g. agricultural waste). Post-consumer food waste is particularly prone to physical contamination, though this can be controlled in certain institutional settings by using only table ware that is either durable (ceramic plates, metal forks) or compostable (though not all “compostable” ware is created equal). Plastic film is the most common physical contaminant in most MSWO composting programs, and many municipalities have banned the use of plastic bags in MSWO collection.

Chemical contaminants include a wide range of compounds used in various home and lawn care products. The class of compounds presenting the greatest risk to the finished product are herbicides. Most organic chemicals, including most common herbicides, break down readily in the high-temperature, aerobic conditions of active composting. However, certain herbicides can withstand the composting process and have resulted in tremendous losses for the users of contaminated compost, and in turn the composting operations that produced it. The Institute for Local Self Reliance highlights one such incident in their report *The State of Composting in the US* (Platt, Goldstein, Coker, & Brown, 2013):

> In Vermont in 2012, the Green Mountain Compost facility (owned by the Chittenden Solid Waste District, CSWD) received 510 confirmed complaints of herbicide damage to a variety of garden...
plants and ended up paying 449 claims…. CSWD’s costs totaled approximately $792,000. The culprit? Mainly aminopyralid, although the other primary persistent herbicides of concern – clopyralid, picloram, and aminocyclopyrachlor – were also found in compost, and regulators were unable to identify all sources of contamination.

There are nation-wide efforts to recall and ban these herbicides, but none of these efforts have succeeded thus far.

The most common herbicide used on residential lawns is glyphosate (historically produced by Monsanto and sold as Roundup®, now available in generic forms), which readily breaks down in the composting process. The more persistent herbicides are not registered for use in residential applications, and product labels explicitly warn against use in residential lawns and landscaping (these products kill shrubs and trees). The main application of persistent herbicides is on hay and straw farms, pasture, and rights-of-way. The four main persistent herbicides that present a risk to composters and compost users are:

- Clopyralid (sold as Confront, Stinger, and other brands),
- Picloram (sold as Tordon or Grazon),
- Aminopyralid (sold as Milestone, ForeFront, and other brands), and
- Aminocyclopyrachlor (sold as Imprelis, Streamline, and other brands).

According to Coker (2013), “They are registered for use on right-of-ways (including roadsides, electric utility lines, railroads, etc.), industrial sites, natural areas, and pastures and grazed areas around these sites. They can end up in composting facilities that take in grass clippings, hay, straw and manures from herbivorous animals that have grazed in pastures or eaten hay or grains containing persistent herbicides.” In fact, manure and composted manure contaminated with clorpyralid has caused crop damage in two incidents in Alaska (Steve Seefeldt, personal communication, November 17, 2015).

While chemical contamination of incoming feedstocks is a serious risk, there are several strategies that composters can use to address it. Compost operations should develop feedstock acceptance protocols and practice recipe management to control and limit the use of potential high-risk feedstocks (primarily manure and agricultural waste) in their process. There are compost amendments (including wood ash) that have the potential to irreversibly bind some contaminants. There are also simple bioassays that can be done to check for persistent herbicides with some confidence, but they take time and have varying sensitivity. Chemical analysis of incoming feedstocks is the most robust way to check for persistent herbicides, but it is prohibitively expensive for most operations.

In general, the risk of persistent herbicide contamination of feedstocks in Alaska is much lower than in the Lower 48. Picloram is banned in Alaska, due to the threat it poses to water quality related to its persistence in the environment. Aminopyralid and aminocyclopyrachlor are expensive, and are rarely, if ever, used in Alaska (Steve Seefeldt, personal communication, November 17, 2015). Clorpyralid is used by some Alaskan farmers, but in general farmers are knowledgeable about the risks and given the
relatively small number of farms and the simplicity of the agricultural market in Alaska, these risk can be adequately managed by feedstock acceptance protocols and effective communication between composters and farmers.

### 2.7.2 Testing and Certification

The USCC’s Seal of Testing Assurance (STA) Program was developed in 2000 out of the need for more information and quality assurance regarding composts on the market. The program specifies testing requirements, provides labeling, and discloses information about compost products. Testing frequency depends on the volume of compost produced annually. Participants in the program include manufacturers and marketers who are required to regularly test their compost products for the following properties:

- pH
- Soluble salts
- Nutrient content (total N, P₂O₅, K₂O, Ca, Mg)
- Moisture content
- Organic matter content
- Bioassay (maturity)
- Stability (respirometry)
- Particle size (report only)
- Pathogen (Fecal Coliform or Salmonella)
- Trace metals (Part 503 regulated metals)

There is a list of approved laboratories across the country which are qualified to conduct these tests. Participants are required to submit the test results to the USCC on a regular prescribed basis.

There is an annual fee of $800 per product. Enrollment of additional products is $375 per year (for non-USCC members). Members of USCC get discounted prices. Participants of the program have the right to use the STA logo on their products as well as in advertising, and will have their products advertised in general USCC outreach to the landscaping industry and other user groups.

Compost can also be certified as “Organic” (big O) through the USDA’s National Organics Program (NOP) (USDA, 2015). A certifying agent can review the feedstocks and composting processes of an operation to determine if they meet the qualifications for use in organic production. Biosolids/sludge and any fertilizer, plant, or animal matter containing prohibited synthetic substances are prohibited from use in Organic compost. Certain parameters must be met, including:

- A starting C:N ratio between 15:1 and 60:1
- Compost must reach a minimum temperature of 131 degrees Fahrenheit for at least 3 days
- Turning or other measures must be completed to ensure that all parts of the pile reach required temperatures
• The compost must be cured

2.8 Controlling Odor

Odor control is one of the greatest challenges facing the composting industry. Composting is naturally an odiferous process. Operations processing food waste are particularly prone to odor problems. There is no way to completely eliminate the odors associated with composting. However, with proper management of collection and processing conditions, odors can be effectively minimized.

Several factors contribute significantly to odor production. The following are some of the more common causes of odor problems:

• Inadequate aeration – anaerobic conditions produce some of the most objectionable odors (anaerobic conditions may also be caused by excess moisture)
• Partially decomposed feedstocks – particularly a problem for food waste, this occurs where feedstocks begin to decompose (generally anaerobically) during collection or storage, prior to the active composting phase
• Naturally odiferous feedstocks (e.g. biosolids or fish waste)
• Too-rich nutrient balance – starting C:N ratios below 15:1 should be avoided
• pH out of balance – acidic or basic conditions can contribute to noxious odors

Most of the factors listed above can be effectively controlled through careful management of composting conditions. However, the issue of partially decomposed feedstocks must be considered in the collection process. Beyond optimizing collection and composting conditions to manage odors, odors can be reduced using technologies such as wet scrubbers, carbon adsorption, or biofilters (Environment Canada, 2013). With the exception of biofilters, which can be as simple as a layer of finished compost or wood chips laid over the active compost (as employed by GHU; see Section 3.3), odor control via technological approaches is often expensive.

Perhaps the most effective strategy for mitigating the impacts of odor are siting and timing. Composting operations should ideally be sited away from densely populated areas, and processes that tend to generate the most odors should be timed to coincide with wind blowing away from populated areas.
3.0  Case Studies

The following sections present individual case studies of the four major Alaskan composting operations considered in this study. Our original proposal included plans to look at examples of MSWO programs outside of Alaska as well. However, due to the similarity of the proposed alternatives to existing Alaskan operations, and the unique considerations of composting in cold climates, a more detailed presentation of Alaskan case studies was deemed more useful. In addition to the four major Alaskan composting operations, several Fairbanks-area CSA farmers were interviewed about their composting practices and organic-material needs. A discussion of local demand for compost is discussed in Section 4.0, along with rates currently charged for compost from Alaskan operations. The composting program operated at the University of Alaska Fairbanks (UAF) was also reviewed, and a brief summary of their program provided.

3.1  Susitna Organics

Susitna Organics (SO) is a private composter processing primarily agricultural waste (manure and waste hay) in the Matanuska-Susitna Valley. SO produces a high-quality compost using an outdoor turned windrow system. SO has been in operation since 2007. They sell their compost in bulk (truckloads and in 1-cy sacks), in their own topsoil mix, and in 20-quart bags through garden supply stores. They have tested and certified their compost based on the USCC’s STA program and USDA NOP standards (through independent certifying agency Washington State Department of Agriculture). They have had a recent focus on Organic certification, as they feel it is a more rigorous standard. We toured SO’s operation with owner and manager Mark Fisher on September 3, 2015.

