Business Plan for Recycling Food Waste on Martha's Vineyard, Massachusetts

Prepared For

Island-Wide Organics Waste Management Study Oversight Committee
Martha's Vineyard, MA

Prepared By:

Coker Composting and Consulting
Troutville, VA

In association with:

Robert L. Spencer, Environmental Consultant

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List of Tables

List of Figures

Executive Summary

Massachusetts' food waste ban went into effect October 1, 2014. In response to this ban, the Martha's Vineyard Vision Fellowship funded an Island-wide organic waste management feasibility study which was finalized in May 2017. That study assessed various technologies and approaches to managing food waste on the Island and made specific recommendations for next steps. This report was commissioned by the Island-Wide Organics Waste Management Study Oversight Committee in order to begin to understand the magnitude of the infrastructure investment needed to process food waste on Martha's Vineyard, rather than to ship it back to mainland Massachusetts for processing at a landfill or combustion facility as is currently the practice.

This business plan examines three composting alternatives and a proprietary animal feed production technology. The composting alternatives are turned windrow, aerated static pile and in-vessel rotary drum. This plan includes capital, operating and cash flow forecasts for the three composting alternatives which are summarized below. As the animal feed technology would be provided and operated by a private company, only estimated capital costs are provided, with their proposal included in the Appendix.

The economic evaluation in this study is based on a facility sized to process 4,000 tons/year of food wastes. For the composting alternatives, to meet the desired process design criteria, another 6,000 tons/year of brush, leaves, grass clippings and old corrugated cardboard were included in the compost recipe (Appendix A). The footprint analysis (Appendix B) was based on total incoming compostables of 10,600 tons/year. The rotary drum composting and animal feed production technologies were sized for 15,600 tons/year due to the inability to scale down the technologies below a certain point[1].

No site has yet been selected for the proposed organics recycling facility. The composting alternatives will need a site in the range of 6-8 acres. The animal feed alternative will only require 1.5 – 2 acres. The economic evaluation includes proposed land acquisition, but if the implementing entity is a public-sector government, that expense may not be needed.

A summary of the capital cost estimates is provided in Table ES-1 and detailed cost estimates are in the Appendix E.

Table ES-1. Summary of Initial Capital Cost Estimates

Cost Element	Windrow Composting	ASP Composting	Rotary Drum Composting	Animal Feed Extrusion
Site development & design	$2,871,500	$2,779,953	$2,856,500	$2,725,000
Equipment	$1,101,000	$917,444	$3,040,500	$8,700,000
Total	$3,972,500	$3,697,397	$5,897,000	$11,425,000

[1] Rotary drum technology is available in either small (< 60 CY capacity) or large (> 750 CY capacity), if using the smaller drums, eight units would be required to handle expected daily throughputs.

Estimated operating costs for the three composting options were prepared by using a "time-and-motion" prediction of the steps in the volumetric compost production process, which resulted in estimates of labor needed, and equipment costs for operations. Production in the turned windrow and rotary drum alternatives would need 2 full-time equivalents (FTEs) while the aerated static pile alternative would require 2 FTEs and 1 part-time equivalent. The pro forma analysis assumed 2 FTEs for the windrow and drum composting and 3 FTEs for ASP composting to account for housekeeping, recordkeeping and process monitoring, along with sales support. Annual operating costs per ton are estimated to be $32.70/ton for turned windrows, $33.30/ton for rotary drum and $45.10/ton for ASP. The primary differences between them are higher processing costs for active composting with straddle-turned windrows and higher processing costs for curing with the rotary drum, along with mixing and electricity costs for rotary drum and ASP. The operating costs for the animal feed production alternative were estimated at $87/ton by the technology provider.

Financial *pro formas*, projections of monthly profit or loss over a three-year period (2019 – 2021), were prepared. For all composting approaches, the assumptions used are shown in Table ES-2. It was assumed that operating costs and tip fees would go up 3% per year. Timing of compost sales was based on experiences from other compost producers and the timing of production expenses was proportional to the tonnages collected by IGI in 2017. Capital cost recovery factors used were 3.75% per year for equipment with less than a 12-yr anticipated life and 5.5% per year for site improvements and infrastructure, assuming a 20-year life. As the implementing entity is not yet known, it is unknown how financing would be arranged, so the *pro forma* analysis does not include any cost of capital.

Table ES-2. Pro forma assumptions for composting

Parameter		2019	2020	2021	Notes
Tip fee		$50.00	$51.50	$53.00	$ per ton
Tip fee tonnage	Tons	2,215	2,900	4,000	No tip fee for carbon materials
Compost sales price	Commercial	$25.00	$25.00	$25.00	$ per CY
	Residential	$35.00	$35.00	$35.00	$ per CY
Annual sales volume		10,500	13,775	19,000	CY

The results of the *pro forma* analysis are summarized in Tables ES-3, ES-4 and ES-5. Detailed spreadsheets are in Appendix F. All options are similar in terms of predicted financial performance. The facility can be profitable within three years if the tonnages go up year-over-year as shown, and all the compost is sold at the assumed price points. These estimates do not include any collection costs or revenues, nor any corporate or governmental overhead allocations.

Table ES-3. Summary of windrow composting *pro forma* analysis

	2019	2020	2021
Revenues	$399,500	$528,163	$734,500
Expenses	$589,500	$579,653	$590,388
Net income	($190,000)	($51,491)	$144,112

Table ES-4. Summary of ASP composting *pro forma* analysis

	2019	2020	2021
Revenues	$399,500	$528,163	$734,500
Expenses	$687,111	$701,484	$716,287
Net income	($287,612)	($173,322)	$18,213

Table ES-5. Summary of rotary drum composting *pro forma* analysis

	2019	2020	2021
Revenues	$399,500	$528,163	$734,500
Expenses	$659,908	$643,650	$654,826
Net income	($260,408)	($115,488)	$79,674

Of the four alternatives evaluated, the animal feed production is the most expensive, in part because it is sized for 50 tons/day and would require inputs from off-island for the economics to work out. Rotary drum composting is well-practiced in Massachusetts (Marlborough and Nantucket) but would also be sized larger than needed. Windrow composting is the most widely practiced composting approach and is the least expensive and most flexible to changes in quantities of feedstocks. ASP composting is becoming more common as it offers better process and odor control but has the least favorable financial performance projection.

There are a number of factors that could influence these calculations, as outlined in Table ES-6. Readers should consider these factors before drawing any conclusions.

Table ES-6. Factors Affecting Financial Analysis

Assumptions used in study	Value chosen	Uncertainties
Feedstocks		
Food wastes from residential sources	1,090 tons/year to 1,816 tons/year	Will residential diversion program be implemented?
Carbon sources from MVRD	1,980 CY/yr brush, 1,600 CY/yr leaves	Will this be made available given it is being recycled now?
Processing Alternatives		
Rotary drum composting	Single drum - 50 ton/day capacity	This is more capacity than needed, will off-island sources be included?
Animal Feed Extrusion	SAFE proposed ~16,000 tons/yr capacity	This is more capacity than needed, will off-island sources be included?
Economic Analysis		
Cost factors used	Labor - $22.50/hr	Is this appropriate?
Cost of land	$74,000/acre	Could be higher or lower? If municipal implementation, could be free.
Construction costs	No land clearing needed	Is this appropriate?

	On-site well, on-site septic, 500' utility extensions	Are these appropriate?
Equipment costs	Equipment costs based largely on late 2017 prices	Will March 2018 steel tariffs raise prices?
Pro Forma Analyses		
Capital cost recovery factors	3.75%/yr for equipment; 5.5% for site improvements	Are these appropriate?
Food waste tipping fee	\$50 - \$53/ton	Is this appropriate? Better financial performance at tip fee = \$75/ton
Compost sales prices	\$25 - \$35/CY	Is this appropriate?
Animal feed revenues	None provided by SAFE	

The next steps in the process should be to find one or more candidate sites, identify who the implementing entity will be, quantify the real market potential for compost sales on the Island, and refine this preliminary sizing analysis and estimates of costs.

Introduction

Massachusetts' food waste ban was proposed in July 2013, accepted to update the state's Solid Waste Facility Regulations (310 CMR 19.006) in January 2014, and went into effect October 1, 2014. The regulatory body responsible for enforcing the ban is the Massachusetts Department of Environmental Protection (MassDEP). Under the ban, generators of food wastes are prohibited from disposing, transferring for disposal, contracting for the disposal, or transporting commercial organic material. "Commercial Organic Material" means food material and vegetative material from any entity that generates more than one ton of those materials for solid waste disposal per week but excludes material from a residence.

MassDEP's guidance materials for the Commercial Organics Waste Ban give the following guidelines for some of the commercial and institutional generators who may be affected by the ban, based on generic sector-based estimates:

- Residential Colleges or Universities with ≥ 730 students
- Non-residential Colleges or Universities with ≥ 2,750 students
- Secondary Schools with ≥ 4,000 students
- Hospitals with ≥ 80 beds
- Nursing Homes with ≥ 160 beds
- Restaurants with ≥ 70 or more full time employees
- Resort/Conference Properties with ≥ 475 seats
- Supermarkets with ≥ 35 full time employees.

In response to this ban, the Martha's Vineyard Vision Fellowship funded an Island-wide organic waste management feasibility study which was finalized in May 2017. The study's oversight committee members were chosen for their knowledge of and experience with food waste diversion, waste management and/or their unique perspectives on how to introduce new projects/programs to the Island community. The committee members currently are: Don Hatch, Director of the Martha's Vineyard Refuse Disposal and Resource Recovery District; Michael Loberg, chairman of the Tisbury Board of Health; Chris Murphy, Chilmark Conservation Commission and former MV Commission member; Jon Previant, Agricultural Consultant; Richard Toole, Vineyard Conservation Society board president; Matt Poole, Edgartown Board of Health Agent and Rebecca Haag, Executive Director at Island Grown Initiative.

The study assessed various technologies and approaches to managing food waste on the Island and made specific recommendations for next steps. The Committee applied for and received funding from the Vision Fellowship for a Phase II, the purpose of which is to lay the groundwork for community and investor commitments to specific organic waste management for the Island.

The precursor study to this report, "*Island-Wide Organics Feasibility Study Final Report*"[2] concluded that two composting technologies and one animal feed manufacturing technology should be considered for implementation to help Island businesses comply with the new rules. The composting technologies selected were open-air turned windrow and an in-vessel composting system. The project team has based its analysis in this report on the rotary drum composting technology, due to its years of experience in recycling organic wastes (particularly in Marlborough and Nantucket, MA) and its proven capability for handling food wastes. This report also evaluates an aerated static pile (ASP) composting approach. The animal feed manufacturing technology suggested in that report was based on the use of a proprietary dry extrusion system.

This report was commissioned by the Island-Wide Organics Waste Management Study Oversight Committee in order to begin to understand the magnitude of the infrastructure investment needed to process food waste on Martha's Vineyard, rather than to ship it back to mainland Massachusetts for processing at a landfill or combustion facility as is currently the practice. This plan was prepared from the perspective of a private-sector company opening an organics recycling facility on the Island and handling all compost sales and marketing. It is possible that a public-sector entity would develop and operate the facility.

About the authors

This report was prepared by Coker Composting & Consulting, with the assistance of Robert L. Spencer, Environmental Planning Consultant.

Coker Composting & Consulting is a sole proprietorship consulting operation run by Craig S. Coker. Mr. Coker has over 40 years' experience in the planning, permitting, design, construction and operation of organics recycling facilities processing animal manures, animal mortalities, food wastes, biosolids, yard trimmings and source-separated organic solid wastes. He has planned, permitted, built and/or operated twelve ASP facilities in eight states. He is a licensed Waste Management Facility Operator, a certified Nutrient Management Planner (both Agriculture and Turf/Landscape) and a USCC/SWANA Certified Compost Systems Manager. He holds an undergraduate degree in Environmental Science from the University of Virginia and a graduate degree in Environmental Engineering from George Washington University.

Robert L. Spencer is an Environmental Planner with extensive experience in Massachusetts and in the previous evaluations of food wastes on Martha's Vineyard. His experience working with Martha's Vineyard started in the fall of 2014 when he was retained by Bruno's Roll-Off Inc. to assist the company in identifying options for complying with the Massachusetts Food Waste Ban that took effect in October 2014. Spencer was then retained by the Martha's Vineyard Vision Fellowship in December 2015 for a 12-month feasibility study of food waste recycling options. Spencer has also been retained by the Massachusetts DEP's RecyclingWorks technical assistance program to assist the following Martha's Vineyard farms with composting food waste: Whippoorwill Farm, Beetlebung Farm, and Thimble Farm.

[2] S. Abrams and R.L. Spencer, "Island-Wide Organics Feasibility Study", Martha's Vineyard Vision Fellowship, May 2017

Acknowledgements

The project team would like to acknowledge the invaluable assistance provided by the following people during this project:

- Rebecca Haag, Executive Director, Martha's Vineyard Island Grown Initiative
- Jon Previant, Island-Wide Organics Waste Management Oversight Committee
- Sophie Abrams Mazza, Food Equity and Recovery Director, Island Grown Initiative

Compost Facility Sizing

Composting, at any scale, is a biological manufacturing process, where the inputs to the process are compostable materials (feedstocks), air and water, and the outputs are compost, heat, water vapor and carbon dioxide. Compost production requires a medium dry enough to provide pore spaces with free air but wet enough to sustain biological activity (around 50% to 55% moisture). Porosity (around 35% to 50%) typically is provided by mixing organic wastes with a structural bulking agent or amendment, such as wood chips. The addition of woody materials as amendments also serves to raise the carbon-to-nitrogen (C:N) ratio of the organic waste materials into the preferred range of 20% to 35%. Other carbon-adjusting amendments include leaves, sawdust and horse manure and bedding.

Composting is also a batch-type volumetric materials handling process. The steps in this process are feedstock receipt and storage, mixing, active composting, curing (also known as maturation), screening (needed to recover oversized bulking agent), and product storage. Each of these process steps is sized individually, then summed to determine the total area needed. For this project, sizing was done for turned windrow and rotary drum composting methods. For the animal feed alternative, the technology vendor offered sizing suggestions.

Once estimates of compostable feedstocks are determined, a compost recipe can be prepared. Compost recipes are developed on a mass, or weight, basis to ensure that the mix conforms to desired process design criteria, but the feedstocks are commingled on a volumetric basis (i.e. so many cubic yards [CY] of Feedstock A mixed with so many CY of Feedstock B, etc.). Incoming source-separated organic materials (SSO) would be processed by grinding/shredding/mixing to achieve a consistent particle size, and to combine the SSO with fresh bulking agent, oversized bulking agent from the screening process, and finished compost (used as a microbial inoculum).