Situated in the heart of the Matanuska-Susitna Valley, SO has ready access to a variety of agricultural-waste feedstocks. Their primary feedstocks are manure (various livestock) and waste hay. Collection is through a combination of pickup service (for a fee) and on-site receiving. SO adds small amounts of peat moss to their compost, to help with moisture stabilization and odor control. They supplement agricultural waste with fish waste obtained in Anchorage from fish processors, providing a boost of nitrogen and various micro-nutrients where needed. They also accept small quantities of yard trimmings from local landscapers. Overall, SO processes about 2,500 to 3,000 cy of feedstocks annually. SO intends to expand into other feedstocks, including pre-consumer food waste from local grocery stores, but has not secured any long-term collection contracts. They have experimented with small quantities of “compostable” table ware, which they have had preliminary success breaking down in their composting process.

Susitna Organics

Feedstocks:
- Manure
- Hay
- Peat (supplement)
- Fish (trace)
- Yard trimmings (trace)

Bulking agents:
- Wood chips

Feedstock prep:
- none

Process:
- Outdoor windrows
- Turned daily with tractor/windrow turner for 3 weeks

Finishing
- Cured 2-3 months in windrows
- Screened
SO’s active composting process appeared streamlined, efficient, and involved a modest amount of equipment. SO owns and maintains the following equipment: a tractor equipped with a Midwest Biosystems PT-120 windrow turner and water tank, a loader, a small screen plant, two dump trucks, and a bagging machine. They recently acquired roll-off containers and a trailer for grocery-store food waste pickups. The operation is run by Mr. Fisher and one seasonal employee, with occasional assistance from another part-time worker. Their composting process involves the following basic stages:

1. Feedstock blending and windrow building
2. Active composting, achieved with daily turning and watering of windrows for 3 weeks
3. Curing, achieved by aging compost for 2-3 months in windrows
4. Screening (and bagging for non-bulk sales)

During active composting, SO closely monitors temperatures and moisture levels, adding moisture from the tank attachment on the windrow turner as needed. SO conducts their composting operation during the summer months, generally completing active composting by mid-October.

As noted above, SO tests and certifies their finished compost in accordance with the USCC’s STA program and/or the USDA’s NOP. SO is careful to communicate closely with farmers to ensure they do not accept feedstocks with persistent herbicide contamination. Odor has been an occasional issue for SO, especially when handling the fish-waste feedstock, but odor dissipates 1-2 days into the active composting phase. SO’s location is well suited for composting, away from most residential areas, thereby minimizing complaints.

The primary markets for SO’s bulk compost are local gardeners and peony growers. They also produce a topsoil mix that incorporates their compost, and sell the topsoil in bulk. SO also sells about 30 pallets of bagged compost per year, mostly through Alaskan nurseries (including Holm Town Nursery in Fairbanks). SO has received some interest from road construction contractors for bulk compost, but has not been able to achieve the required volume for the desired cost to supply these projects.

Key aspects of SO’s business model include their manure removal service, which covers some of their hauling and collection expenses; their ability to deliver finished product in bulk with their own dump trucks and drivers; the diversity in the markets they sell to; keeping costs low with used equipment
and conducting maintenance in-house; and producing a premium marketable product meeting recognized quality standards.

3.2 Alaska Waste

Alaska Waste is a waste-management contractor serving Alaska’s largest municipalities, including Fairbanks and Anchorage. AW’s Anchorage operation has been engaged in composting agricultural and pre-consumer food waste since 2009. They utilize an in-vessel rotating drum composter located in their Rosewood Street facility. We toured AW’s operation with operations supervisor Michael Schrewsbury on September 3, 2015.

AW’s primary feedstocks are pre-consumer food waste from Anchorage grocery store, animal manure (primarily horse), and wood chips. As the waste-management contractor for the Municipality of Anchorage, AW operates an extensive waste collection system. They have one truck dedicated to compostable collection from local stores, collecting food waste three times per week. They offer a slightly lower pickup fee than commercial garbage fees, thereby incentivizing stores to sort their food waste (a particularly heavy waste due to its moisture content). They collect from 10 grocery stores, as well as several other locations including one café where they collect coffee grounds. Food waste, manure, and wood chips are stored in a garage bay, where they are mixed with a skid-steer loader before being loaded into the rotating drum composter by a conveyor.

AW made a significant investment with the purchase of the rotating-drum composter. It is 32 feet long, approximately 8 feet in diameter, and sloped at a 1° pitch, allowing the compost to migrate to the end of the drum during the composting process (allowing somewhat continuous operation). Other than the drum, AW maintains a collection truck, a bobcat, and a simple screen plant. The operation is run by two staff; one full-time person in charge of collections and operation, and an equipment maintenance person (with other maintenance duties not related to composting).

AW’s active composting takes place in the rotating-drum composter (left). The drum rotates at four full rotations per day, for a total composting time of seven days. The drum has a capacity of about 60 cy. AW actively monitors temperature and moisture throughout the active composting phase, though the wet food waste generally contains enough moisture that no watering is needed (depends on the season and nature of produce).
Once the active composting stage is complete, AW transports the compost to their yard for curing. Compost is stored in piles and left to cure. Depending on the customer, AW sometimes screens finished compost prior to sale using a small screen plant.

AW tests and certifies their finished compost in accordance with the USCC’s STA program. Given the nature and consistency of their feedstocks, they have had few issues with contamination. Odor is fairly well controlled as the material does not sit long before it is loaded in the composter. One concern with AW’s process is that seven days is a fairly minimal time period to complete the active composting phase. Compost leaving the drum (right) is still in a somewhat “active” state; active composting likely continues for some time in the curing piles.

The primary markets for AW’s compost are road construction (revegetation) and landscaping. They sell compost in bulk (10-15 cy dump truck loads and occasional pickup truck loads), both screened and unscreened. AW produces between 600 cy and 800 cy of compost per year.

**IMPORTANT UPDATE:** During the time we conducted our research for this project, including our visit to AW’s facility, they were in full operation. Starting in November 2015, shortly after the draft of this report was submitted, AW shut down their composting operation and are now diverting MSWO to a farm north of Anchorage where it is composted for on-farm use. AW cited weakness in the market as the primary reason for shutting down. As noted below, AW’s primary customers were landscapers and road-construction contractors. According to Michael Shrewsbury (personal communication, January 21, 2016), compost sales had been declining due to changes in Alaska Department of Transportation and Public Facilities (ADOT&PF) specifications and increased pressure on road-construction contractors to lower their bids.

### 3.3 Golden Heart Utilities

Golden Heart Utilities is the water and sewer utility company for Fairbanks. They operate a wastewater treatment plant (WWTP) at the south end of Peger Road near the Tanana River. The WWTP formerly stored biosolids (sludge from the wastewater treatment process) in large containment ponds; however, due to serious odor problems and numerous complaints from the community, GHU began composting the biosolids in the mid-1990s. Composting represented an affordable and more sustainable means to deal with this noxious byproduct. We toured the GHU WWTP and composting operation on November 5, 2015 with composting manager Scott Creel.

The feedstocks for GHU’s compost are biosolids and wood chips (purchased from a local sawmill and received from the local electric utility). The wood chips provide a carbon source and act as a bulking agent. Biosolids are prepared for composting by centrifugation to remove excess water; biosolids are about 30% solids following
centrifugation. Biosolids are then loaded into a dedicated 10 cy dump truck with a specialized hopper in the WWTP.

**Golden Heart Utilities**

<table>
<thead>
<tr>
<th>Feedstock:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Municipal biosolids</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bulking agents:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Wood chips</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feedstock prep:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Centrifugation (to remove moisture)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Process:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Active composting in large aerated static piles for minimum of 28 days</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Finishing</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cured 1-6 months in static pile</td>
</tr>
<tr>
<td>• Screened</td>
</tr>
</tbody>
</table>

GHU uses an ASP approach, with positive aeration provided by blowers and a network of perforated high-density polyethylene piping. The ASPs are constructed as biosolids are generated. The area where active composting takes place is lined and finished with a sloping asphalt pad; leachate is collected from the liner and ground surface and returned to the WWTP. First, piping is laid on the ground surface, and covered with a bed of new and/or recycled wood chips to a depth of 1-2 feet (right). Then a mix of four parts biosolids to one part wood chips is laid over the prepared bed to a depth of approximately 8 feet. This is then capped with a 1-2 foot layer (thicker in winter) of finished compost to control odors and maintain heat. The ASP is constructed until it contains about 10,000 cy of biosolids/wood chips; GHU processes four such ASPs each year, for a total of about 40,000 cy of raw feedstocks. Handling this quantity of material is accomplished with five large loaders (four Case 821 loaders and one smaller Case 621 loader); two loaders are dedicated to mixing raw feedstocks, and three loaders work to move finished compost, load the screen plant, and load trucks with finished product. In this way GHU prevents cross-contamination of finished compost with raw biosolids.

During the active composting phase, temperature is monitored closely. Watering is not required due to the high moisture content of the biosolids. Aeration is provided throughout the active composting phase, though it is reduced in the winter so as not to freeze the piles (composting progresses more slowly in the winter as a result). The biosolids are aerated for a minimum of 28 days, during which the compost must reach processing for further reduction of pathogens (PFRP) temperatures (>55 °C) for a minimum of 3 consecutive days. When active composting is complete, compost is relocated to a finishing pad for curing. There the compost is placed in a static pile and allowed to cure for one to six months.
months until screening. GHU has a bivi-TEC® screen plant (left) with polymer-mat screens; Mr. Creel indicated this screen plant has been an excellent investment, and has proven reliable and robust in their application (other screens broke down frequently and had troubles handling the high-moisture compost). Using this screen plant they are able to recycle a majority of their wood chips for reuse in the composting process.

GHU tests and certifies their compost based on USEPA requirements for biosolids promulgated in the USEPA Part 503 Biosolids Rule. Testing includes analysis of basic nutrients, pH, pathogens (fecal coliform), and heavy metals. Interestingly, no other contaminant testing is required. The GHU compost meets USEPA requirements for “Class A compost.” Given the consistency of their feedstocks, GHU encounters little variation in finished compost quality, and only had one batch ever fail for fecal coliforms (which then passed after reprocessing).

The primary market for GHU compost is individual FNSB residents, who typically use the compost for landscaping, though some use it in vegetable gardens. Installing new lawns is a popular application for GHU compost. Other significant customers are landscaping companies, road contractors, and peony growers. GHU screens around 8,000 cy of finished compost each summer, and they generally sell their entire inventory. The price charged for their finished product is well below the true cost to produce the compost (see Section 4.0), contributing to their ability to sell the product in markets where high volumes are required.

Despite the fact that GHU’s compost meets USEPA standards for use in agriculture, many FNSB residents and local farmers have concerns about chemical contaminants and avoid using GHU’s compost for applications involving food production. Any chemical that could enter the city sewer system (via sinks, shop drains, etc.) can enter the WWTP and potentially accumulate in the biosolids. Certain persistent organic pollutants (POPs; e.g. dioxins, polychlorinated biphenyls, organochlorine pesticides) are extremely recalcitrant (resistant to degradation) and may pass through the wastewater treatment process unchanged, or worse yet modified to more-toxic secondary contaminants (Harrison, Oakes, Hysell, & Hay, 2006). However, most of these organic contaminants, with the exception of heavy hydrocarbons related to petroleum fuels, have seen decreased concentrations in biosolids in recent decades (Bright & Healey, 2003). Fairbanks, being a small community with relatively little industry, is likely to have lower levels of POPs in the wastewater stream than larger communities. Recent studies have focused on “emerging contaminants” (new chemicals or chemicals with newly discovered health risks, often in wide use) and their potential accumulation in biosolids (Clarke & Smith, 2011); these emerging contaminants are more prevalent in biosolids and may pose health risks. Similar concerns exist for pharmaceuticals and personal care products, some of which are recalcitrant and can also accumulate in biosolids (Xia, Bhandari, Das, & Pillar, 2004). There is evidence that suggests composting works to remove or further degrade organic contaminants that may be present in biosolids (Cai et al., 2007; Gibson, Wang, Padgett,
Lopez-Real, & Beck, 2007). However, the efficacy varies widely for different contaminants (Gibson et al., 2007), and without testing there is no way to ensure that composting effectively reduces organic contaminants in GHU biosolids.

Understanding that GHU’s compost may not be suitable for sensitive applications including in food production, it is still a quality product for use in many applications in the FNSB. One key element in GHU’s success is their ability to sell compost below the true cost to produce it, as it is serving to dispose of a noxious byproduct of the wastewater treatment process (composting is essentially an operational expense). Economies of scale also work in GHU’s favor, given the large volume of feedstocks they process.

3.4 Warren Smith

One local farmer in the Fairbanks area is composting a very unique feedstock on a significant scale. Warren Smith grows three varieties of wild Alaskan grasses on his Eielson Farm Road farm east of Fairbanks, selling the harvested seeds for use in revegetation projects across the state. Given the nature of the grasses, and the narrow window in which he must harvest the grass for seed, the straw produced is generally of a lower quality than that sold in local markets. About 5 years ago, Smith developed a composting operation to turn this agricultural waste into a valuable organic soil amendment. We toured Smith’s operation on October 28, 2015.

Smith’s operation is unique as he uses only one feedstock: straw. Also unlike the above operations, his feedstock comes solely from his own farm; he brings no other inputs or bulking agents on-site for use in the compost. Unlike most compost mixes, which start with a C:N generally around 30:1, Smith’s mix starts at 60:1. Despite these challenges, Smith has managed to develop a successful composting process that works with his unique feedstock, though it takes longer than it would with a richer mix. He successfully composts as many as 75 round bales per year, equivalent to about 390 cy (or 60 tons) of straw.

Warren Smith

Feedstock:
- Wild Alaskan grass straw

Bulking agents:
- None

Feedstock prep:
- Tub grinder

Process:
- Active composting in large static pile for ~1 year
- Periodic turning during active phase with screen bucket

Finishing:
- Cured ~1 year in static pile
Adequate feedstock preparation is critical to Smith’s composting process. At harvest, straw is baled in large round bales and stored outside for the following winter. At the beginning of the next season, these bales are processed with a tub grinder to reduce particle size. A tub grinder is a specialized piece of farm equipment designed for breaking down hay and straw for use in silage; it is essentially a large tub with grinding wheels in the bottom and a built-in conveyor, driven by the PTO of a large tractor. After processing with the tub grinder, the straw is watered and placed in a large static pile.

Active composting takes place during the first season following harvest. The pile is turned several times using another specialized piece of equipment – a REMU WL 160 screen bucket (right) mounted on Smith’s Cat 924G loader. The screen bucket works to further reduce particle size and thoroughly mixes the compost to prevent cold spots in the pile. The pile is watered as needed during turning.

At the start of the second season, the pile is again turned, then left to undergo the curing process. Curing stops with the onset of winter, as heat is no longer actively generated. Smith sells the finished compost during the third season. At this point, he loads the compost (no further screening necessary) into 1-cy bulk bags using the loader and a hopper. Each bulk bag holds a total of 36 cubic feet (uncompacted volume). Finished compost is tested by Western Laboratories, Inc. for basic nutrients. The primary market for Smith’s compost is local gardeners (often people putting in new gardens) and small farms. Last year he sold all 20 bulk bags he produced (from an original feedstock volume of 40 bales).

Some key factors to Smith’s success include matching the right process and equipment to his unique feedstock; keeping the operation small and simple and selling in bulk; and marketing his product as organic (though not certified as such) and free of any potential contaminants. It is also important to note that as with GHU, Smith’s composting operation serves to deal with a byproduct of his main line of business, farming wild Alaskan grass seed, and thus is supplemented by income from the larger operation.