Feedstock Estimates

Food Wastes

The 2017 Abrams and Spencer report estimated potential food waste diversion on Martha's Vineyard at 6,500 tons per year. That estimate was based on a combination of visual observations by Mr. Don Hatch of the Martha's Vineyard Refuse Disposal District of the percentage of food (45%) in the municipal solid waste stream shipped off-island for disposal (19,000 tons/year), supplemented with Mr. Spencer riding with a commercial hauler collecting trash in Edgartown in the fall of 2014 to inspect loads tipped at the Oak Bluffs transfer station.

Industrial/Commercial/Institutional (I/C/I) sources

Tables 3 and 4 in the 2017 Abrams and Spencer report list the 26 establishments that are, or might be, subject to the MassDEP food waste ban which applies to generators of 1 tons per week or more of food waste. This list included 16 establishments open only 20 weeks per year, one open 40 weeks/year, two open 48 weeks/year and 7 open 52 weeks/year, so it reflects the higher waste generation of the spring/summer/fall tourist seasons. Estimates of waste generation for those establishments were developed based on MassDEP Recycling Works methodology, which is a reasonable method of estimation. Based on the Spencer and Abrams calculations, the total expected annual waste generation from those MV establishments is approximately 1,006 tons/year. Those estimates were compared to estimates from a "State List" which consists of a spreadsheet of food waste sources by community in Massachusetts prepared in 2002 by Draper/Lennon, Inc. It is reasonable to assume that all 1,006 tons/year will be available to the organics recycling facility.

Abrams and Spencer calculated potential tonnages from another 89 food waste generators on MV, not necessarily subject to the ban, who might be producing another 740 tons/year. If any of those establishments produce 1 ton per week for any portion of the year, they are subject to the ban. As many of these generators are small, it is reasonable to assume that 50% of this tonnage (370 tons/year) will be available to the facility.

As part of this current project, Mr. Spencer confirmed that there have been no major new food waste generators (i.e. restaurants or grocery stores) built since the previous calculations were done in Nov. 2016, through interviews with health agents in all six towns. Food service establishments must have a permit from the Board of Health, and that permit lists the number of seats in the establishment, which can then be used to estimate the amount of food waste per establishment.

Residential Sources

The 2017 report estimated a total yearly residential food waste stream of 4,844 tons, with 1,963 tons coming from year-round residents and 2,881 tons coming from summer visitors. This was based on an estimate of year-round population of 16,500 producing 238 lbs. of food waste per year and a summer population estimate of 98,500 producing 0.65 lbs./day for 90 days. This is a reasonable method of estimation.

As there is no mandate for residential diversion of food wastes, then any residential diversion program must be a voluntary participation model, paid for either by usage fees or public funds subsidies. In either case, voluntary programs are characterized by participation rates (the percentage of households participating in the program) and setout rates (the percentage of households that actually set their organics out for collection on their assigned collection day, or who actually take their organics to a drop-off station weekly). For this study, assumed participation rates were 30% in 2020, rising 10% per year to 50% by 2022. Of those participating, a setout rate of 75% was assumed (based on data from a Vermont residential diversion program).

The estimated food waste generation is shown in Table 1.

Table 1. Estimated food waste generation

Source	Food waste (tons/year) 2020	2021	2022
I/C/I subject to ban	1,000	1,200	1,500
I/C/I not subject to ban	125	250	370
Residential (year-round)	442	590	736
Residential (visitor)	648	864	1,080
Totals	2,215	2,904	3,686

The economic evaluation in this study is based on a facility sized to process 4,000 tons/year of food wastes.

Carbon sources

Although food-soiled paper is often included in the food wastes collected in SSO diversion programs (as they are not recyclable elsewhere), they alone rarely provide enough biodegradable carbon to satisfy the recipe criteria. Other sources of carbon amendments on Martha's Vineyard were identified in a 2014 study[3]. That study estimated that 5,699 cubic yards (CY) of wood chips, 4,868 CY of leaves, and 117 CY of sawdust could be available to a composting facility. Those estimates were used to develop the compost recipe.

In addition, the Martha's Vineyard Refuse District (MVRD) in West Tisbury reports they collect approximately 1,980 CY of brush and 1,600 CY of leaves annually that is diverted to the Keene Excavating Compost Facility. Those quantities were included in the recipe.

Old Corrugated Cardboard (OCC)

There are old corrugated cardboard (OCC) and waxed cardboard materials in the waste stream that could potentially be captured and diverted to the composting facility. The 2017 Abrams and Spencer study estimated that 19,000 tons/year of mixed solid waste were shipped off-island for disposal annually. A 2011 Waste Characterization Analysis by MassDEP estimates that compostable paper comprises 6.2% of solid waste disposed, that OCC comprises 8.7% and that waxed cardboard comprises 1%[4]. The compostable paper will likely be collected with the food waste, but a separate OCC collection effort would have to be initiated. OCC/waxed cardboard were estimated to potentially add another 468 tons/year of divertable SSO assuming 25% of OCC/waxed cardboard waste stream could be captured by 2022.

[3] Abrams, S., "Closing the Loop on the Thimble Farm Slaughterhouse: A Waste Composting Feasibility Study", Marlboro Graduate School, July 2014

[4] Massachusetts Dept. of Environmental Protection, "Massachusetts Waste Characterization Data, Material Category Profiles", March 2011

Compost Recipe

A mass-based compost recipe was developed for the estimated quantities above. The recipe was based on the food waste plus leaves, sawdust, wood chips, OCC, yard waste, compost inoculant and overs from the product screen. The recipe is based on the four key process design criteria for good composting:

- Carbon:Nitrogen (C:N) ratio of more than 20:1
- Mix moisture content of 50% - 65%
- Volatile solids content greater than 80%
- Predicted (based on bulk density) free air space content of 40%-60%

Compost recipes should be adjusted to reflect the fact that not all carbon in compostable materials is available to the bacteria responsible for primary decomposition in active composting. This is because some carbon is contained within lignin molecules in wood, carbonaceous and paper products. Lignaceous carbon is biodegraded by fungi in curing/maturation. Carbon content is adjusted for the lignin content using a methodology by Chandler (1980)[5]:

Biodegradable Fraction (B.F.) = 0.83 – (0.028 x Lignin Content of Volatile Solids)
Biodegradable-C = Total Carbon x B.F. x Volatile Solids

A summary of the recipe is in Table 2 and the detailed recipe and calculations are in the Appendix.

Table 2. Daily Compost Recipe Summary

Parameter	Targets	Values
Average Daily Compostables Volumes (CY/day)		121
Carbon:Nitrogen Ratio	> 20:1	20
Moisture Content	50%-65%	53%
Volatile Solids	> 80%	85%
Predicted Free Air Space	40% - 60%	70%

The only recipe model parameter outside the recommended range is predicted free air space (FAS). FAS is defined as pore space minus the pore space volume occupied by water. The equation predicting FAS is based on Alburquerque (2008)[6] and is a function of bulk density. So, materials with low bulk densities have higher predicted FAS and vice-versa. Compost piles with high FAS may have difficulty retaining heat during active composting and can be mitigated by covering piles with finished compost or a fabric cover. This will be monitored by the facility's operating staff, so is not considered problematic at this early stage.

[5] Chandler, J.A., "Predicting Methane Fermentation Biodegradability", *Biotechnology and Bioengineering Symposium*, 10, 93, 1980

[6] Alburquerque, J.A., et. al., "Air Space in Composting Research: A Literature Review", Compost Science and Utilization, Vol. 16, No. 3, 2008, p. 159-170

Facilities Footprint

The technologies initially under consideration by the Oversight Committee include three composting approaches and a dry extrusion animal feed facility. The three composting approaches modeled were turned windrow composting and curing, aerated static pile (ASP) composting with windrow curing and rotary drum composting followed by windrow curing.

The sizing models used are based on the volumes determined by the recipe model due to the volumetric materials handling nature of composting. Windrow systems are more flexible in terms of changing quantities of feedstocks (to be expected on Martha's Vineyard given seasonal tourism) where in-vessel systems have fixed volumetric capacities.

For the windrow alternative, the sizing analysis was based on the use of a straddle windrow turner with a 6' H x 12' W drum (Figure 1). The ASP alternative was based on the use of concrete block bunkers and Fuji ring compressors (Figure 2). For the rotary drum alternative (Figure 3), the sizing was based on the use of a single 12' diameter, 185' long rotary drum with mixer[7].

Figure 1. Straddle Windrow Turner Composting

[7] Rotary drum technology is available in either small (< 60 CY capacity) or large (> 750 CY capacity), if using the smaller drums, eight units would be required to handle expected daily throughputs.

Figure 2. ASP Composting

Figure 3. Rotary Drum Composting

A summary of area needs is shown in Table 3. Detailed calculations are in the Appendix.

Table 3. Summary of Area Needs

	Windrow Composting	ASP Composting	Rotary Drum Composting
Area Summary	Area	Area	Area
	(sq. ft.)	(sq. ft.)	(sq. ft.)
Feedstock Receipt	1,600	1,600	1,600
Feedstock Storage			
Food wastes	400	400	400
OCC	400	400	400
Leaves	19,900	19,900	19,900
Wood chips	8,400	8,400	8,400
Yard wastes	6,000	6,000	6,000
Overs from Screen	750	750	750
Composting Area	87,500	26,250	24,000
Curing Area	75,000	95,625	115,500
Screening Area	4,500	4,500	4,500
Product Storage Area	24,000	24,000	24,000
Retail sales area	6,400	6,400	6,400
Subtotal	234,850	194,225	216,650
Equip storage, etc. @ 25%	58,713	48,556	54,163
Total square feet needed	293,563	242,781	270,812
Total acreage needed	6.7	5.8	6.2

As much of the space needs are taken up by non-composting/curing activities, the key differences are in the composting and curing footprints. While rotary drum composting takes up the least space, it requires the largest curing (maturation) footprint. Essentially, all alternatives will require a 6-8 acre site.

Animal Feed Extrusion Facility

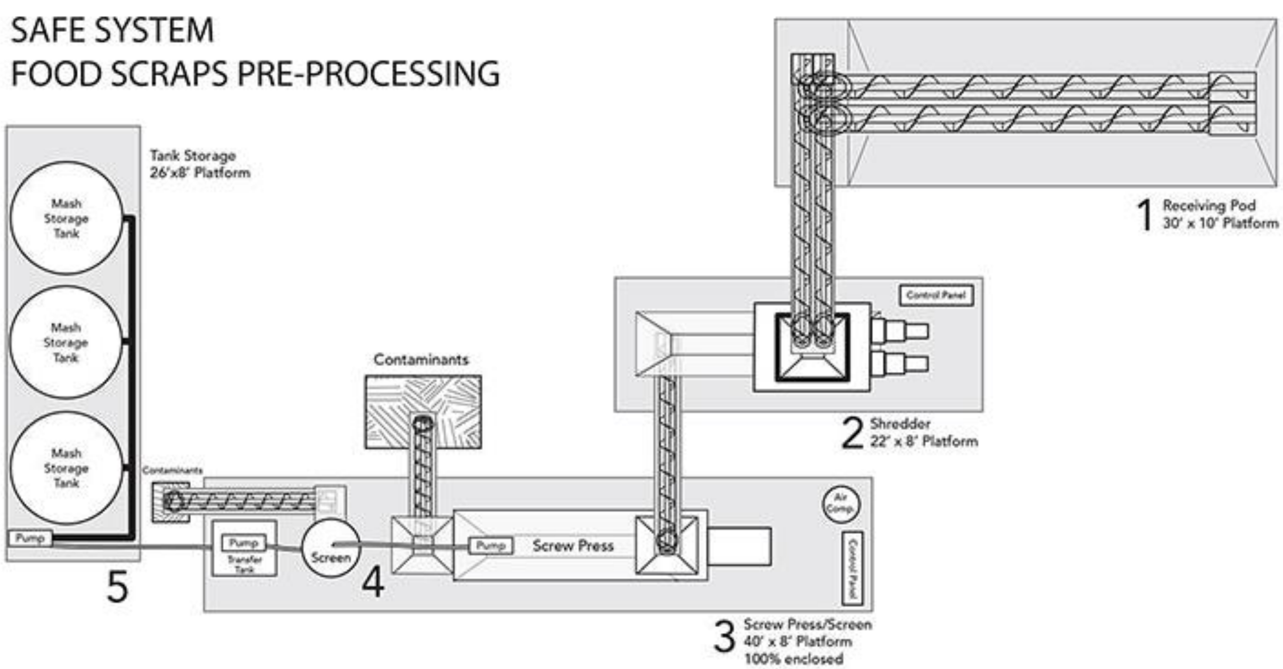
The animal feed manufacturing process recommended for further evaluation in the 2017 study is a dry extrusion process, patented by Sustainable Alternative Feed Enterprises (www.forktofeed.com) which has a 100 ton/day facility operating in Santa Clara, CA.

Description of Operation

The Santa Clara facility operated by S.A.F.E. consists of a pre-processing step to remove contaminants and make the food waste compatible with the feed production system, which consists of a dehydrator, a sterilizer, and an extruder press to recover oils from grease trap wastes.