### 3.5 Fairbanks-Area CSAs

We interviewed owners/operators of two Fairbanks-area CSA farms. We met with Brad and Christine of Goosefoot Farms on October 29 and Tom and Christie of Calypso Farm and Ecology Center (Calypso) on
November 4, 2015. Brad has managed the Fairbanks Farmer’s Market for the past two summers, Christine has a strong background in agriculture and composting, and Tom and Christie have been involved in CSA farming, outreach, and education for at least a decade; between them, they have an excellent understanding of the current state of CSA and small organic farming in the Fairbanks area and the potential role of compost in such operations. Each provided valuable insights into the market for Organic compost within the small farming industry in Fairbanks; see Section 4.1 for additional discussion.

Each farm has their own approach to developing SOM. When Calypso started composting shortly after their founding in 2000, they brought in organic waste from a variety of sources, including horse barns (manure), coffee shops (coffee grounds), and local lawns (grass clippings). One strategy for helping ensure grass clippings were free of herbicides was to only collect clippings that also contained dandelions. Calypso eventually reduced their off-site collections due to the time and labor they consumed, and now only composts on-site agricultural waste supplemented by six to eight truckloads of horse manure from nearby horse owners. Goosefoot Farms, on the other hand, started with relatively organic-rich soil on the land they lease from long-time Fairbanks farmer Paul Quist. They apply organic soil amendments, but do not use a significant quantity of compost. They expressed their desire to use organic compost if it were available in bulk at an affordable price.

3.6 University of Alaska Fairbanks

UAF has a composting program that is jointly coordinated and operated by the Office of Sustainability (OS) and Facilities Services (FS). We met with Michaela Swanson of OS and Raif Kennedy of FS to discuss the program. OS coordinates placement of bins and management of the overall program, while FS conducts the day-to-day operations. UAF collects a combination of landscaping waste (largely lawn trimmings) and food waste (mostly pre-consumer food waste from various cafeterias), which they compost in a large static pile at UAF’s “eco-dump.” UAF also “grass-cycles” – leaving lawn trimmings in place to slowly decompose – on many of their lawns.

UAF’s food-waste collection system consists of large plastic trash cans on rollers (right) used to collect waste from about six locations in kitchens on campus. The bins are collected three times a week, using the roller bins to transport the waste outside the buildings where it is then dumped by hand into a pickup truck. Mr. Kennedy noted that a waste collection truck with a lift-arm for curbside-style containers would greatly facilitate collection of the heavy food waste.

UAF comports their organic waste in a large static pile. However, at the time of our site visit, organic waste was mixed with a large amount of soil, and active composting was not taking place. Mr. Kennedy also indicated that the pile was not turned on a regular basis and no temperature monitoring was conducted. Past efforts in composting may have involved more active management of the static pile, but currently the operation meets none of the conditions of active composting. Rather, organic material is left to decay slowly in the static pile.
UAF expressed desire to increase collections and improve their composting process to resume more active composting. Current operations are limited by the lack of a dedicated composting staff (Mr. Kennedy has many other duties, including grounds-keeping) and lack of funding for the appropriate equipment. UAF has pioneered food-waste collection in an institutional setting in Fairbanks, but they have yet to develop a robust, effective composting program that yields a high-quality finished product.
4.0  Fairbanks Compost Market

One of the most important considerations in starting a new composting operation (or expanding an existing one) is whether the market can support it. The general conclusion from our interviews with various Alaskan composting operations, particularly those in Fairbanks, is that demand far exceeds current supply. However, a thorough market analysis should be conducted to better estimate the demand from various user groups. It is also important to explore the different needs of various user groups, to ensure compost quality meets user expectations. The following sections provide a discussion of such needs.

4.1  Compost User Groups

Home gardeners

Home gardeners are a diverse group utilizing compost in relatively small quantities. Many of them are willing to pay a high price for premium compost, such as that produced by SO. Others prefer to go with a cheaper bulk compost, such as that produced by GHU. Their primary quality concerns are contamination issues such as chemical contamination, pathogens, and weed seed content. Home gardeners also care to some degree about soluble salts, pH, nutrient value, organic matter content, and maturity of the compost. Their main goals are to raise the organic matter content of their soil, improve the water and nutrient holding capabilities, and improve soil structure.

Small farms

Small farms demand a considerable quantity of high quality compost. These farms include high tunnel growers, vegetable growers, CSA farms, and small diversified operations. Larger farms typically don’t utilize compost due to the expense and labor required to apply it on large fields, although there are exceptions. Most of the small farms in Interior Alaska make their own compost but some may be willing to buy compost if it was affordable and of decent quality. These individuals are knowledgeable and particular about the quality of compost. Their most important concerns include weed seed content, soluble salts (for greenhouses and high tunnels), pathogens, chemical contamination, and maturity of compost. Qualities that are important but not critical include pH, nutrient value, and organic matter content. These qualities affect farmers’ production, but can be compensated for by the use of amendments such as lime and fertilizer.

Home lawns and landscaping

Landowners installing or renovating lawns and other landscaping projects are usually looking for the cheapest possible source of organic matter to improve their soil structure and water holding capacity. Their concerns about the quality of the product are mostly associated with contamination issues such as pathogens or chemical contamination. They do care to some degree about weed seed content, pH, nutrient value, organic matter content, and maturity. However, they are willing to sacrifice some of these qualities if it means getting a more affordable product.
**Business landscaping and green infrastructure**

Businesses installing landscaping or green infrastructure on their properties are interested in buying a cheap, low quality product to improve the organic matter content of their soil. Green infrastructure is an approach to water management that protects, restores, or mimics the natural water cycle. It can include such practices as swales, rain gardens, and tree planting for the collection and processing of storm water runoff and other benefits. Business owners and managers are very concerned with contamination issues, as this can either (1) cost them money, or (2) cause liability issues. They are less worried about the other characteristics of the compost as long as it improves the organic matter content of the soil, allowing plants to grow and thrive.

**Peony farms**

Peony farming is a new cut flower industry that has been growing almost exponentially in Alaska over the past decade. The estimated current number of peony growers in Interior Alaska is about 60 growers, with an additional 35 new growers preparing their fields for planting within the next several years (Jessica Guritz, Fairbanks Soil and Water Conservation District [FSWCD], personal communication, November 3, 2015). Peony fields can range anywhere in size from less than one acre to as large as 40 acres. Very conservative estimates predict a compost demand of 150 tons over the next few years. Most local peony growers have used GHU compost to amend their soils, but some have been unable to when GHU sells out of available product. When GHU compost is not available, peony farmers typically look for the next cheapest source of organic matter, whether that is topsoil or compost. Their biggest quality concerns are chemical contamination, pathogens, weed seed content, pH, and maturity of compost. Peonies are perennials which can live up to 50 years, so weeds are a major issue because the methods of control around perennial crops are limited. Another major concern is pH, due to the large scale of many peony fields and the price of lime making it unaffordable to adjust the pH in many cases. Maturity of the compost is also very important because immature compost ties up available nutrients, requiring additional fertilizer inputs and leading to decreased plant productivity. Somewhat important concerns include soluble salts, nutrient value, and percent organic matter.

**Roadside and erosion control projects**

Roadside and erosion control projects typically involve minimal soil improvement followed by the seeding of native grasses or native plant mixes containing wildflowers. Organic matter amendments must be very cheap due to the large scale of projects. Also, since the goal is simply to establish a vegetative ground cover, there is little concern for the quality of soil amendments. Chemical contamination would be the biggest issue because it could kill plants and lead to project failure. Weed seed content, pathogens, nutrient value, and organic matter content are somewhat important. Soluble salts, pH, and maturity of compost are not very important because they would not be likely to be a major factor in whether or not a ground cover is effectively established.

**Marijuana cultivation**

With the recent legalization of marijuana, Fairbanks is anticipated to see a significant expansion in indoor cultivation. Given that marijuana cultivation is an intensive, high-value operation, generally conducted indoors with potted plants or outdoors in greenhouses, cultivators are expected to demand a very high-quality compost
to boost the organic matter content of commercially available topsoil. All quality measures are likely to be important, and this user group is expected to be willing to pay a high price for premium compost.

4.2 Current Supply

Currently, there are only a handful of commercially available compost products in Fairbanks, at either end of the price and quality spectrum. Susitna Organics and Alaska Waste produce compost in the Anchorage area, but it is prohibitively expensive for most users to ship it in bulk to Fairbanks. This leaves GHU as the only alternative for bulk compost, at the low end of the price and quality spectrum. Remaining supply is from SO and large compost producers in the Pacific Northwest that sell their premium bagged compost through Fairbanks retailers. There is a definite gap in that there is no premium, bulk compost available locally. The following table presents an overview of the current compost supply and pricing for compost available in Fairbanks:

Table 2 – Current Compost Supply and Pricing in Alaska

<table>
<thead>
<tr>
<th>Composter</th>
<th>Location</th>
<th>Primary feedstock</th>
<th>Bulk price&lt;sup&gt;A&lt;/sup&gt; (per cy)</th>
<th>Bagged price&lt;sup&gt;B&lt;/sup&gt; (per cf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warren Smith</td>
<td>Fairbanks</td>
<td>Straw</td>
<td>$150</td>
<td>--</td>
</tr>
<tr>
<td>Golden Heart Utilities</td>
<td>Fairbanks</td>
<td>Biosolids</td>
<td>$10</td>
<td>--</td>
</tr>
<tr>
<td>Susitna Organics</td>
<td>Mat-Su Valley</td>
<td>Hay, straw, manure</td>
<td>$90</td>
<td>$21&lt;sup&gt;C&lt;/sup&gt;</td>
</tr>
<tr>
<td>Alaska Waste</td>
<td>Anchorage</td>
<td>Pre-consumer food waste, manure</td>
<td>$95</td>
<td>--</td>
</tr>
</tbody>
</table>

Notes:  
- <sup>A</sup> Bulk price listed for pickup at facility  
- <sup>B</sup> Bagged price listed is at Fairbanks retailers (Holm Town Nursery or Plant Kingdom)  
- <sup>C</sup> Retail for 20-quart (0.66 cf) bag is $14  
- cy cubic yard  
- cf cubic foot
5.0 Analysis of Alternatives

The following sections present an analysis of four alternative strategies to increase composting of MSWO in the FNSB, ranging from an outreach and education program, to an independent composting operation, to incorporation of MSWO into GHU’s existing operation. For each, a strategy is listed (how the FNSB can help bring about this alternative), assumptions are stated, costs are evaluated, and outcomes are projected.

No attempts were made to evaluate the potential impact of each alternative on the landfill’s operating costs or tipping fee. Ideally, implementing a MSWO composting program would save the FNSB significant costs related to landfill methane capture in Cell 3 if significant diversion occurred before Cell 3 is opened; however, such cost savings are hard to predict. Alternatively, increasing diversion rates of MSWO could be expected to cause a slight increase in the tipping fee (due to decreasing waste volumes with flat operational costs). On the other hand, implementing MSWO collection at transfer sites would be expected to significantly decrease hauling costs from the FNSB solid waste collection district. Alternatives should be considered in light of the potential impacts to collection, hauling, and landfilling costs (including landfill methane capture). However, such an analysis is complex, involves a great deal of uncertainty, and is beyond the scope of this project.

5.1 Evaluation of Potential Feedstocks and Collection Scenarios

As with recycling programs, the approach to collection has important implications for the volume and quality of feedstocks. Generally, the volume collected is proportional to the convenience of the collection system. If people have to go out of their way to drop off their MSWO, volume will diminish. With convenience, however, comes cost. For example, curbside pickup is perhaps the most convenient collection method, resulting in large collection volumes, but is also the most costly. Food waste is particularly expensive to collect due to the necessary frequency of collection (1-3 times per week).

Also related to convenience and cost is quality. Quality is inversely proportional to volume for a given cost. For example, assume a municipality could operate one staffed collection point for roughly the cost of five unstaffed collection points. These unstaffed collection points will be much more convenient for residents and a higher volume will be collected. The single staffed collection point, while it will yield less volume, will collect a much higher quality feedstock. The goal when developing a collection system should be to find a balance between these competing outcomes for a reasonable cost.

One of the best ways to control quality in a collection system (in recycling as well as composting) is by staffing collection points with qualified staff (or volunteers) that can help residents sort quality compostables and divert potentially contaminated feedstocks to the landfill. However, this becomes expensive if implemented in multiple locations. Adequate outreach and education conducted prior to or in conjunction with a MSWO composting program is important in improving collected feedstock quality.

Collection scenarios should reflect the quality requirements of the process and the market for the finished compost. Each of the following alternatives differs significantly with regards to these factors, and could be complemented by different collection scenarios.
5.2 Alternative 1 - Backyard Composting and Grass-Cycling

As noted in Section 1.1, backyard composting is practiced by many households in the FNSB. Likewise, many residents with lawns practice grass-cycling. However, there are a number of reasons why some people do not engage in composting. The following presents some of the more common obstacles to backyard composting we have encountered in the course of research for this study. Note that some could be addressed by education, outreach, and incentives; some may not. Potential obstacles to backyard composting or grass-cycling include:

- “I don’t generate enough food waste to make it worth it (and I don’t have a lawn)”
- “I don’t have time” or “It’s too much work”
- “I don’t have the space”
- “Ewww! Compost is stinky and gross!”
- “I don’t have a garden. What would I do with it?”
- “I don’t like how cut grass looks left on the lawn” (grass-cycling)
- “I don’t know how”
- “I can’t afford a compost bin”
- “I don’t want to attract moose or other animals”

Some of these responses indicate a lack of understanding or education; several indicate limitations in terms of time or money; while others represent practical limitations that make backyard composting simply not practical or feasible.

Over the past few decades, multiple education and outreach efforts have been led on the topics of composting and grass-cycling. Leading organizations in this area include UAF’s Cooperative Extension Service (now the School of Natural Resources and Extension), USDA’s Natural Resources Conservation Service (NRCS), the Fairbanks Soil and Water Conservation District (FSWCD), and Calypso Farm and Ecology Center. These organizations have published numerous educational pamphlets, brochures, and guidance documents, including the following:

- The Compost Heap: Basic Composting in Alaska (Rader, 2013),
- Composting in Alaska (Seefeldt, 2015), and
- Composting Dog Waste (USDA NRCS & FSWCD, 2005)

These documents provide solutions to challenges such as “I don’t know how,” “Ewww! Compost is stinky and gross!,” and “I don’t want to attract moose or other animals.” However, many are not aware that this information is readily available. The key here is getting existing information to people that need it, and connecting people to existing resources, such as local experts and the occasional composting workshop. The more logistical, practical complaints related to time, effort, or expense can be somewhat addressed by facilitating access to easy, efficient, affordable backyard composting technology, such as small rotating-drum systems.
5.2.1 Strategy

This alternative involves implementing an education and outreach campaign to demystify, teach, and encourage backyard composting in the FNSB. It would ideally be led by a non-profit organization with experience in this field, such as the Fairbanks Soil and Water Conservation District. Mechanisms for funding this alternative include the FNSB Recycling Commission or a general request for proposals (RFP).

The first step recommended in implementing this alternative (and useful in planning implementation of any of the below alternatives) is conducting a survey of FNSB residents to gauge the extent of backyard composting and what residents feel are the primary challenges. With this information, the education and outreach campaign could be designed for maximum impact.

The education and outreach campaign could include the following individual strategies:

- Host a series of free hands-on workshops in the spring or early summer at various locations throughout the FNSB to teach the fundamentals of composting.
- Providing materials for construction of low-cost composting systems (e.g. bunkers from pallets, hoops from hardware cloth) in conjunction with hands-on workshops
- Distribute existing information to residents at relevant events and venues (e.g. outdoor shows, farmers market, garden supply stores, etc.)
- Work with local retailer and compost-bin manufacturer to offer coupon for discounted backyard composting bins and/or vermicomposting bins
- Conduct outreach to FNSB schools, educating students about the benefits of composting

5.2.2 Assumptions

In order to evaluate the cost of this alternative, we made the assumption that a local non-profit would be contracted to conduct the outreach and education campaign. This alternative could be as extensive or as modest and simple as the FNSB desired. Ideally, it would include a fairly extensive series of hands-on workshops, as this is where people stand to learn the most about what is truly a hands-on activity. In developing the costs for this alternative (below), we assumed all of the above strategies would be implemented.