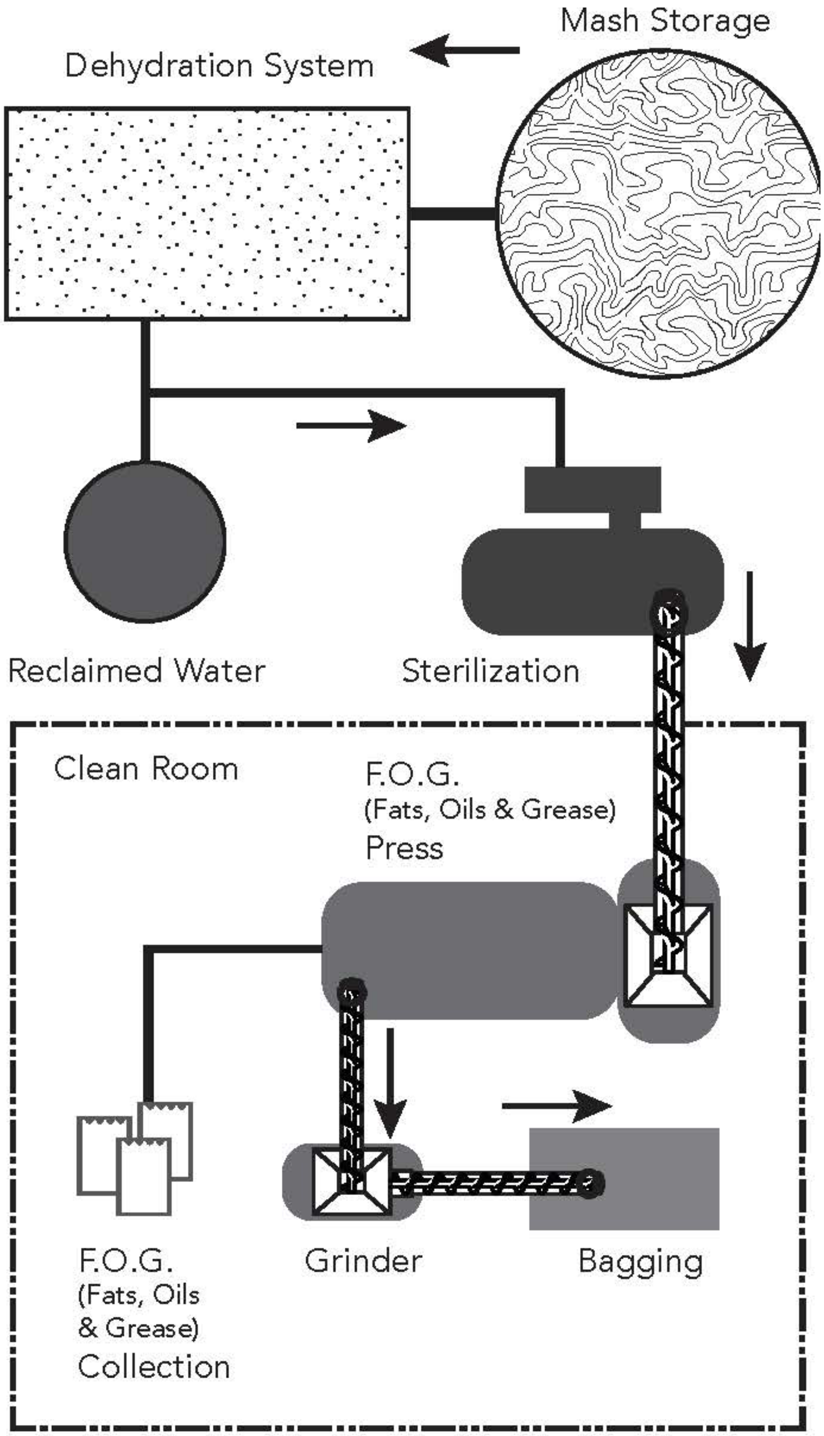
The pre-processing system Is shown in Figure 3 and consists of a shredder, a screw press, a filtering screen, and mash storage tanks. The screw press is the primary contaminant removal mechanism, producing a high-solids thick liquid, called mash.

Figure 3. SAFE pre-processing system



The feed production system is shown in Figure 4. Company officials have indicated that, in future installations, they plan to move the Fats/Oils/Greases (FOG) press between the mash storage tanks and the dehydration system. The extruder technology (labeled Sterilization in Figure 4) is based on Insta-Pro International dry extruders, which generate heat through friction to accomplish numerous processes including: cooking, expanding, sterilizing, stabilizing, dehydrating and texturizing. The extruders can be either high or medium shear which create various pressures and temperatures.

Figure 4. SAFE feed production system



The output from the extruder is a dry pelleted product, which can be fed to non-ruminant animals. The Santa Clara facility has experimented with making treats for domestic dogs from the process, which was apparently successful.

A key advantage to a SAFE system on Martha's Vineyard is that it is a compact processing system. The Santa Clara plant takes up about 15,000 square feet of processing area. However, as the 2017 study noted, "Only food waste would be processed. The technology does not process other organics like leaf and yard waste, cardboard or soiled paper, meaning either a missed opportunity to recycle those materials locally, or the need for a separate composting facility." Company officials have estimated the facility will need approximately 11,000 SF of processing area, and this study assumes this to be done inside a building on a 0.5 acre site

Company officials have indicated that it may be difficult to downsize some of the system components to meet the projected 12.8 ton/day food waste diversion rate (based on 4,000 tons/year over a 312-day year), so there may be interest in bringing in other material off-island for processing.

Neither the 2017 study or this evaluation has assessed the on-island market(s) for animal feed produced by a SAFE system.

SAFE provided a preliminary budgetary design-build proposal for their technology, consisting of a pre-processing system to produce the food mash and an animal food production system consisting of a dryer, decanting centrifuge, pumps, tanks, the extrusion system, and a suspended air flotation system for pretreating the decanted wastewater prior to sewer discharge. Their proposal is included in the Appendix.

As a site has not been selected yet for any organics recycling facility, it is not known whether adequate 3-phase power is available nearby, nor if any one of the island's five wastewater treatment plants can accept the pretreated wastewater.

Cost Estimates

Cost Factors Used

In the absence of any island-specific construction cost factors, this analysis used cost factors from two sources: a general contractor's Schedule of Values for a composting facility under construction in the northern Virginia suburbs of Washington, D.C., and from construction estimating software I use (Craftsman National Construction Cost Estimator), adjusted for costs in Zip Code 02575 (materials +4%, labor +36%, equipment +1%).

For windrow composting operating costs, we assumed a labor rate of $22.50/hour, a machine rate for loaders/trucks of $55/hr, for grinder at $110/hr, and for a windrow turner at $450/hour. The rotary drum vendor (Waste Options) and SAFE provided estimates of equipment and operating costs for those equipment alternatives. We assumed all alternatives to be open 6 days/week.

Capital Cost Estimates

Composting Facility

For all composting approaches, a greenfields development was assumed on a site with minimal tree cover requiring clearing, fine grading only (i.e. a reasonably flat site), 6" stone base, 6" asphalt paving (recommended to protect island groundwater resources), concrete slab for waste receipt and feedstock storage bunkers (food and OCC only; other feedstocks stored in open trapezoidal piles), concrete block walls for bunkers, a portable construction trailer office (8' x 24') with minimal landscaping, 500' extension of 3-phase power from the road (for the ASP and rotary drum alternatives only), an on-site 4" well for water (60' deep), an on-site septic tank for sewage (and maybe leachate), sediment and erosion control (construction entrance, silt fence and erosion control blankets), storm water runoff management using run-on berms, runoff swales, solids separator, and closed (i.e. lined) bioretention pond, and a 50' wide planted vegetative buffer (tree/shrub density 1,000 plants/acre). Site development costs also included a 7.5% design fee and a 25% contingency.

The ASP alternative was based on the generic positive (forced) aeration design, with one blower per bunker. The capital cost estimate assumed a concrete bunker floor with aeration trenches and aeration pipe covered with galvanized steel trench covers, concrete block bunker walls, and a sliding timber panel end wall (so that bunkers could be filled to capacity). During this project, two technology providers (AgriLabs in VT and Engineered Compost Systems in WA) offered possible ASP facilities based on their technologies. This information has been included in Appendix C. If ASP composting is the selected alternative, these vendor offerings should be investigated in more detail.

The rotary drum capital cost estimate also included two buildings, one for waste receipt and drum loading and one for product discharge and screening, a mechanical mixer and a biofilter. The estimate was based on a March 2017 preliminary layout prepared for the Martha's Vineyard Refuse District by Structor Engineering.

The equipment included in the cost estimates was a well pump and pressure tank, a horizontal grinder (Morbark 2600 wood hog), a straddle windrow turner (Scarab 612) or a rotary drum (Citic 12' x 165') with a Luck mechanical mixer, Vortron TX 714 fabric windrow covers with punched tire hold-downs, Fuji ring compressor blowers with Intermatic timers, a yard truck (10 CY dump) for moving materials through the production process, a rubber-tired front-end loader (John Deere 524K with 2 – 3CY buckets, one for waste and one for product), and a TROM 406 trommel screen.

Food Extrusion Facility

SAFE provided estimates for facility design, pre-processing equipment, animal food production equipment, and wastewater pretreatment equipment[8]. They estimated about 11,000 square feet (SF) would be needed in a building somewhere. This study used the same site development cost factors used for composting site development and added estimated cost for a 11,000 SF pre-engineered metal building.

A summary of the capital cost estimates is provided in Table 5 and detailed cost estimates are in the Appendix E.

Table 5. Summary of Initial Capital Cost Estimates

Cost Element	Windrow Composting	ASP Composting	Rotary Drum Composting	Animal Feed Extrusion
Site development & design	$2,871,500	$2,779,953	$2,856,500	$2,725,000
Equipment	$1,101,000	$917,444	$3,040,500	$8,700,000
Total	$3,972,500	$3,697,397	$5,897,000	$11,425,000

Operating Cost Estimates

Composting Facility

Estimated operating costs for the three composting options are shown in Table 6 and detailed cost estimates are in the Appendix. The estimates were prepared by using a "time-and-motion" prediction of the steps in the volumetric compost production process, which resulted in estimates of labor needed, and equipment costs for operations.

Production in the turned windrow and rotary drum alternatives would need 2 full-time equivalents (FTEs) while the aerated static pile alternative would require 2 FTEs and 1 part-time equivalent. The pro forma analysis assumed 2 FTEs for the windrow and drum composting and 3 FTEs for ASP composting to account for housekeeping, recordkeeping and process monitoring, along with sales support. Annual operating costs per ton are estimated to be $32.70/ton for turned windrows, $33.30/ton for rotary drum and $45.10/ton for ASP. The primary differences between them are higher

[8] SAFE based their estimates on late 2017 materials prices but noted that pending tariffs on Chinese steel would require that the estimates be revisited before placing an equipment order.

processing costs for active composting with straddle-turned windrows and higher processing costs for curing with the rotary drum, along with mixing and electricity costs for rotary drum and ASP.

Table 6. Annual Composting Operational Expenses

		Turned Windrow	
Process	Hours per day	Labor Cost	Machine Cost
Waste Receipt	0.7	$4,734	$11,572
Grinding/shredding	0.7	$7,020	$34,320
Transport to Pad	2.4	$16,569	$40,503
Building Windrows	2.0	$14,202	$34,717
Windrow Mixing/Turning	1.1	$7,898	$19,305
Moving Compost to Curing	1.4	$9,942	$24,302
Managing Curing Piles	1.3	$9,042	$22,103
Screening Compost	1.5	$11,504	$28,121
Moving Compost to Storage	1.0	$7,158	$17,497
Moving Overs to Storage	0.3	$2,193	$5,360
Product Marketing & Sales	0.8	$5,616	$13,728
Total Workhours	13.2	Totals	$347,406
FTEs needed*	1.93	Annual Tonnage	10,623
		Cost per ton	**$32.70**
		Rotary Drum	
Process	Hours per day	Labor Cost	Machine Cost
Waste Receipt	0.7	$4,734	$11,572
Grinding/shredding	0.7	$7,020	$34,320
Transport to Pad	2.4	$16,569	$40,503
Loading Rotary Drum	0.4	$5,616	$13,728
Electricity for Rotary Drum	--	--	$28,852
Moving Compost to Curing	1.7	$11,599	$28,352
Managing Curing Piles	3.0	$21,304	$52,076
Screening Compost	1.5	$12,079	$29,527
Moving Compost to Storage	1.5	$10,439	$25,517
Moving Overs to Storage	0.3	$2,244	$5,485
Product Marketing & Sales	0.8	$5,616	$13,728
Total Workhours	12.1	Totals	$353,771
FTEs needed*	1.78	Annual Tonnage	10,623
		Cost per ton	**$33.30**
		Aerated Static Pile	
Process	Hours per day	Labor Cost	Machine Cost
Waste Receipt	0.7	$4,734	$11,572
Grinding/shredding	0.7	$7,020	$34,320
Mixing	4.2	$18,937	$72,029
Transport to Pad	2.1	$14,913	$36,453
Building ASPs	2.4	$17,043	$41,660
Electricity for blowers	--	--	$78,122
Moving Compost to Curing	1.5	$10,439	$25,517
Managing Curing Piles	1.3	$9,326	$22,797
Screening Compost	1.5	$12,079	$10,410

Moving Compost to Storage	1.1	$7,516	$18,372
Move Overs to Storage	0.3	$1,879	$4,593
Product Marketing & Sales	0.8	$5,616	$13,728
Total Workhours	19.5	Totals	$479,075
FTEs needed*	2.44	Annual Tonnage	10,623
		Cost per ton	**$45.10**

*Assumes 85% productivity of on-site staff

Food Extrusion Facility

SAFE provided the following operating cost estimate for feed production:

- Energy $25/ton
- Labor $25/ton
- Maintenance $ 4/ton
- G&A[9] $ 8/ton

Total $62/ton

They estimated the pre-processing system would add another $25/ton to the operating cost, for a grand total of $87/ton. This is based on processing 15,600 – 16,800 tons/year, which is considerably more than is available on Martha's Vineyard. Generally speaking, lower-capacity systems have higher operational costs due to a lack of economies of scale.

[9] G&A – General and Administrative costs

Financial *Pro Formas*

As noted previously, this study is based on the assumption that a private- or public-sector entity will develop an organics recycling facility based on composting. As the implementing entity is not yet known, it is unknown how financing would be arranged, so the *pro forma* analysis does not include any cost of capital. For the animal feed extrusion alternative, SAFE, a private company, has offered to design/build a new facility on Martha's Vineyard, so no *pro forma* analysis was performed. These *pro formas* are, in essence, projections of monthly profit or loss over a three-year period (2019 – 2021).

Methodology and Assumptions

Composting

For all composting approaches, the assumptions used are shown in Table 7. Compost sales prices were set lower than current Vineyard prices in order to capture market share. It was assumed that operating costs and tip fees would go up 3% per year. Timing of compost sales was based on experiences from other compost producers and the timing of production expenses was proportional to the tonnages collected by IGI in 2017 (as delineated in Table 8).

Capital cost recovery factors used were 3.75% per year for equipment with less than a 12-yr anticipated life and 5.5% per year for site improvements and infrastructure, assuming a 20-year life.

Table 7. Pro forma assumptions for composting

Parameter		2019	2020	2021	Notes
Tip fee		$50.00	$51.50	$53.00	$ per ton
Tip fee tonnage	Tons	2,215	2,900	4,000	No tip fee for carbon materials
Compost sales price	Commercial	$25.00	$25.00	$25.00	$ per CY
	Residential	$35.00	$35.00	$35.00	$ per CY
Annual sales volume		10,500	13,775	19,000	CY

Table 8. Timing of Sales and Expenses

Month	Percent of Sales	Percent of incoming tonnages
January	0.2%	1.5%
February	4.4%	1.8%
March	12.8%	1.6%
April	15.3%	2.2%
May	9.5%	7.4%
June	9.1%	11.5%
July	2.1%	19.5%
August	4.2%	24.5%
September	16.2%	10.2%
October	14.0%	8.4%
November	5.5%	5.7%
December	6.7%	5.8%

Pro Forma Summary

The results of the *pro forma* analysis are summarized in Tables 9, 10 and 11. Detailed spreadsheets are in Appendix F.

All options are similar in terms of predicted financial performance. The facility can be profitable within three years if the tonnages go up year-over-year as shown, and all the compost is sold at the assumed price points. These estimates do not include any collection costs or revenues, nor any corporate or governmental overhead allocations.