5.2.3 Costs

The total cost of this alternative is estimated at $40,000. The following are some examples of expenses associated with such a campaign:

- $25,000 labor and overhead (5 hands-on workshops, outreach to major FNSB schools)
- $2,000 advertising and printing
- $5,000 sourcing local materials for bins
- $8,000 discount program for commercial bins
Ideally, the scale of the program would be designed to match the public demand for this kind of information, which could be judged by a survey of FNSB residents (see Section 8.0).

5.2.4 Projected Outcomes

This alternative would accomplish the valuable goal of educating the community about the benefits of composting. It would make composting more accessible to residents that participate. This alternative could be pursued sooner than Alternatives 2 or 3, and might help boost participation in a potential future municipal composting program. This alternative could also be expected to slightly boost MSWO organic diversion rates with an increase in backyard composting, but it is hard to gauge the potential impact of outreach and education efforts on diversion rates.

5.3 Alternative 2 - Community Composting Cooperatives

This alternative was included in our original proposal, but was removed from consideration in the course of our research for a number of reasons. The original goal in considering decentralized, neighborhood-based composting via community cooperatives was to include an alternative that minimized the distance between waste sources, processing locations, and end uses. MSWO is a heavy waste, so transportation costs are high. Composting is a simple process, so theoretically it could be pursued at a small scale in numerous locations. It could be beneficial to engage participants in such a program in the process itself. This alternative would involve establishing numerous neighborhood composting sites around the FNSB where participants would bring their MSWO, volunteer to support composting operations, and receive finished compost as a benefit of participation.

However, there are practical reasons why this alternative is not likely to be successful on any borough-wide scale. First, composting requires careful management of incoming feedstocks (both for quality and to ensure they are composted before spoiling and causing odor problems), which in turn requires experience and consistency. The infrastructure required for numerous small operations is likely to exceed that required for one centralized operation, and processing efficiency would be far less. Strong leadership and a dedicated core staff (or volunteers) would be required for such a program to become organized and sustain itself. It would also require dedicated and proactive participants (well beyond what would be required to participate in centralized program). To bring these things together on a neighborhood scale is not something that the FNSB is likely to be able to coordinate. Instead, community composting cooperatives are more likely to succeed if they grow organically.

One way that the FNSB could help incentivize the formation of such cooperatives would be through zoning to make them legally possible and by providing low-cost leases on suitable land. The outreach and education campaign proposed in Alternative 1 could also help lay the groundwork for such cooperatives. There may be other ways that the FNSB could support cooperatives if they were to pop up, but we do not recommend the FNSB pursue this alternative further.
5.4 Alternative 3 - Centralized Composting

This alternative considers an independent, centralized composting operation processing MSWO for the FNSB. The operation would likely also accept and process agricultural waste and other organic wastes (e.g. wood waste from fuel-reduction clearing). It would take an approach similar to that of SO, with an outdoor windrow-based system, processing organic waste roughly from May to October. Collection would be through a combination of pickups of mixed MSWO from the areawide recycling facility; pickups of food waste from grocery stores, restaurants, and other commercial kitchens for a small fee (enough to cover hauling costs); bulk pickups of agricultural waste (manure and hay) from farms; and a receiving center at the composting facility itself for yard waste, wood waste, and other organics. The operation would be expanded to include pickups from transfer sites within the first three years, with quality control provided by staff and/or volunteers of the greater recycling program. The program could later be expanded to include curbside pickup of MSWO within the City of Fairbanks and on both nearby military bases.

This alternative would produce a high-quality, potentially Organic compost that would fill a gap in the current commercial compost supply in Fairbanks. The market price achieved by this approach would likely be similar to that charged by SO in the Matanuska-Susitna Valley ($90 per cy). However, we conservatively assume a price of $60 per cy for our base economic analysis, as quality of feedstocks for this alternative may be a bit lower than those used by SO. Table 4 explores different pricing and volume scenarios. As the only local producer of premium bulk compost in significant quantities, the composter would have significant control over pricing. The ability to charge a premium for bulk compost is a key element of potential success for this alternative.

5.4.1 Strategy

There are a number of ways this alternative could be approached, ranging from a borough owned and operated composting facility located at the landfill to a private, for-profit company operating independently with no government support. The approach with the greatest chance of success, however, may be somewhere in between. As with recycling, a borough-operated program is likely to be more expensive than an independently operated program (PDC Inc. Engineers, 2015). Unlike recycling, however, the “facility” needed for composting requires far less initial investment – all that is really required is a sizable plot of suitable land. The primary start-up costs are in equipment. Given that independent composters in Alaska (namely SO) have demonstrated that composting can comprise a sustainable business, it is not unreasonable to expect that given the right incentives, an independent composting operation could be feasible in the FNSB.

We recommend the following strategies to implement this alternative:

- Design the areawide recycling facility proposed in FNSB Ordinance 2015-20-1K with a MSWO receiving area. Plan on expanding operation of the areawide recycling facility to include receiving MSWO organics (including implementing a feedstock acceptance protocol).
• Provide a mechanism for payment to a composter collecting and processing waste from the areawide recycling facility. A composter would have to meet certain performance requirements to qualify for payment, such as meeting a set collection schedule, meeting certain quality requirements, and effectively managing odors. Payment could either be routed through the contract to operate the areawide recycling facility, or could be set up independently. Since collection of MSWO from the areawide recycling facility on a specific schedule represents a fairly fixed cost regardless of volume, the contract amount should be a flat fee, but could include a mechanism to pay for additional tonnage beyond a certain limit. The total contract amount for an assumed tonnage should roughly reflect the value of the service to the FNSB (in terms of avoided landfilling costs, including projected landfill methane recovery costs). In order to allow for adequate financial planning, the term of this contract should be 5 years or more.

• Plan for expansion to the five major transfer sites within the first three years. Similarly, provide a mechanism for payment to a composter collecting MSWO from the transfer sites. This payment amount should reflect the cost of hauling avoided by the FNSB, which is fairly easy to calculate.

• Consider providing a low-cost lease of FNSB land to a composter intending to collect and process MSWO. The lease could include options for termination if expectations are not met in a certain timeframe. Fortunately with MSWO, if an operation fails the feedstocks will degrade naturally (unlike plastics, which could remain a nuisance for decades), presenting less risk of liability for site cleanup to the FNSB.

5.4.2 Assumptions

A number of assumptions must be made to estimate costs for this alternative. The following assumptions were made based on our research and the strategies listed above:

• The composter will collect MSWO from the areawide recycling facility three times a week (assumes a single 40-cy rolloff container for food waste minimum, and separate containers for yard waste and wood waste collected as needed)
• The costs of collecting MSWO from other sources would be covered by pickup fees
• A total of 4,330 tons of MSWO will be collected and processed in a year (Section 1.2)
• An additional 1,000 tons of agricultural waste would be processed by the composter
• The FNSB contract amount would be $86,600 per year (equating to $20 per ton of MSWO collected and processed), and a commitment made to a 5-year contract (allowing the private composter to show government support in their pursuit of startup capital)
• Avoided hauling cost payments for transfer-site collections are not considered in the economic analysis, but it is assumed they would at least offset the composter’s true costs of collection (and thus not affect the final outcome of this analysis)
- Volume reduction of 50% achieved during composting process; using published waste-density information, a total of approximately 10,000 cy of finished compost would be sold per year.
- Compost would be sold at a rate of $60/cy.
- Composter would purchase and maintain the following equipment (considered at a combination of new and used pricing):
  - Flatbed truck
  - Rolloff truck with 4 rolloff containers (40 cy)
  - 10 cy dump truck
  - Midwest Biosystems PT-130 compost turner with water tank
  - John Deere 6135E tractor
  - Cat 924G or equivalent loader
  - bivi-TEC screen plant
  - Industrial wood chipper
- Composting would take place on a 20 to 40-acre parcel, with a single combined shop/office building.
- Active composting would take place during a 6-month season, roughly from May to October (materials would be stockpiled on-site in the winter).
- Staff would include a full-time owner/manager ($40k/year + profit), a full-time equipment operator/driver ($60k/year), and a seasonal operator/assistant ($20/hour).