Table 9. Summary of windrow composting *pro forma* analysis

	2019	2020	2021
Revenues	$399,500	$528,163	$734,500
Expenses	$589,500	$579,653	$590,388
Net income	($190,000)	($51,491)	$144,112

Table 9. Summary of ASP composting *pro forma* analysis

	2019	2020	2021
Revenues	$399,500	$528,163	$734,500
Expenses	$687,111	$701,484	$716,287
Net income	($287,612)	($173,322)	$18,213

Table 11. Summary of rotary drum composting *pro forma* analysis

	2019	2020	2021
Revenues	$399,500	$528,163	$734,500
Expenses	$659,908	$643,650	$654,826
Net income	($260,408)	($115,488)	$79,674

Summary and Recommendations

Of the four alternatives evaluated, the animal feed production is the most expensive, in part because it is sized for 50 tons/day and would require inputs from off-island for the economics to work out. Rotary drum composting is well-practiced in Massachusetts (Marlborough and Nantucket) but would also be sized larger than needed. Windrow composting is the most widely practiced composting approach and is the least expensive and most flexible to changes in quantities of feedstocks. ASP composting is becoming more common as it offers better process and odor control but has the least favorable financial performance projection.

There are a number of factors that could influence these calculations, as outlined in Table 12. Readers should consider these factors before drawing any conclusions.

Table 12. Factors Affecting Financial Analysis

Assumptions used in study	Value chosen	Uncertainties
Feedstocks		
Food wastes from residential sources	1,090 tons/year to 1,816 tons/year	Will residential diversion program be implemented?
Carbon sources from MVRD	1,980 CY/yr brush, 1,600 CY/yr leaves	Will this be made available given it is being recycled now?
Processing Alternatives		
Rotary drum composting	Single drum - 50 ton/day capacity	This is more capacity than needed, will off-island sources be included?
Animal Feed Extrusion	SAFE proposed ~16,000 tons/yr capacity	This is more capacity than needed, will off-island sources be included?
Economic Analysis		
Cost factors used	Labor - $22.50/hr	Is this appropriate?
Cost of land	$74,000/acre	Could be higher or lower? If municipal implementation, could be free.
Construction costs	No land clearing needed	Is this appropriate?
	On-site well, on-site septic, 500' utility extensions	Are these appropriate?
Equipment costs	Equipment costs based largely on late 2017 prices	Will March 2018 steel tariffs raise prices?
Pro Forma Analyses		
Capital cost recovery factors	3.75%/yr for equipment; 5.5% for site improvements	Are these appropriate?
Food waste tipping fee	$50 - $53/ton	Is this appropriate? Better financial performance at tip fee = $75/ton
Compost sales prices	$25 - $35/CY	Is this appropriate?
Animal feed revenues	None provided by SAFE	

The next steps in the process should be to find one or more candidate sites, identify who the implementing entity will be, quantify the real market potential for compost sales on the Island, and refine this preliminary sizing analysis and estimates of costs.

Appendices

A. Compost Recipe
B. Footprint Analysis
    Windrow composting
    Aerated Static Pile composting
    Drum composting
C. Aerated static pile system information from AgriLabs and Engineered Compost Systems
D. Rotary drum layout and quote
E. Cost Estimates
    Capital costs
    Operating costs
F. *Pro Forma* Analyses
    Windrow composting
    Aerated static pile composting
    Rotary drum composting
G. SAFE proposal

Appendix A - Compost recipe

Martha's Vineyard Organics Composting Business Plan

Assumptions:

Composting facility open 6 days/week (312 days/yr)

Food waste tonnage based on 4K ton/year; 50% comm'l, 50% residential

Carbon amendments based on 2014 Abrams study: Wood chips - 5,699 cy, Leaves - 4,868 cy, Sawdust - 117 cy

Additional carbon amendments from MVRD: 1,980 CY brush & 1,600 CY leaves & grass

OCC & Waxed = 9.7% (Source: MassDEP, 2011) of 19,000 tons/year sent off-island, assume 25% captured

Compost recycle added at 10% by volume

MIX RATIO CALCULATIONS- AVERAGE DAILY CONDITIONS

INGREDIENTS	I/C/I Food Wastes	Residential Food Wastes	Leaves	Sawdusts	Wood Chips	MVRD Yard waste	OCC & waxed	Compost Recycle	Overs from Screen	TOTAL MIX	TARGET
C (% DWB)	31.4	36.6	30.4	41.0	33.2	34.4	34.1	34.0	30.3		
N (% DWB)	5.5	0.68	0.8	0.2	0.8	0.9	0.05	1.7	0.29		
MOISTURE%	71.2	38.2	59.5	39.8	61.6	40.1	8	47.5	61.6		
UNITS IN MIX BY WGT (T)	6.41	6.41	2.7	0.1	5.2	3	1.5	4.0	4.8	34	
UNITS IN MIX BY WGT (LB)	12,821	12,821	5,461	103	10,468	5,995	2,954	7,933	9,540	68,095	
UNITS IN MIX BY VOL (CY)	16.0	25.6	15.6	0.4	18.3	11	11.4	6.7	15.9	121	
DENSITY (LBS/CY)	800	500	350	275	573	523	259	1184	600	561.0	
POUNDS OF BIODEG. CARBOI	4,026	4,692	1,660	42	3,475	2,062	1,007	2,697	2,891	22,553	
POUNDS OF NITROGEN	705	87	44	0.2	84	54	1	135	28	1,138	
BIODEGRADABLE C:N RATIO	6	54	38	205	42	38	682	20	104	**20**	20 TO 30
POUNDS OF MOISTURE	9,128	4,897	3,249	41	6,448	2,404	236	3,768	5,877	36,050	
NUMBER OF UNITS	12,821	12,821	5,461	103	10,468	5,995	2,954	7,933	9,540	68,095	
PERCENT MOISTURE										**53**	50 TO 65%
VOLATILE SOLIDS (%)	96.2	91.7	98	99.6	89.5	98.3	94	57.1	59		
VOLATILE SOLIDS (LBS)	12333	11756	5352	103	9369	5893	2776	4530	5629	57,741	
NUMBER OF UNITS	12821	12821	5461	103	10468	5995	2954	7933	9540	68,095	
MIX VS (%)										**85**	> 80%
DENSITY (LBS/CY)	800	500	350	275	573	523	259	1184	573		
DENSITY (KG/M3)	474.6	296.6	207.6	163.2	340.0	310.0	153.7	702.4	340.0		
% AIR SPACE	57.28	73.30	81.31	85.32	69.40	72.10	86.17	36.78	69.40		
FEEDSTOCK VOLUME (CY)	16.03	25.64	15.60	0.38	18.27	11.47	11.40	6.70	15.90	121.4	
AIR VOLUME (CY)	9.2	18.8	12.7	0.3	12.7	8.3	9.8	2.5	11.0	85.3	
PREDICTED FREE AIR SPACE										**70%**	40-60%

Data Sources:

I/C/I food wastes - March 2012 lab analysis of dining hall pre-consumer food wastes, Culver, IN

Residential food wastes - Jan. 2012 lab analysis of cafeteria post-consumer food wastes, Smyrna, TN

Bulk densities for food wastes from Brattleboro (VT) comm'l and curbside collection programs

Leaves - March 2012 analysis of fallen leaves, City of Richmond, VA

Sawdust - April 2012 analysis of hardwood sawmill sawdust, Smith Mountain Lake, VA

Wood chips - Jan. 2014 analysis of wood chips, Royal Oak Farm, Evington VA

Yard waste - June 2011 lab analysis of mixed yard waste, Prince William Co., VA

OCC - On-Farm Composting Handbook, NRAES-54, 1992

Compost recycle - April 2017 analysis of 3/8" screened yard waste compost, Prince William Co., VA

Overs C,N, Moisture - Jan. 2014 lab analysis from Royal Oak Farm in VA; other from literature

Predicted Free Air Space equation from Alburquerque, J.A., *et. al.*, "Air Space in Composting Research: A Literature Review"
Compost Science and Utilization, Vol. 16, No. 3, 2008, p. 159-170

Adjusting for Biodegradable Carbon:

Biodegradable Fraction (B.F.) = 0.83 – (0.028) x Lignin Content of Volatile Solids ($L.C._{VS}$)

Biodegradable-C = Total C x B.F. x Volatile Solids (VS)

Feedstock	Carbon (%)	Lignin Content (%)	Biodegradable Fraction (B.F.)	Volatile Solids (%)	Biodegradable Carbon (%)
Example: Yard Trimmings	*49.2%*	*4.1%*	*82.89%*	*98.3%*	*40.1%*
Sawdust	49.8	12.7	47.44%	99.6	41.0
I/C/I food waste	39.3	0.4	81.88%	96.2	31.4
Residential food waste	45.9	0.4	81.88%	96.2	36.6
Leaves	37.6	18.1	32.32%	98.0	30.4
Wood chips	44.8	12.7	47.44%	89.6	33.2
Yard waste	49.2	4.1	71.52%	84.2	34.4
OCC	44.0	17.4	34.28%	94.0	34.1
Cleaned overs	38.6	12.7	47.44%	95.0	30.3

Biodegradable Fraction & Carbon equations from Chandler, J.A., et.al., "Predicting Methane Fermentation Biodegradability", *Biotechnology and Bioengineering Symposium*, 10,93, 1980

Lignin content data sources:

Sawdusts- Richards, T. "Effect of Lignin on Biodegradability", Cornell University, 1996

Food waste - Das, K.C., "Odor Related Issues in Commercial Composting", University of Georgia, 2000

Leaves- Quarles, R.G., "Long-term decomposition rates of forest floor litter", Forests 2016, 7, 231

Wood chips- Richards, T. "Effect of Lignin on Biodegradability", Cornell University, 1996

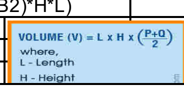
Yard waste - Das, K.C., "Odor Related Issues in Commercial Composting", University of Georgia, 2000

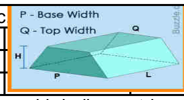
OCC - Gonzalez-Estrella, J., et.al., "A review of anaerobic digestion of paper and paper board waste", Reviews in Environmental Science and Bio/Technology 16.3 (2017): 569-590.

Cleaned overs - assumed the same as woodchips

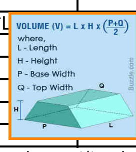
Appendix B - Footprint Analyses

MV Food Waste Composting - windrows - straddle turners									
Assumptions:									
1. Facility is open 6 days/week (312 days/year)									
2. Facility will use open-air turned windrows turned with straddle turner									
Waste Volumes (in cubic yards)									
							Average Daily Volume		
I/C/I food wastes							16.0	CY/day	
Residential food wastes							25.6		
Leaves							15.6		
Sawdusts							0.4		
Wood chips							18.3		
MVRD yard waste							11.5		
OCC							11.4		
Compost recycle							6.7		
Overs from screen							15.9		
	Totals						121.4	CY/day	
Composting Materials Flows									
Residence times for windrow composting (wintertime conditions)									
			Composting		Curing		Total		
	Windrow		45	days	60	days	105	days	
Daily Volumes going to composting									
		Daily volumes of mixed feedstocks =					121.4	CY/day	
Volume of material in Primary Composting									
			Residence Days	Mixed feedstocks					
	Windrow		45	5,462	CY				
Daily Volumes going to curing (assume 30% volume shrink in composting)									
		Daily volumes of composted feedstocks =					85.0	CY/day	
Volume of material in Curing:									
			Residence Days	Composted Feedstocks					
	Windrow		60	5,098	CY				
Daily Volumes going to screening (assume 10% volume shrink in curing):									
		Daily volumes of cured feedstocks =					76.5	CY/day	
Screening	a. Assume approx. 80% finished compost capture rate and 20% going to overs								
	b. Finished compost production (daily):								
		Daily volumes of screened compost =					61.2	CY/day	
	c. Daily volumes of overs =						15.3	CY/day	
	d. Finished compost production (annually, based on 312-day year)								
		Annual volume of screened compost =					19,088	CY/year	
Feedstocks Receipt									
Assume landscape/carbon delivery once/week (except leaves)									
Assume food wastes delivery daily									
Size receipts area for 2.0x average daily volume						=	242.8	CY/day	
to allow equipment to move feedstocks into storage						=	6,555	CF/day	
Assumed pile height						=	6	ft	
Pile footprint						=	1092	SF	
Plus equipment access/movement						=	546	SF	
Receipt area needed						=	1639	SF	
Proposed dimensions						=	40	ft. W	
							40	ft. L	
Feedstocks Storage									
Assume storage of food wastes, OCC in rectangular concrete block bunkers, rest in open piles									
Food Wastes									
Food wastes in recipe daily						=	42	CY	
Assume a maximum storage period prior to use						=	2	days	
Storage volume needed for food wastes						=	90	CY	
						=	2,430	CF	
Assume bunker depth						=	4	ft	
Bunker footprint						=	608	SF	
Proposed dimensions						=	20	ft W	
						=	30	ft L	
OCC									
OCC in recipe daily (on average)						=	11.4	CY	
Assume a storage capacity						=	7	days	
Storage volume needed for paper/OCC						=	80	CY	
						=	2,160	CF	
Assume bunker depth						=	6	ft	
Bunker footprint						=	360	SF	
Proposed dimensions						=	20	ft W	
						=	20	ft L	
Leaves		Assume stored in trapezoidal piles outdoors							
Annual volumes of leaves to be handled						=	4,868	CY/yr	
		Assume all come in Nov - Jan.				=	131,436	CF	
Assume maximum storage pile height						=	10	ft	
Assume pile base width						=	30	ft	
Volume per linear foot (trapezoidal - V=1/2(B1+B2)*H*L)						=	7.41	CY/LF	
Total linear footage of storage piles needed						=	660	LF	
Assume pile length						=	200	ft.	
Number of storage piles needed						=	3		



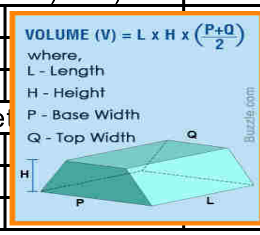


Space allowance around piles for equipment, etc	=	25	ft	
Needed storage area footprint	=	19900	SF	
Proposed dimensions	=	250	ft L	
	=	80	ft W	
Wood chips — Assume stored in trapezoidal piles outdoors				
Wood chips in recipe daily (on average)	=	18	CY/day	
Assume a storage period prior to use	=	30	days	
Storage volume needed for wood chips	=	550	CY	
	=	14,850	CF	
Assume maximum storage pile height	=	10	ft	
Assume pile base width	=	30	ft	
Volume per linear foot (trapezoidal - V=1/2(B1+B2)*H*L)	=	7.41	CY/LF	
Total linear footage of storage piles needed	=	80	LF	
Assume pile length	=	80	ft.	
Number of storage piles needed	=	1		
Space allowance around piles for equipment, etc.	=	25	ft	
Needed storage area footprint	=	2450	SF	
Proposed dimensions	=	105	ft L	
	=	80	ft W	
Yard waste — Assume stored in trapezoidal piles outdoors				
Yard waste in recipe daily (on average)	=	11	CY/day	
Assume a storage period prior to use	=	30	days	
Storage volume needed for yard waste	=	350	CY	
	=	9,450	CF	
Assume maximum storage pile height	=	10	ft	
Assume pile base width	=	30	ft	
Volume per linear foot (trapezoidal - V=1/2(B1+B2)*H*L)	=	7.41	CY/LF	
Total linear footage of storage piles needed	=	50	LF	
Assume pile length	=	50	ft.	
Number of storage piles needed	=	1		
Space allowance around piles for equipment, etc.	=	25	ft	
Needed storage area footprint	=	1550	SF	
Proposed dimensions	=	75	ft L	
	=	80	ft W	
Overs from screening — Assume stored in trapezoidal piles outdoors				
Screen overs in recipe daily (on average)	=	16	CY/day	
Assume a storage period prior to use	=	7	days	
Storage volume needed for screen overs	=	120	CY	
	=	3,240	CF	
Assume maximum storage pile height	=	10	ft	
Assume pile base width	=	30	ft	
Volume per linear foot (trapezoidal - V=1/2(B1+B2)*H*L)	=	7.41	CY/LF	
Total linear footage of storage piles needed	=	20	LF	
Assume pile length	=	20	ft.	
Number of storage piles needed	=	1		
Space allowance around piles for equipment, etc.	=	25	ft	
Needed storage area footprint	=	650	SF	
Proposed dimensions	=	30	ft L	
	=	25	ft W	
Feedstock Mixing				
Assume all feedstock mixing done by windrow turner on pad				
Active Composting				
Assume use of a straddle turner with a 6' x 12' tunnel				
Assume trapezoidal windrow shape				
a. Volume per linear foot of windrow:				
A = (H x (B-H)), where H = height, B = width at base				
Height	=	6	ft	
Base	=	12	ft	
Cross-sectional area per linear foot	=	36	SF	
Volume per linear foot	=	1.3	CY/ LF	
Average linear footage of new windrows daily				
Daily volume from mixing / volume per linear foot	=	91.0	LF / day	
Total volume of material in windrows during 45-day active composting	=	5,462	CY	
Total linear footage of material in windrows	=	4,097	LF	
Total area occupied by windrows	=	49,162	SF	
Assume each windrow holds 2 days worth of mixed material/3 built per week				
94 LF / day x 2 days	=	182	LF	
Volume of material in each windrow	=	243	CY	
Number of windrows in active composting	=	23	windrows	
Assume 3' spacing between windrows and 25' turning radius at each end				
Each windrow is				
Length — 189 ft + 25 ft + 25 ft	=	232	ft	
Width — 12 ft + 3 ft	=	15	ft	
Area of each windrow (gross)	=	3,481	SF	Avg Month Rain
Area of all windrows (gross)	=	78,328	SF	0.25
Assume pad length is equal to gross windrow length	=	250	ft. L	
Pad width is — 23 windrows @ 15' ea	=	338	ft. W	
Composting Pad =		350	ft. W	
		250	ft. L	
Curing				
Assume same size windrows as in active composting				

Assume 30% volume shrink during composting									
		Avg. daily volume to composting				=	121	CY/day	
		Avg. daily volume to curing				=	85	CY/day	
Average linear footage of new windrows daily									
	Avg. daily volume from composting / volume per linear foot					=	64	LF / day	
Total volume of material in windrows during 60-day curing period						=	5,098	CY	
Total linear footage of material in windrows						=	3,824	LF	
Total area occupied by windrows						=	45,885	SF	
Assume each curing windrow holds 1.5 composting windrows									
		1.5 x 755 CY/windrow x 30% shrinkage				=	255	CY	
Number of windrows in curing						=	20	windrows	
Length of each windrow						=	191	ft	
Assume 3' spacing between windrows and 25' turning radius at each end									
Each windrow is									
		Length	595 ft + 25 ft + 25 ft			=	241	ft	
		Width	12 ft + 3 ft			=	15	ft	
		Area of each windrow (gross)				=	3,618	SF	
		Area of all windrows (gross)				=	72,356	SF	
Assume pad length is equal to gross windrow length						=	241	ft	
		Pad width is				=	300	ft	
				Curing Pad =			300	ft. W	
							250	ft. L	
Screening & Product Storage Sizing and Layout Calculations									
Assume use of trommel screener with 3/8" screen									
Assume approximately 80%/20% fines/overs split									
Plan on four months finished compost storage									
Daily volume going to screening						=	76	CY/day	
Daily volume going to storage						=	61	CY/day	
Daily volume of overs recycled as bulking agent						=	15	CY/day	
Screen size						Length	24.5	ft	
						Width	6	ft	
Allow 25 ft all sides for equipment movement									
				Screening Area =			60	ft. W	
							75	ft. L	
Total Volume in Storage Pile									
		Daily volume x 6 days/week operation x 4 months capacity					5,873	CY	
						=	158,578	CF	
Assume maximum storage pile height						=	10	ft	
Assume pile base width						=	30	ft	
Volume per linear foot (trapezoidal - V=1/2(B1+B2)*H*L						=	7.41	CY/LF	
Total linear footage of storage piles needed							800	LF	
Assume pile length							200	ft.	
Number of storage piles needed						=	4		
Space allowance between piles for equipment, etc.						=	25	ft	
Needed storage area footprint						=	24150	SF	
Assume open storage pile with 30' access in front for equipment/trucks									
Width (depth) of storage area						=	120	ft	
Length of storage pile						=	201	ft	
				Product Storage Area =			120	ft. W	
							200	ft. L	
Retail Sales Area									
Assume 90% of production goes out in transfer trailers, 10% is small truck retail sales									
Truck loading area:									
	Dump trailer dimensions with 30' on either side for loading:					=	68.5	ft W	
							53	ft L	
Retail sales:									
	Pick up truck dimensions with 30' on either side for loading:					=	64	ft W	
							20	ft L	
Area needed						=	4911	SF	
	Add another 25% for vehicle queuing					=	1228	SF	
						Total	6138	SF	
Dimensions:						=	80	ft. W	
						=	80	ft. L	
Area Summary			Width	Length		Area	Area		
			(ft.)	(ft.)		(sq. ft.)	(acres)		
Feedstock Receipt			40	40		1,600	0.04		
Feedstocks Storage									
Food wastes			20	20		400	0.01		
OCC			20	20		400	0.01		
Leaves			80	250		19,900	0.46		
Wood chips			80	105		8,400	0.19		
Yard waste			75	80		6,000	0.14		
Overs from screen			25	30		750	0.02		
Composting Pad			350	250		87,500	2.01		
Curing Pad			300	250		75,000	1.72		
Screening Area			60	75		4,500	0.10		
Product Storage Area			120	200		24,000	0.55		
Retail Sales Area			80	80		6,400	0.15		
						234,850	5.39		
Allowance for equipment storage, movement, etc. @ 25%					Totals	293,563	6.74		

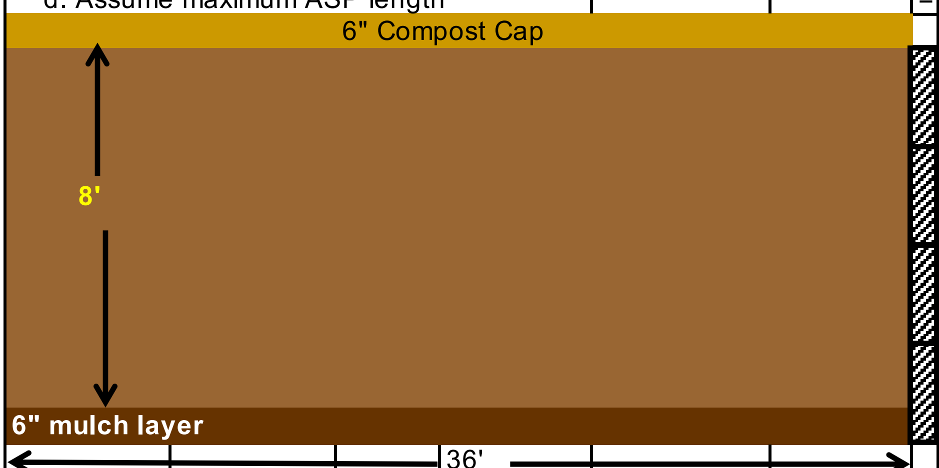
MV Food Waste Composting - Aerated Static Piles									
Assumptions:									
1. Facility is open 6 days/week (312 days/year)									
2. Facility will use aerated static piles (positive air) with loader-turned curing piles									
Waste Volumes (in cubic yards)									
						Average Daily Volume			
I/C/I food wastes							16.0	CY/day	
Residential food wastes							25.6		
Leaves							15.6		
Sawdusts							0.4		
Wood chips							18.3		
MVRD yard waste							11.5		
OCC							11.4		
Compost recycle							6.7		
Overs from screen							15.9		
	Totals						121.4	CY/day	
Composting Materials Flows									
Residence times for ASP composting (wintertime conditions)									
			Composting		Curing		Total		
	ASP		28	days	60	d	88	days	
Daily Volumes going to composting (assume 10% volume shrink in mixing)									
		Daily volumes of mixed feedstocks =					109.2	CY/day	
Volume of material in Primary Composting									
			Residence Days	Mixed feedstocks					
	ASP		28	3,059	CY				
Daily Volumes going to curing (assume 30% volume shrink in composting)									
		Daily volumes of composted feedstocks =					76.5	CY/day	
Volume of material in Curing:									
			Residence Days	Composted Feedstocks					
	Windrow		60	4,588	CY				
Daily Volumes going to screening (assume 10% volume shrink in curing):									
		Daily volumes of cured feedstocks =					68.8	CY/day	
Screening	a. Assume approx. 80% finished compost capture rate and 20% going to overs								
	b. Finished compost production (daily):								
		Daily volumes of screened compost =					55.1	CY/day	
	c. Daily volumes of overs =						13.8	CY/day	
	d. Finished compost production (annually, based on 312-day year)								
		Annual volume of screened compost =					17,179	CY/year	
Feedstocks Receipt									
Assume landscape/carbon delivery once/week (except leaves)									
Assume food wastes delivery daily									
Size receipts area for 2.0x average daily volume						=	242.8	CY/day	
to allow equipment to move feedstocks into storage						=	6,555	CF/day	
Assumed pile height						=	6	ft	
Pile footprint						=	1092	SF	
Plus equipment access/movement						=	546	SF	
Receipt area needed						=	1639	SF	
Proposed dimensions						=	40	ft. W	
							40	ft. L	

Feedstocks Storage				
Assume storage of food wastes, OCC in rectangular concrete block bunkers, rest in open piles				
Food Wastes				
Food wastes in recipe daily		=	42	CY
Assume a maximum storage period prior to use		=	2	days
Storage volume needed for food wastes		=	90	CY
		=	2,430	CF
Assume bunker depth		=	4	ft
Bunker footprint		=	608	SF
Proposed dimensions		=	20	ft W
		=	30	ft L
OCC				
OCC in recipe daily (on average)		=	11.4	CY
Assume a storage capacity		=	7	days
Storage volume needed for paper/OCC		=	80	CY
		=	2,160	CF
Assume bunker depth		=	6	ft
Bunker footprint		=	360	SF
Proposed dimensions		=	20	ft W
		=	20	ft L
Leaves	Assume stored in trapezoidal piles outdoors			
Annual volumes of leaves to be handled		=	4,868	CY/yr
	Assume all come in Nov - Jan.	=	131,436	CF
Assume maximum storage pile height		=	10	ft
Assume pile base width		=	30	ft
Volume per linear foot (trapezoidal - V=1/2(B1+B2)*H*L)		=	7.41	CY/LF
Total linear footage of storage piles needed		=	660	LF
Assume pile length		=	200	ft.
Number of storage piles needed		=	3	
Space allowance around piles for equipment, et		=	25	ft
Needed storage area footprint		=	19900	SF
Proposed dimensions		=	250	ft L
		=	80	ft W



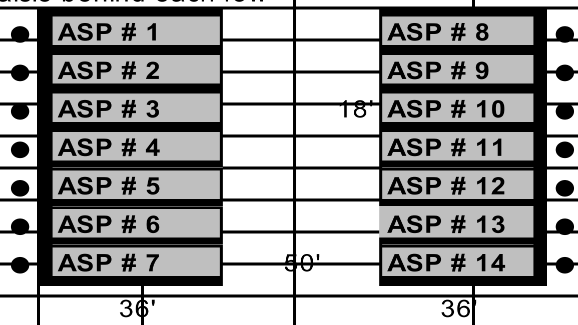
Wood chips	Assume stored in trapezoidal piles outdoors			
Wood chips in recipe daily (on average)		=	18	CY/day
Assume a storage period prior to use		=	30	days
Storage volume needed for wood chips		=	550	CY
		=	14,850	CF
Assume maximum storage pile height		=	10	ft
Assume pile base width		=	30	ft
Volume per linear foot (trapezoidal - V=1/2(B1+B2)*H*L)		=	7.41	CY/LF
Total linear footage of storage piles needed		=	80	LF
Assume pile length		=	80	ft.
Number of storage piles needed		=	1	
Space allowance around piles for equipment, etc.		=	25	ft
Needed storage area footprint		=	2450	SF
Proposed dimensions		=	105	ft L
		=	80	ft W
Yard waste	Assume stored in trapezoidal piles outdoors			
Yard waste in recipe daily (on average)		=	11	CY/day
Assume a storage period prior to use		=	30	days
Storage volume needed for yard waste		=	350	CY
		=	9,450	CF
Assume maximum storage pile height		=	10	ft
Assume pile base width		=	30	ft
Volume per linear foot (trapezoidal - V=1/2(B1+B2)*H*L)		=	7.41	CY/LF
Total linear footage of storage piles needed		=	50	LF
Assume pile length		=	50	ft.