5.4.3 Costs

Table 3 presents start-up costs for this alternative:

<table>
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<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed Assets</strong></td>
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<tr>
<td>Real Estate</td>
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<td>Buildings</td>
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<td>Equipment</td>
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<td>Furniture and Fixtures</td>
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<td>Vehicles</td>
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<td>Other Fixed Assets</td>
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<td><strong>Fixed Assets Total</strong></td>
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<tr>
<td><strong>Operating Capital</strong></td>
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<td>Pre-Opening Salaries and Wages</td>
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<td>Working Capital (Cash on Hand)</td>
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<td>Other Initial Start-Up Costs</td>
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<td><strong>Total Operating Capital</strong></td>
<td>$128,000</td>
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<tr>
<td><strong>Total Required Funds</strong></td>
<td>$1,195,000</td>
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</tbody>
</table>
The above equipment expense includes mostly new equipment; financing assumptions were made based on defaults for the financial model we used (25% owner contribution, 75% bank loan with 8.25% interest). This alternative could be made more viable by purchasing used equipment or by exploring alternative financing or lease options on new equipment (e.g., most equipment dealers offer 0% financing for 5 years for new equipment).

Along with basic assumptions about sources of start-up funding, salaries and wages, fixed operating expenses, fixed payments (including the $86,600 FNSB contract), and variable unit costs, we input these numbers into a financial model to produce a projected income statement, cash flow statement, and balance sheet for the first three years of operation. The year-end summary for the first three years with the above assumptions is included in Appendix A; the year-end summary includes an itemized list of operating expenses. Given the assumptions noted above, this alternative is viable, and could be a profitable business venture for a private composter.

5.4.4 Projected Outcomes

While this alternative is viable with the above assumptions, the success of such a model is highly dependent on volumes of sale and the market price for finished compost. Table 4 illustrates the dependence of this model on these variables:

<table>
<thead>
<tr>
<th>Volume (cy)</th>
<th>Unit Price (per cy)</th>
<th>Net Revenue (year 3)</th>
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</thead>
<tbody>
<tr>
<td>10,000</td>
<td>$60</td>
<td>$234,346</td>
</tr>
<tr>
<td>7,000</td>
<td>$60</td>
<td>$78,236</td>
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<tr>
<td>5,000</td>
<td>$60</td>
<td>$(39,238)</td>
</tr>
<tr>
<td>5,000</td>
<td>$90</td>
<td>$120,170</td>
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<tr>
<td>7,000</td>
<td>$90</td>
<td>$282,000</td>
</tr>
<tr>
<td>10,000</td>
<td>$90</td>
<td>$524,746</td>
</tr>
</tbody>
</table>

Given this dependence on volume and market price, it is critical that both aspects are adequately evaluated prior to pursuing this alternative, through the use of a detailed analysis of feedstock availability (participation) and market capacity.

If our assumptions are valid, this alternative could represent an increase in FNSB diversion rates up to 16%. Given the relatively low cost of this alternative (compared to recycling), this represents a very cost-effective means for increasing overall waste diversion rates.

5.5 Alternative 4 - Diversion to GHU Composting

Similar to alternative 3, this alternative considers collection of MSWO from an areawide recycling facility (with eventual expansion to transfer sites). However, this alternative consists of diverting that waste to an expanded
GHU composting operation. This is a more institutional approach, one that would include a much greater involvement from the FNSB in terms of capital investment and program implementation. However, there is increased security in this alternative due to the established, proven success of GHU’s operation. The primary downside is that the market price is limited to the rates currently charged by GHU, and the quality of finished product is questionable for application in food production. Therefore, this alternative does not yield the benefit of meeting the existing gap in supply to serve the small farm and home gardener markets.

5.5.1 Strategy

Given the fact that GHU’s current composting operation exists primarily to deal with a noxious byproduct of the wastewater treatment process, and that it is not a profitable endeavor considered separate from the larger operation, GHU would naturally expect to have expansion and operational costs largely covered by the FNSB. This strategy represents a much larger commitment by the FNSB, but as noted above, there is increased security in this alternative. This alternative essentially represents a public-private partnership, with the FNSB absorbing a bulk of the capital investment and operational costs. The details of this partnership would need to be negotiated, but here we assume the burden would be primarily on the FNSB to fund expansion.

5.5.2 Assumptions

A number of assumptions must be made to estimate costs for this alternative. The following assumptions were made based on our research and the strategies listed above:

- The FNSB would be responsible for transporting MSWO from the areawide recycling facility to GHU three times a week (assumes a single 40-cy rolloff container for food waste, and separate containers for yard waste and wood waste collected less frequently); a hauling cost of $250/load is assumed
- A total of 4,330 tons of MSWO will be collected and processed in a year (Section 1.2)
- Volume reduction of 50% achieved during composting process; using published waste-density information, a total of approximately 10,000 cy of finished compost would be sold per year
- Compost would be sold at a rate of $10/cy (current GHU price)
- GHU would purchase the additional following equipment (considered at new pricing):
  - Two Case 821 loaders
  - Blowers and piping
- Additional staff of two full-time equipment operators ($60k/year) would be hired to handle the additional material
- Composting would take place on the 9.23-acre parcel directly east of GHU’s existing operation; we assume this parcel could be acquired at 1.5-times the current FNSB-assessed value of $110,796
- Site prep would include grading, placement of fill, and laying an asphalt pad large enough to handle the additional material
5.5.3 Costs

Table 5 presents start-up costs for this alternative:

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed Assets</strong></td>
<td></td>
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<tr>
<td>Real Estate</td>
<td>$165,000</td>
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<tr>
<td>Site preparation</td>
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<tr>
<td>Equipment</td>
<td>$500,000</td>
</tr>
<tr>
<td>Blowers and piping</td>
<td>$55,000</td>
</tr>
<tr>
<td>Other Fixed Assets</td>
<td>$10,000</td>
</tr>
<tr>
<td><strong>Fixed Assets Total</strong></td>
<td>$980,000</td>
</tr>
<tr>
<td><strong>Total Required Funds</strong></td>
<td>$980,000</td>
</tr>
</tbody>
</table>

Unlike with Alternative 3, GHU already owns some of the critical equipment (e.g. screen plant) with additional capacity, and a building would not be necessary. Also, we do not consider opening operating capital (it is assumed this would be provided by GHU). It is assumed that the FNSB would cover the capital investment for fixed assets.

Along with basic assumptions about salaries and wages, fixed operating expenses, and variable unit costs, we input these numbers into a financial model and back-calculated anticipated operating expenses we assume would be absorbed by the FNSB.

With the assumed volume of 10,000 cy of finished compost sold at GHU’s current rate of $10/cy, the operation would require a contribution of about $280,000 per year to break even. This equates to a per-ton contribution of about $70 per ton of MSWO processed.

This alternative with the above assumptions would require a capital investment of $980,000 and an annual operating expense of $280,000.

5.5.4 Projected Outcomes

This alternative is just as dependent on the volume and price of sold compost as is Alternative 3. Table 6 illustrates the dependence of this model on these variables:
Table 6 – Alternative 4 Volume and Price Scenarios

<table>
<thead>
<tr>
<th>Volume (cy)</th>
<th>Unit Price</th>
<th>Operating Expense (year 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,000</td>
<td>10</td>
<td>$281,853</td>
</tr>
<tr>
<td>7,000</td>
<td>10</td>
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<td>5,000</td>
<td>30</td>
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<tr>
<td>7,000</td>
<td>30</td>
<td>$164,617</td>
</tr>
<tr>
<td>10,000</td>
<td>30</td>
<td>$81,517</td>
</tr>
</tbody>
</table>

As the above table illustrates, if a volume of 10,000 cy was produced and sold at a rate of $30 per cy, the annual operating expense becomes comparable to the annual contract amount proposed for alternative 3. However, it is highly unlikely that a price of $30 per cy could be achieved, given the precedent set by GHU selling their compost for $10 per cy, and the quality concerns certain user groups have related to the biosolids feedstock.
6.0 Conclusions

Our general conclusion is that implementing a MSWO composting program is likely feasible in the FNSB, though additional information is needed prior to acting on any one alternative. Through our review of various composting techniques presented in Section 2.0, the Alaskan case studies presented in Section 3.0, and the preliminary market assessment presented in Section 4.0, we have explored many different approaches to composting that could potentially be implemented. It is clear that successful programs must consider the unique blend of feedstocks available to them, match the composting technique to the feedstocks appropriately, and meet market expectations.

The most critical factors in the economic analysis of potential large-scale operations (Alternatives 3 and 4) were the volume of feedstocks processed and the demand (volume and market price) for the finished product. The level of subsidization was also important. Given the uncertainty in the volume of feedstocks available to a potential large-scale composting operation, our economic analysis should not be acted upon until better numbers can be determined through research. It is essential a composting operation be scaled appropriately, or started small and expanded as diversion rates grow.

A robust market analysis would also be useful. Our preliminary assessment of the Fairbanks compost market suggests a healthy demand for premium, high-quality compost, but it is unclear what volumes are needed. We believe that a private composting operation accepting food waste, lawn waste, and agricultural waste producing a high-quality product for premium markets would have the greatest chance of success. It is worth pointing out that Susitna Organics, which takes this basic approach, is the only independent, private composting operation in Alaska that has remained sustainable and profitable.

We also conclude that there is a need for additional public education and outreach on composting in general. While increasing public education and outreach may in effect increase backyard composting, this does not represent an “alternative” so much as a requisite for a successful municipal program. An educated public will be more ready and able to participate effectively in a municipal program, with greater awareness of the challenges to such a program (e.g. chemical contamination of feedstocks). Demystifying the process of composting and correcting common misconceptions about composting may help lay the groundwork in terms of public support for a larger program.
7.0 Data Gaps and Further Research

While our study shows that MSWO composting by an independent composter could be viable, the success of such a venture hinges on two key factors: availability of feedstocks in sufficient volume and a market for high-quality bulk compost. The current cost of disposal is likewise an important factor in determining how best to incentivize diversion of MSWO to a composting program, and the level of government support such a program should receive.

Current volumes and availability of MSWO feedstocks in the FSNB are largely unknown. This report assumed nationwide averages for purposes of financial modeling, but as discussed in Section 1.2, this assumption may not be realistic. Further work is needed to evaluate the volume of feedstocks from various sources (Section 1.2.1), as well as the current costs of disposal.

Currently, Fairbanks has no supplier of premium bulk compost. The only commercially available compost in Fairbanks is at two extremes of the quality and cost spectrum. GHU’s compost, sold at $10-20 per cy, is in wide use in landscaping and other high-volume markets where trace chemical contamination is less of a concern. On the other extreme is the premium bagged compost available at local nurseries for around $15 per cubic foot (equating to $405 per cy). Key individuals in the small-farming community in Fairbanks stated that significant demand exists for something in-between these extremes. Thus, there is a likelihood that there is a healthy market for a high-quality compost product in Fairbanks.

Three key questions should be answered before a MSWO composting operation can become a reality:

- What are the anticipated sources, nature, quality, and volumes of MSWO feedstocks realistically available in the FNSB?
- What are the current costs of disposing of MSWO, both to private generators and the FSNB?
- What is the demand in the FNSB for a premium bulk compost, and what bulk rate will the market support?

In order to design an effective composting program, one must have realistic estimates of the sources, nature, quality, and volumes of MSWO potentially available to a program. The categories of MSWO generators listed in Section 1.2.1 are a good starting point for framing such research. For each major category, an effort should be made to estimate the nature and quality of feedstocks generated, as well as the potential recoverable volume of these feedstocks given different collection scenarios. Recovery rates will depend on collection scenarios, but also individual willingness to participate.

Equally important is the current cost of disposing MSWO, both to private generators as well as the FSNB. Costs of disposal to private generators are important when considering ways to incentivize participation in a composting program. For instance, restaurants currently paying for hauling and disposal of heavy food waste may be more likely to participate than a farmer disposing of tons of agricultural waste on-site for free. Likewise, for each category of MSWO, it is important to identify the true cost to the FSNB for current disposal practices. Here, residential MSWO is likely to present the highest costs to the FSNB (and in turn, FNSB property-tax payers).
due to the costs of hauling (within the Solid Waste Collection District) and landfilling. Understanding the true cost of current disposal to the FNSB is critical in later justifying any expense by the FSNB on composting.

It is reasonable to expect that any potential composting entrepreneur would answer the third question in the course of market research prior to launching such an operation as considered in Section 5.4 (Alternative 3). Our preliminary evaluation of the market suggest there is healthy demand for high-quality bulk compost, but this should be confirmed before a composting program is implemented relying on this market.

Obtaining baseline information on MSWO sources and current costs of disposal is critical in long-term planning for incorporating MSWO composting into the broader solid waste management program. Also, providing this information to the public may help incentivize the creation of an independent composting operation. With these questions answered, MSWO composting can move forward in Fairbanks with confidence.
8.0 Recommendations

Our immediate recommendation is for the FNSB Solid Waste Division account for future collection of MSWO when designing the proposed areawide recycling facility. At a minimum, the facility should include indoor space for up to a 40-cy rolloff container (smaller containers could be used at first), with means for residents to easily dump organic waste into the container. We recommend designing the air-handling system with negative pressure in the MSWO area (perhaps dedicate a separate garage bay to MSWO) to help control odors. Outdoor space should be dedicated for at least two more 40-cy rolloffs with access ramps, for seasonal collection of wood and lawn waste. The design phase is at a critical phase where composting should be at least considered for planning purposes; it will be easier to leave it out in the future than to redesign a facility to incorporate it later.

Clearly there is a need for further research before any major community composting program is implemented. We recommend conducting research to fill the data gaps described in Section 8.0, and to answer the key questions needed to plan for and incentivize the start of a community composting program. We recommend a combination of phone and internet-based surveys to gauge residential MSWO generation and willingness to participate in various collection scenarios, and phone and door-to-door surveys of other generators (e.g. restaurants, farmers, grocery stores) to estimate volumes and quality of non-residential MSWO. This research should include an evaluation of the seasonality of various feedstocks, and how volumes may vary with collection strategies. Additional market research should also be done to better estimate the demand for premium compost in the FNSB.

We also recommend the FNSB Recycling Commission pursue an education and outreach program on composting, as proposed in Section 5.2 (Alternative 1). As noted above, this will not only help expand backyard composting until a more comprehensive program can be implemented, but should help lay the groundwork and build public support for a more comprehensive program.

Beyond these immediate recommendations, we encourage the FNSB Recycling Commission, Solid Waste Division, Borough Assembly, and Mayor’s Office to begin exploring strategies for supporting composting as part of the larger solid waste management program. There are many ways in which the FNSB could incentivize or otherwise support composting; what is critical is that composting be considered alongside commodity-based materials recycling, and valued equally in terms of support and implementation in future programs.
9.0 References


### Alternative 3 - Centralized Composting

#### Year End Summary

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<thead>
<tr>
<th></th>
<th>Year One</th>
<th>%</th>
<th>Year Two</th>
<th>%</th>
<th>Year Three</th>
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<tr>
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<td></td>
</tr>
<tr>
<td>Cost of Sales</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulk Compost (per cy)</td>
<td>64,100</td>
<td>10.68%</td>
<td>70,510</td>
<td>10.68%</td>
<td>77,561</td>
<td>10.68%</td>
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<tr>
<td>Product/Service B</td>
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<td></td>
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<tr>
<td><strong>Total Cost of Sales</strong></td>
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<td><strong>Gross Margin</strong></td>
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<td><strong>Total Salary and Wages</strong></td>
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<td>Customer Discounts and Refunds</td>
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<td>Rent (on business property)</td>
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<tr>
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<td><strong>Total Fixed Business Expenses</strong></td>
<td>(15,980)</td>
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<td>(16,468)</td>
<td>-2.49%</td>
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<td><strong>Total Other Expenses</strong></td>
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<tr>
<td><strong>Net Income</strong></td>
<td>129,563</td>
<td>21.64%</td>
<td>178,589</td>
<td>27.05%</td>
<td>234,346</td>
<td>32.28%</td>
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