Number of storage piles needed	=	1	
Space allowance around piles for equipment, etc.	=	25	ft
Needed storage area footprint	=	1550	SF
Proposed dimensions	=	75	ft L
	=	80	ft W
Overs from screening Assume stored in trapezoidal piles outdoors			
Screen overs in recipe daily (on average)	=	16	CY/day
Assume a storage period prior to use	=	7	days
Storage volume needed for screen overs	=	120	CY
	=	3,240	CF
Assume maximum storage pile height	=	10	ft
Assume pile base width	=	30	ft
Volume per linear foot (trapezoidal - V=1/2(B1+B2)*H*L)	=	7.41	CY/LF
Total linear footage of storage piles needed	=	20	LF
Assume pile length	=	20	ft.
Number of storage piles needed	=	1	
Space allowance around piles for equipment, etc.	=	25	ft
Needed storage area footprint	=	650	SF
Proposed dimensions	=	30	ft L
	=	25	ft W
Feedstock Mixing			
Assume all feedstock mixing done by mechanical mixer			
Assumed mixer dimensions: 20.4' L x 9.2' W			
Allow 20' on long axis sides for tractor/equip access			
Assumed dimensions	=	30	ft. W
	=	22	ft. L
Total Feedstock Mixing Area	=	660	SF
Active Composting			
Composting residence time	=	28	days/cycle
ASP sizing	=	4.0	weeks/cycle
a. Total volume each cycle	=	3,059.0	CY
b. Assume ASP height (w/o 6" compost cap)	=	8.0	ft. H
c. Assume ASP width	=	21	ft. W
d. Assume maximum ASP length	=	36	ft. L



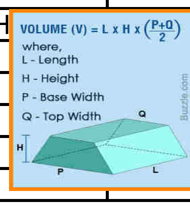
V = (36' x 18' x 8') + (0.5' x 18' x 36') =	=	6426	ft3
	=	238	CY
e. ASP Volume	=	238	CY
f. No. of days to fill one bunker	=	2	
Number of ASP bunkers needed	=	13	

Assume two rows of 7 bunkers each separated by 50' wide access aisle
and 20' wide utility aisle behind each row



Width = (7 ASPs x 21' / ASP) + (8 walls x 2' each)	=	163	ft
Length = (2 rows x 36' / ASP) + (1 aisle x 50' ea) + (2 utility x 20' ea)	=	162	ft
Composting Area Dimensions =	=	150	ft W
		175	ft L
Composting Aeration System			
Volume of each pile	=	238	CY/bunker
Assumed bulk density of each pile	=	900	lbs/CY
Wet tonnage in each pile	=	107.1	wet tons
Assumed pile moisture content at beginning	=	62	%
Dry tonnage in each pile	=	66.4	dry tons
Aeration rate	=	600	CFH / dry ton
Aeration needed for each pile	=	39,841	CFH
Fan Air Flow needed	=	664	CFM
Assume one blower for each ASP bunker			
Maximum Air Flow @ 6" W.C.	=	600	CFM
Curing System			
Assume curing is windrows turned with front end loader			
Assume 30% volume shrink during composting			
Total volume of material in piles during 60-day curing period	=	4,588	CY
Assume high parabolic windrow shape (NRAES-114, p. 13)			
Volume per linear foot of windrow:			
A = 0.667 x (b) x (h), where h = height, b = width at base			
Height of loader reach without driving up on pile	=	9	ft
Base of parabolic pile	=	18	ft
Cross-sectional area per linear foot	=	108	SF
Volume per linear foot	=	4.0	CY/ LF
Linear footage of new windrows weekly			
Avg. weekly volume from composting / volume per linear foo	=	115	LF / week
Total linear footage of material in windrows	=	1,147	LF
Assume each windrow holds 3 ASP bunker volumes			
204 CY/bunker x 30% shrink			
Volume of material in each windrow	=	500	CY
Number of windrows in curing	=	9	windrows
Assume each windrow is 225' long		225	ft
Assume 20' spacing between windrows and 15' at each end (turning radii + pile displacement)			
Each windrow is			
Length 225 ft + 15 ft + 15 ft	=	255	ft
Width 18 ft + 20 ft	=	38	ft
Area of each windrow (gross)	=	9,690	SF
Area of all windrows (gross)	=	88,960	SF
Assume curing area length is equal to gross windrow length	=	255	ft. L
Curing area width is	=	349	ft W
Curing area =		225	ft. W
		425	ft. L

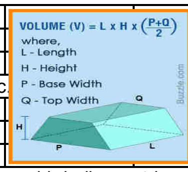
Screening & Product Storage Sizing and Layout Calculations			
Assume use of trommel screener with 3/8" screen			
Assume approximately 80%/20% fines/overs split			
Plan on four months finished compost storage			
Daily volume going to screening	=	69	CY/day
Daily volume going to storage	=	55	CY/day
Daily volume of overs recycled as bulking agent	=	14	CY/day
Screen size — Length		24.5	ft
Width		6	ft
Allow 25 ft all sides for equipment movement			
Screening Area =		60	ft. W
		75	ft. L
Total Volume in Storage Pile			
Daily volume x 6 days/week operation x 4 months capacity		5,286	CY
	=	142,720	CF
Assume maximum storage pile height	=	10	ft
Assume pile base width	=	30	ft
Volume per linear foot (trapezoidal - V=1/2(B1+B2)*H	=	7.41	CY/LF



Total linear footage of storage piles needed		720	LF
Assume pile length		200	ft.
Number of storage piles needed	=	4	
Space allowance between piles for equipment, etc.	=	25	ft
Needed storage area footprint	=	21750	SF
Assume open storage pile with 30' access in front for equipment/trucks			
Width (depth) of storage area	=	120	ft
Length of storage pile	=	181	ft
Product Storage Area =		120	ft. W
		200	ft. L
Retail Sales Area			
Assume 90% of production goes out in transfer trailers, 10% is small truck retail sales			
Truck loading area:			
Dump trailer dimensions with 30' on either side for loading:	=	68.5	ft W
		53	ft L
Retail sales:			
Pick up truck dimensions with 30' on either side for loading:	=	64	ft W
		20	ft L
Area needed	=	4911	SF
Add another 25% for vehicle queuing	=	1228	SF
Total		6138	SF
Dimensions:	=	80	ft. W
	=	80	ft. L

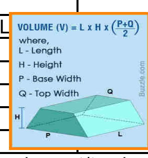
Area Summary	Width (ft.)	Length (ft.)	Area (sq. ft.)	Area (acres)
Feedstock Receipt	40	40	1,600	0.04
Feedstocks Storage				
Food wastes	20	20	400	0.01
OCC	20	20	400	0.01
Leaves	80	250	19,900	0.46
Wood chips	80	105	8,400	0.19
Yard waste	75	80	6,000	0.14
Overs from screen	25	30	750	0.02
Composting Pad	150	175	26,250	0.60
Curing Pad	225	425	95,625	2.20
Screening Area	60	75	4,500	0.10
Product Storage Area	120	200	24,000	0.55
Retail Sales Area	80	80	6,400	0.15
			194,225	4.46
Allowance for equipment storage, movement, etc. @ 25%			242,781	5.57

MV Food Waste Composting - rotary drum composting								
Assumptions:								
1. Facility is open 6 days/week (312 days/year)								
2. Facility will use rotary drum for active composting, turned windrow curing (turned with loader)								
Waste Volumes (in cubic yards)								
						Average Daily Volume		
I/C/I food wastes							16.0	CY/day
Residential food wastes							25.6	
Leaves							15.6	
Sawdusts							0.4	
Wood chips							18.3	
MVRD yard wastes							11.5	
OCC							11.4	
Compost recycle							6.7	
Overs from screen							15.9	
	Totals						121.4	CY/day
Composting Materials Flows								
Residence times for rotary drum composting (wintertime conditions)								
			Composting		Curing		Total	
	Rotary Drum		5	days	90	days	95	days
Daily Volumes going to composting								
		Daily volumes of mixed feedstocks =					121.4	CY/day
Volume of material in Primary Composting								
			Residence Days	Mixed feedstocks				
	Windrow		5	607	CY			
Daily Volumes going to curing (assume 30% volume shrink in composting)								
		Daily volumes of composted feedstocks =					85.0	CY/day
Volume of material in Curing:								
			Residence Days	Composted Feedstocks				
	Windrow		90	7,647	CY			
Daily Volumes going to screening (assume 10% volume shrink in curing):								
		Daily volumes of cured feedstocks =					76.5	CY/day
Screening	a. Assume approx. 80% finished compost capture rate and 20% going to overs							
	b. Finished compost production (daily):							
		Daily volumes of screened compost =					61.2	CY/day
	c. Daily volumes of overs =						15.3	CY/day
	d. Finished compost production (annually, based on 312-day year)							
		Annual volume of screened compost =					19,088	CY/year
Feedstocks Receipt								
Assume landscape/carbon delivery once/week (except leaves)								
Assume food wastes delivery daily								
Size receipts area for 2.0x average daily volume						=	242.8	CY/day
to allow equipment to move feedstocks into storage						=	6,555	CF/day
Assumed pile height						=	6	ft
Pile footprint						=	1092	SF
Plus equipment access/movement						=	546	SF
Receipt area needed						=	1639	SF
Proposed dimensions						=	40	ft. W
							40	ft. L
Feedstocks Storage								
Assume storage of food wastes, paper & OCC in rectangular concrete block bunkers, rest in open piles								
Food Wastes								
Food wastes in recipe daily						=	42	CY
Assume a maximum storage period prior to use						=	2	days
Storage volume needed for food wastes						=	90	CY
						=	2,430	CF
Assume bunker depth						=	4	ft
Bunker footprint						=	608	SF
Proposed dimensions						=	20	ft W
						=	30	ft L
OCC								
OCC in recipe daily (on average)						=	11.4	CY
Assume a storage capacity						=	7	days
Storage volume needed for paper/OCC						=	80	CY
						=	2,160	CF
Assume bunker depth						=	6	ft
Bunker footprint						=	360	SF
Proposed dimensions						=	20	ft W
						=	20	ft L
Leaves		Assume stored in trapezoidal piles outdoors						
Annual volumes of leaves to be handled						=	4,868	CY/yr
		Assume all come in Nov - Jan.				=	131,436	CF
Assume maximum storage pile height						=	10	ft
Assume pile base width						=	30	ft
Volume per linear foot (trapezoidal - V=1/2(B1+B2)*H*L)						=	7.41	CY/LF



Total linear footage of storage piles needed		=	660	LF
Assume pile length		=	200	ft.
Number of storage piles needed		=	3	
Space allowance around piles for equipment, etc.		=	25	ft
Needed storage area footprint		=	19900	SF
Proposed dimensions		=	250	ft L
		=	80	ft W
Wood chips	Assume stored in trapezoidal piles outdoors			
Wood chips in recipe daily (on average)		=	18	CY/day
Assume a storage period prior to use		=	30	days
Storage volume needed for wood chips		=	550	CY
		=	14,850	CF
Assume maximum storage pile height		=	10	ft
Assume pile base width		=	30	ft
Volume per linear foot (trapezoidal - V=1/2(B1+B2)*H*L)		=	7.41	CY/LF
Total linear footage of storage piles needed		=	80	LF
Assume pile length		=	80	ft.
Number of storage piles needed		=	1	
Space allowance around piles for equipment, etc.		=	25	ft
Needed storage area footprint		=	2450	SF
Proposed dimensions		=	105	ft L
		=	80	ft W
Yard waste	Assume stored in trapezoidal piles outdoors			
Yard waste in recipe daily (on average)		=	11	CY/day
Assume a storage period prior to use		=	30	days
Storage volume needed for yard waste		=	350	CY
		=	9,450	CF
Assume maximum storage pile height		=	10	ft
Assume pile base width		=	30	ft
Volume per linear foot (trapezoidal - V=1/2(B1+B2)*H*L)		=	7.41	CY/LF
Total linear footage of storage piles needed		=	50	LF
Assume pile length		=	50	ft.
Number of storage piles needed		=	1	
Space allowance around piles for equipment, etc.		=	25	ft
Needed storage area footprint		=	1550	SF
Proposed dimensions		=	75	ft L
		=	80	ft W
Overs from screening	Assume stored in trapezoidal piles outdoors			
Screen overs in recipe daily (on average)		=	16	CY/day
Assume a storage period prior to use		=	7	days
Storage volume needed for screen overs		=	120	CY
		=	3,240	CF
Assume maximum storage pile height		=	10	ft
Assume pile base width		=	30	ft
Volume per linear foot (trapezoidal - V=1/2(B1+B2)*H*L)		=	7.41	CY/LF
Total linear footage of storage piles needed		=	20	LF
Assume pile length		=	20	ft.
Number of storage piles needed		=	1	
Space allowance around piles for equipment, etc.		=	25	ft
Needed storage area footprint		=	650	SF
Proposed dimensions		=	25	ft L
		=	30	ft W
Feedstock Mixing				
Assume all feedstock mixing done by windrow turner on pad				
Active Composting				
Assumed dimensions of rotary drum		=	12	ft diameter
		=	165	ft long
Volume of drum at 60% full (V= π x r^2 x L)		=	44,787	CF
		=	1,659	CY
Assumed residence time in drum		=	5	days
Total volume to be composted during residence time		=	607	CY
Number of drums needed		=	3	
Dimensions of drum		=	12	ft. W
		=	165	ft. L
Mixing building (per Hall's layout)	50' x 35'			
Discharge building (per layout)	35' x 40'			
Biofilter (per layout)	35' x 110'			
	Composting Area =		100	ft. W
			240	ft. L
Curing				
Assume curing in loader-turned windrows				
Windrow dimensions:		=	8	ft H
		=	16	ft W
Assume high parabolic windrows (NRAES-114, p. 11): A= 2/3 x b x h				
Cross-sectional area of windrow		=	85	SF
Volume per linear foot of windrow		=	3.2	CY/LF
Assume 30% volume shrink during composting				
	Avg. daily volume to composting	=	121	CY/day
	Avg. daily volume to curing	=	85	CY/day

Average linear footage of new curing piles daily			
Avg. daily volume from composting / volume per linear foot	=	27	LF / day
Total volume of material in windrows during 90-day curing period	=	7,647	CY
Total linear footage of material in windrows	=	2,418	LF
Total area occupied by windrows	=	38,696	SF
Assume each curing windrow holds 6 days (1 built/week)			
6 days x 88 CY/day coming in	=	510	CY
Number of windrows in curing	=	15	windrows
Length of each windrow	=	161	ft
Assume 20' spacing between windrows and 20' working space at each end			
Each windrow is			
Length 167 ft + 20 ft + 20 ft	=	201	ft
Width 16 ft + 20 ft	=	36	ft
Area of each windrow (gross)	=	7,244	SF
Area of all windrows (gross)	=	108,666	SF
Assume pad length is equal to gross windrow length	=	201	ft
Pad width is	=	540	ft
<u>Curing Pad =</u>		550	ft. W
		210	ft. L
Screening & Product Storage Sizing and Layout Calculations			
Assume use of trommel screener with 3/8" screen			
Assume approximately 80%/20% fines/overs split			
Plan on four months finished compost storage			
Daily volume going to screening	=	76	CY/day
Daily volume going to storage	=	61	CY/day
Daily volume of overs recycled as bulking agent	=	15	CY/day
Screen size	Length	24.5	ft
	Width	6	ft
Allow 25 ft all sides for equipment movement			
<u>Screening Area =</u>		60	ft. W
		75	ft. L
Total Volume in Storage Pile			
Daily volume x 6 days/week operation x 4 months capacity		5,873	CY
	=	158,578	CF
Assume maximum storage pile height	=	10	ft
Assume pile base width	=	30	ft
Volume per linear foot (trapezoidal - V=1/2(B1+B2)*H*L	=	7.41	CY/LF



Total linear footage of storage piles needed		800	LF
Assume pile length		200	ft.
Number of storage piles needed	=	4	
Space allowance around piles for equipment, etc.	=	25	ft
Needed storage area footprint	=	24150	SF
Assume open storage pile with 30' access in front for equipment/trucks			
Width (depth) of storage area	=	120	ft
Length of storage pile	=	201	ft
<u>Product Storage Area =</u>		120	ft. W
		240	ft. L
Retail Sales Area			
Assume 90% of production goes out in transfer trailers, 10% is small truck retail sales			
Truck loading area:			
Dump trailer dimensions with 30' on either side for loading:	=	68.5	ft W
		53	ft L
Retail sales:			
Pick up truck dimensions with 30' on either side for loading:	=	64	ft W
		20	ft L
Area needed	=	4911	SF
Add another 25% for vehicle queuing	=	1228	SF
	Total	6138	SF
Dimensions:	=	80	ft. W
	=	80	ft. L

Area Summary	<u>Width</u> (ft.)	<u>Length</u> (ft.)		<u>Area</u> (sq. ft.)	<u>Area</u> (acres)
Feedstock Receipt	40	40		1,600	0.04
Feedstocks Storage					
Food wastes	20	20		400	0.01
OCC	20	20		400	0.01
Leaves	80	250		19,900	0.46
Wood chips	80	105		8,400	0.19
Yard waste	75	80		6,000	0.14
Overs from screen	30	25		750	0.02
Composting Pad	100	240		24,000	0.55
Curing Pad	550	210		115,500	2.65
Screening Area	60	75		4,500	0.10
Product Storage Area	120	240		28,800	0.66
Retail Sales Area	80	80		<u>6,400</u>	<u>0.15</u>
				216,650	4.97
Allowance for equipment storage, movement, etc. @ 25%			Totals	270,813	6.22

Appendix C - Aerated Static Pile information from AgriLabs & Engineered Compost Systems

agrilab TECHNOLOGIES
Compost Powered Heat

802 933 8336 | info@AgrilabTech.com | www.AgrilabTech.com
1662 Pumpkin Village Road, Enosburg Falls, VT 05450.

The Compost Hot Box 250R™

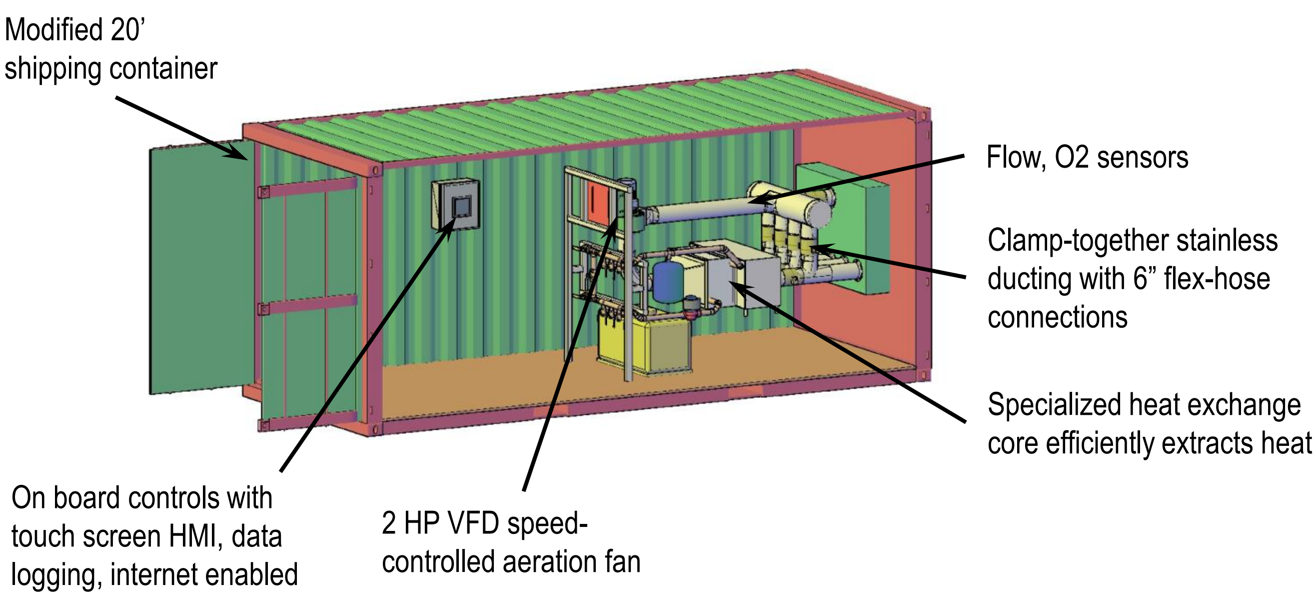
The Compost Hot Box 250R™ is a mobile plug and play compost aeration and heat recovery system with recirculation capability, featuring Agrilab Inside™ technology designed for negatively aerated or enclosed composting systems on medium to large scale farms and commercial/municipal compost operations.

Aerated Static Pile processing means minimal mechanical tumbling of material is required to aerate and break down the material into stable compost.

It includes remote data monitoring, computerized controls, hot water, and condensate recirculation systems. Aeration exhaust can be automatically vented back into the compost for moisture and heat retention, or directly into a bio-filter for odor control. Everything is assembled in a standard 20ft intermodal cargo container for easy setup alongside existing structures or other enclosures. Data captured is used to optimize compost production efficiency and quality. System documents temperature and oxygen level tracking to meet Process for Further Reduction of Pathogens (PFRP) quality standards, and maximize renewable thermal energy captured.

Annual Maximum Compost Volume Processing Capacity: 700 CY/month or 8,400 CY/year

Annual Maximum Energy ROI when heating water to 120F based on $15 per million Btu energy prices: $30,000+



What is Agrilab Inside™?

- The patented Agrilab Inside™ process takes aerated compost systems to the most advanced level with the ability to modulate air flow rates relative to oxygen and temperature levels, capturing useful heat and moisture, and recirculating compost vapor or fresh air into the compost to optimize heat and moisture levels.
- Renewable thermal energy captured as moist hot compost vapor is run through specialized heat exchangers where water is heated and condensate water is reclaimed. Aeration exhaust can be automatically sent back into the compost for moisture and energy optimization. Cooled aeration vapor can be vented directly into a bio-filter for odor control.
- This process is the first and most advanced compost heat recovery system available and saves time and money compared to turned windrow composting. Agrilab Inside™ optimizes the overall composting process and enables effective bio-filter odor control, fast compost production and predictable heat and water recovery.

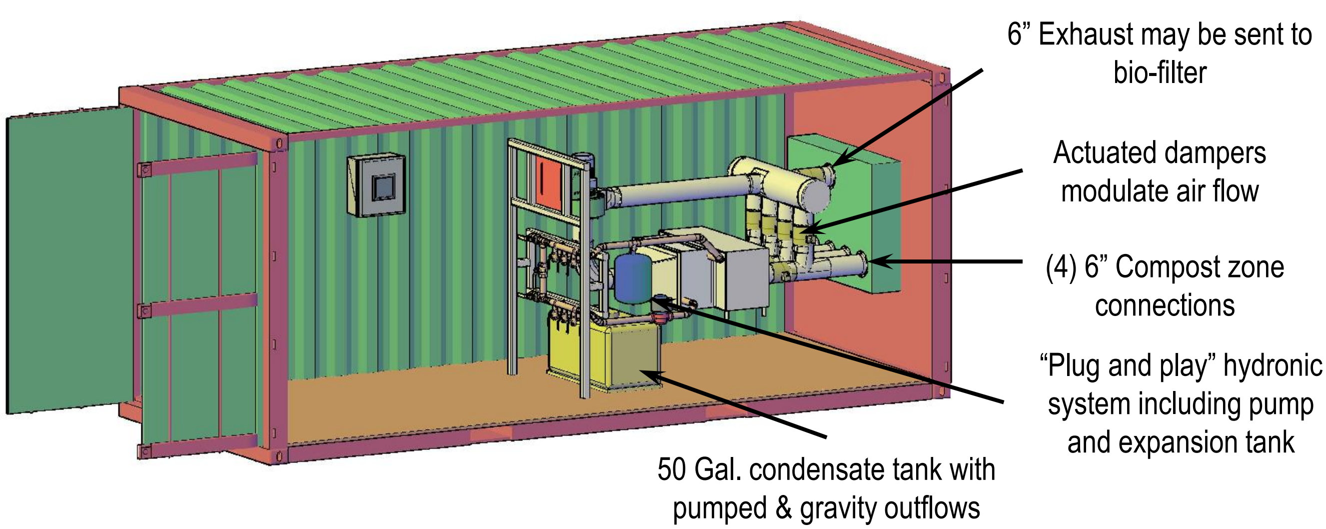
agrilab TECHNOLOGIES
Compost Powered Heat

802 933 8336 | info@AgrilabTech.com | www.AgrilabTech.com
1662 Pumpkin Village Road, Enosburg Falls, VT 05450.

Compost Hot Box 250R™

The Compost Hot Box 250R™ is an integrated, plug and play system that contains the core mechanical and control equipment for aerated composting with heat recovery - the "brains, lungs and heart" of the system. The Hot Box 250R™ is designed for aeration flow of 100 to 350 cubic feet per minute, with 4 compost batch zones and the ability to recirculate into any zone for additional heat recovery. All pumps, blowers and valves are controlled by an on board SCADA system with touch screen interface, data logging and remote monitoring software.

Specifications:	
Dimensions, Installation:	Customized metal shipping container; 8' wide by 20' long by 8' high, ~6,000 lbs. 6" hoses for compost aeration and exhaust connections.
Aeration:	3 Horsepower blower, speed controlled, 100 to 350 CFM range adjusted manually or with feedback controls. Four compost and exhaust zones with fresh air intake.
Recirculation:	Exhaust from any compost zone can be injected into another zone. This conserves heat and moisture, and can jump-start cold or frozen material.
Sample Heating Output:	**With 250 CFM of saturated 140F compost exhaust**: • 124,000 Btu heating loop: 9 GPM heated from 100F to 128 F • 160,000 Btu water pre-heating: 5 GPM heated from 55 to 120 F **With 350 CFM of saturated 140F compost exhaust**: • 151,000 Btu heating loop: 12 GPM heated from 100 to 125 F • 237,000 Btu water pre-heating: 8.75 GPM heated from 55 to 110 F
Monitoring:	Parameters can be used to optimize composting and heat recovery, linked to SCADA system: • Oxygen level of compost vapor • Temperatures at all critical points • Air and water flow rates
Control:	• Touch screen with web server for intuitive operator control • Full control and monitoring via internet. Remote support available by contract. • Expandable to control auxiliary systems (i.e. greenhouse climate control)
Delivery, Purchase or Lease:	Delivery/shipping to be paid for directly by buyer with logistics support from AGT. Purchase includes 8 hours of remote startup support during the first week of operation. Site preparation, Hot Box installation and on going technical support packages available under separate agreement. No $ down lease-to-own financing is available.



From: **Brian Jerose** brian@agrilabtech.com
Subject: Re: ASP for MV
Date: April 3, 2018 at 10:57 AM
To: Bob Spencer spencebbc@aol.com
Cc: ccoker@cokercompost.com, jason@agrilabtech.com, Jaime Tibbits jaime@agrilabtech.com

BJ

Hi Craig and Bob-

Here are some responses to your questions above.

At full build-out of 121 cy/day, assuming 600 cy/week inputs, 3 modular units would provide 3-4 weeks capacity. Depending on the bulk density and oxygen demand of the "standard recipe", each modular system could have 4 aeration bays of 150 cy each. Actual capacity could be up to 200 cy per bay but this provides some margin of safety. 3 modular systems would then have a total 12 aeration bays of 1800 cy aeration capacity (and up to 2400 cy with more porous/lower bulk density blends). Typical batches would have a 3 week aeration retention time before being moved to windrows for further composting and curing.

As the facility would likely take months or years to achieve full capacity, the modular systems could be built out in phases, spreading out capital costs for the operator.

Oxygen levels are targeted for 5-15% and are achieved through adjusting fan speed, and length of aeration cycle. On-board oxygen sensors provide the operator and remote support staff trending graphs to adjust settings to achieve desired oxygen and temperature levels.

We have primarily used NY Blowers and would expect a project of this scale to use 2 to 3hp fans. Actual sizing would depend both on targeted batch size and length (and diameter) of pipe runs.

Biofilter sizing matches the "neighbor sensitivity" of the site, but generally with typical operation of a system of this size having 3 bays under aeration at one time, in a rotating schedule, a biofilter would need roughly 500-600 cy of carbon-rich media to match the vapor/air handling on the incoming aeration side. A secondary booster fan can be evaluated based on predicted resistance. Leaving space to expand biofilter cells is recommended if observed odors exceed desired levels.

We do not typically specify number of air exchanges per hour as we recommend composting building have ample passive ventilation through exaggerated ridge vents in metal-sided pole barn structures or mesh gable end vents in coverall type buildings. We do not recommend insulated buildings for several reasons - initial cost and need to included active ventilation. We have seen systems in operation up to 12 years without moisture condensation and rusting issues on hardware, trusses and roofs using these passive ventilation approaches. With primarily negative aeration, less vapor is released into the building head space versus positive aeration. If active ventilation was absolutely necessary at a facility, we would consult with other building professionals. We see the primary benefits of enclosures to be stormwater management, and avoiding direct wind on windrows wicking away heat.

While I am unfamiliar with your proposed location and possible heating loads I can share applications of recovered compost thermal energy that have been implemented or considered. Product drying to reduce screening costs could likely justify the investment. A quick economic assessment can be completed for one or more of these energy off-takes:

Building heating - office, shop (radiant floor, baseboard or hydronic modine-style heaters)
Greenhouse heating - in floor or under-bench, or modine-style heaters for product testing or diversification of plant/crop sales
Wash water - food scrap totes, trucks and equipment
Product drying - used for drying down finished compost prior to screening (can significantly increase screening yields/hour) and bagging. Also applied to some feedstocks such a green (non-kiln dried) sawdust, short paper fiber or wood chips to increase absorbency.

Recovered thermal energy is also applied to the composting process via recirculated hot vapor to new batches of cold feedstocks or reheating overcooled compost batches. This capability also acts to accelerate decomposition rates, given it achieves reversing aeration, primarily negative but also positive.

We can add more detail to several of these responses as needed for this phase to rough in estimated costs. We would not complete detailed engineering calculations until engaged in a technical services agreement or other design contract.

Thanks again for the interest.I have a site visit this afternoon but can follow up on additional details as needed tomorrow. I've copied Jason and Jaime on our team in case they can also respond while I'm out of the office.

Thanks
Brian

On Thu, Mar 29, 2018 at 9:21 AM, Bob Spencer <spencebbc@aol.com> wrote:

> Craig:
>
> Brian should be able to address your questions by early next week.
>
> **Bob Spencer**
> **Environmental Planning Consultant**
> **15 Christine Court**

Vernon, Vermont 05354
978-479-1450

-----Original Message-----
From: Craig Coker <ccoker@cokercompost.com>
To: Robert Spencer <spencebbc@aol.com>
Cc: Brian Jerose <brian@agrilabtech.com>
Sent: Thu, Mar 29, 2018 8:43 am
Subject: Re: ASP for MV

Bob/Brian - enclosed is the recipe for MV; at build-out, it projects daily incoming compostables at 121 CY/day. Please modify your concept design below to reflect this incoming volume. What is the oxygen loading rate for your proposed aeration system, what blowers are you recommending, what size biofilter are you recommending, how many building air exchanges per hour are you recommending?

As there is no identified market for the recovered heat at this time, what would the cost be without heat recovery?

Craig

Craig Coker
Coker Composting & Consulting
www.cokercompost.com
ccoker@cokercompost.com
540.874.5168

On Mar 29, 2018, at 8:23 AM, Bob Spencer <spencebbc@aol.com> wrote:

Craig:

I met with Brian Jerose, President of Agrilab Technologies yesterday to discuss ASP/heat recovery for our MV project.

See current issue of BioCycle for my article on the Agrilab system at Vermont Natural Ag Products.

Based on the design at VNAP, Brian proposes the following modular ASP approach for MV:

- 3,000 sf asphalt pad
- Four 12' X 60' windrows with dual 8" diameter recessed HDPE aeration pipes, sloped for leachate drainage to retention pond
- Each windrow contains 200 cy, for a total of 800 cy on ASP
- 14 day retention time on ASP
- Hot Box heat exchanger and computer controls for heat capture and accelerated composting/product drying (spec sheet attached)
- 50' X 80' Coverall building
- biofilter

Estimated capital cost $200,000.

Agrilab would charge $6,000 - $10,000 for construction plans (no PE stamp), and provide construction oversight for $5,000.

Additional pad, ASP, Hot Box at $200,000 each.

Larger pads can be designed.

For MV, the Agrilab system qualifies for funding from the Massachusetts Clean Energy Center as renewable energy, and was recently awarded feasibility study funding, and construction funding at Dave Smith's Black Gold Compost facility which you designed with Andrew Carpenter.

> We can set up a time to talk with Brian on Friday this week. He's hosting an open house at a new installation in CT today (see attached).
>
> **Bob Spencer**
> **Environmental Planning Consultant**
> **15 Christine Court**
> **Vernon, Vermont 05354**
> **978-479-1450**
> <Compost-Hot-Box-250R-SpecSheet-March2017.pdf><Collins Powder Hill Dairy Farm-Compost Aeration and Heat Recovery Open House.pdf>

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Brian Jerose, President/Co-founder
Agrilab Technologies Inc.
(802) 933-8336 office
(802) 370-4774 mobile
brian@agrilabtech.com
www.agrilabtech.com
www.facebook.com/agrilabtech

ECS Multi-Use ASP Pilot System

ECS ASP pilot systems allow operators to run simultaneous batches with different control settings, aeration types (positive, negative, and reversing), retention times, pile geometries and configurations. The ECS Pilot System mechanical components and skid-mounted controls are pre-tested at our shop. They typically have 4 compost piles/zones each holding around 200 yd3. The zones can be configured as three sided bunkers, in a mass-bed or as individual piles. The pilot can also be placed within a fabric building with building air capture and scrubbing through a biofilter to best simulate an in-vessel facility. Each zone is individually and automatically monitored and controlled and can be run in a specific way to test a design hypothesis prior to investing in a major infrastructure project. The pilot system can include a controlled and monitored biofilter to scrub the air from piles when zones are in negative mode or when building air above the piles needs to be filtered.

ECS ASP Pilot Equipment Description

The ECS ASP Pilot System has two aeration fans; one to provide positively pressured air to the composting zones and one to provide negatively pressured air by drawing from each zone and exhausting to a biofilter. The speed of each fan is controlled by a variable frequency drive (VFD) located on the Control Skid which determines how much air is being provided to each compost pile. The Supply Fan (for positive aeration) and Exhaust fans are mounted on the Control Skid that is pre-wired to the VFDs.

The Control Skid houses most of the pre-mounted and pre-wired electronics of the pilot system. The skid requires a 480VAC, 3 phase power connection. The CompTroller™ Server has an industrial embedded computer, with UPS, that runs the pilot system and provides an operator interface webpage for managing the system. The Control Server requires access to the internet, and is provided with a wireless interface and antenna so that it can be connected to a wi-fi network provided by the site.

ECS Pilot Description

The four individual compost zones are approximately 21' wide by 57' long (see attached drawing 261-M01). Each zone or pile requires two 6" HDPE aeration sparger pipes that are approximately 60' long. ECS supplied sparger pipes include specially reinforced ends with pull cables so they can be removed with a FEL prior to breaking the pile down. In addition to the zone sparger pipes, the pilot system uses pipe on grade sparger pipes for the 30' x 40' odor scrubbing biofilter.

The negative aeration plenum (suction), and the biofilter plenum, are made of 304 stainless-steel since it handles wet corrosive compost exhaust air. The exhaust fan is made of corrosion resistant aluminum for this same reason. The positive aeration plenum is made of standard galvanized steel duct since it handles ambient air. Both plenums are connected to the zone spargers via motorized dampers. The CompTroller™ system controls the motorized dampers to automatically match the air flow to the ever-changing process conditions, and can alternate between positive and negative aeration modes without operator input.

<u>ECS Supplied Equipment & Services</u>

A. Aeration System

1. Supply and Exhaust Fans
2. Zones to Fan Ductwork (Plenums, branches, transitions)
3. Duct Supports
4. Motorized Zone Dampers
5. Cooling Air Inlet Damper for Biofilter Exhaust
6. Fan to Biofilter Ductwork

B. (Optional) Pipe-on-Grade Aeration System

1. HDPE Zone Sparger Pipes
2. HDPE Biofilter Sparger Pipes

C. Control System

1. CompTroller™ Software
2. Control Server
3. Zone Controller in J-Box (1 per zone)
4. Aeration Panel
5. Compost Temp Probes
6. Ambient Temp Probe
7. Pressure Sensor

D. Technical Services included with the Pilot:

1. Pre-project on-site planning meeting
2. Process, mechanical and electrical drawings
   (ECS drawings do not carry local engineering stamps)
3. Technical support of construction and installation of ECS provided equipment
4. Operations and maintenance manual for ECS provided equipment
5. System start-up and training for site personnel
6. Remote technical support (ongoing during rental period)

E. Technical Services NOT included with the Pilot and available on a Time and Expenses Basis

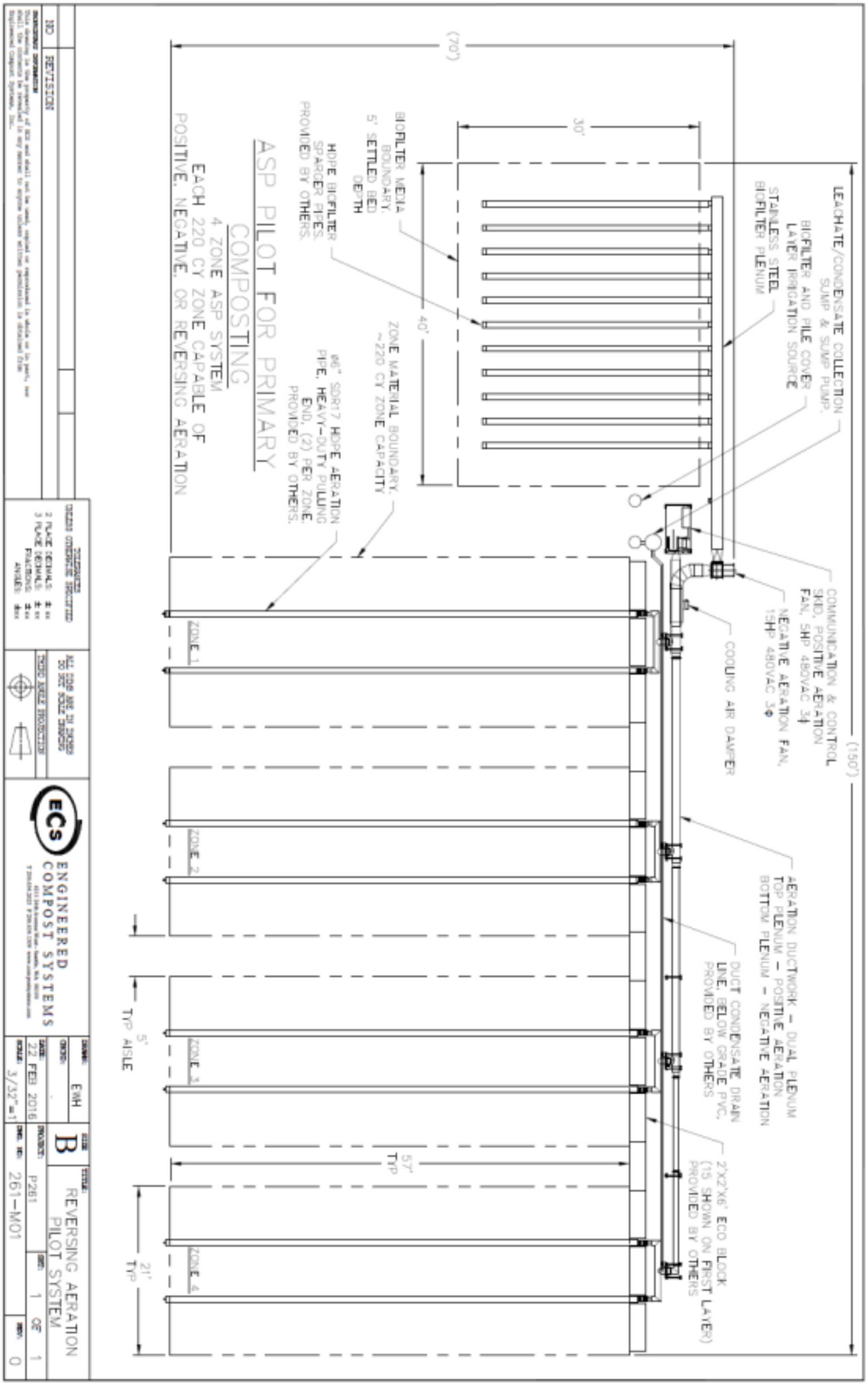
1. Pilot trial planning
2. Data collection planning
3. Data collection
    a. Odor concentration and flux rate
    b. Stability
    c. Oxygen
    d. pH
4. Odor dispersion modelling
5. Data analysis and report writing

Equipment & Services NOT Included and Supplied by Others:

1. Site permits, stamped construction drawings if required.
2. Site preparation, construction, electrical power, electrical and mechanical installation and commodity parts
3. Ecology blocks for push walls
4. Compost leachate drain line, pumped sump, leachate/condensate tanks or other means of disposal
5. Pile and biofilter irrigation components (can be sourced and specified by ECS)
6. Biofilter media (can be sourced and specified by ECS)

ECS Pilot Description

System Layout Diagram



engineeredcompostsystems

Pilot System Rental or Purchase Quotation

For Craig Coker
Project Martha's Vineyard - Research ASP Pilot System
By Steve Diddy
Date 5/18/2018

Basis of Design: Four (4) zone pilot system. Each zone capable of Positive, Negative, or Reversing aeration. Compatible with in-floor aeration or pipe-on-grade aeration floor.

ECS Pilot System Design Data

Nominal Throughput	tpy	5,000 - 6,000
Total Number of Zones	#	4
Zone Length	ft	56
Zone Width	ft	21
Standard Initial Pile Depth	ft	8
Zone Capacity	cy	220
Standard Bio-cover Layer Depth	ft	1
Installed Fan Power	Hp	22.5
Nominal Biofilter Size	ft2	1,300

Rental Terms

Down Payment with order		$25,000
Monthly Rental Payment	month	$6,000
Minimum Rental Duration	months	9
Rental Months to Ownership	months	18

Purchase Terms - Optional

List Price	$155,000
Discount (some components used previously)	19%
Purchase Price (instead of rental)	$125,000

Pilot System Description

Includes: Installation drawings and technical support; Pre-Assembled aeration and control skid; CompTroller automated controls; Aeration system; Biofilter mechanical components; Start up; Operator training; O&M Manual; and Allowances for freight FOB site & ECS staff travel expenses.

Does not include: Permits, civil engineering, ECS equipment installation, construction, utilities, electrical connections, biofilter media, HDPE pipe on grade aeration with pulling ends and drilled holes, specialized transition pipes to use existing in-floor aeration; HDPE biofilter pipes with drilled holes, surface water & leachate storage and treatment, access roads and storage pads, lights, utilities, buildings, pre-processing design, taxes -- Post rental equipment cleaning, demobilization, crating and shipping back to Seattle.

Appendix D - Rotary Drum Layout and Quote

From: CITIC HIC Engineering & Technology CO., LTD.
206 JIANSHE ROAD, LUOYANG, CHINA
Phone: +86 0379 64087625
Fax: +86 0379 64086016
To: Mr. Pearse Okane
Subject: Quotation for supply of one 12×185 feet Digester
April. 11th, 2018

We are very happy to receive your enquiry for the digester; we hereby take great pleasure to quote one digester according to your requirement by email as follows:

1. Scope of supply of each digester:
Shell, two casting tyres, girth gear , pinion, supporting system, motor and gearbox .

2. Price of one digester:

Description	Price (USD)	Remarks
Design	120,000	
Equipment (FOB Shanghai)	1,579,000	
Total	1,699,000	

Remarks:
1) The quotation is based on the following materials.

Description	Material
Shell	ASTM A-36
Tyre	ZG42CrMo
Girth Gear	GS42CrMo
Pinion	34CrNiMoA
Pinion shaft	35CrMo
Supporting roller	42CrMo
Supporting roller shaft	35CrMo

2) Remarks for all above prices:
a. The price will be adjusted accordingly if the material is changed.
b. All prices above are subject to bulk cargo ship to be used. In case of container ship, the Client shall bear any extra charge arising from it.
c. The above prices are based on the exchange rate of USD/RMB=1/6.28.

3. Payment:

- 30% within 7 days of the date of the Contract (to be paid by the Client to the Supplier by telegraphic transfer).

-35% shall be paid within 10 days after receipt of all the shell plates for the digester by Supplier at its manufacturing facility and finishing the casting work of the tyre.

-35% shall be paid at ex-work before delivery

4. Delivery

240 consecutive calendar days after drawing confirmation.

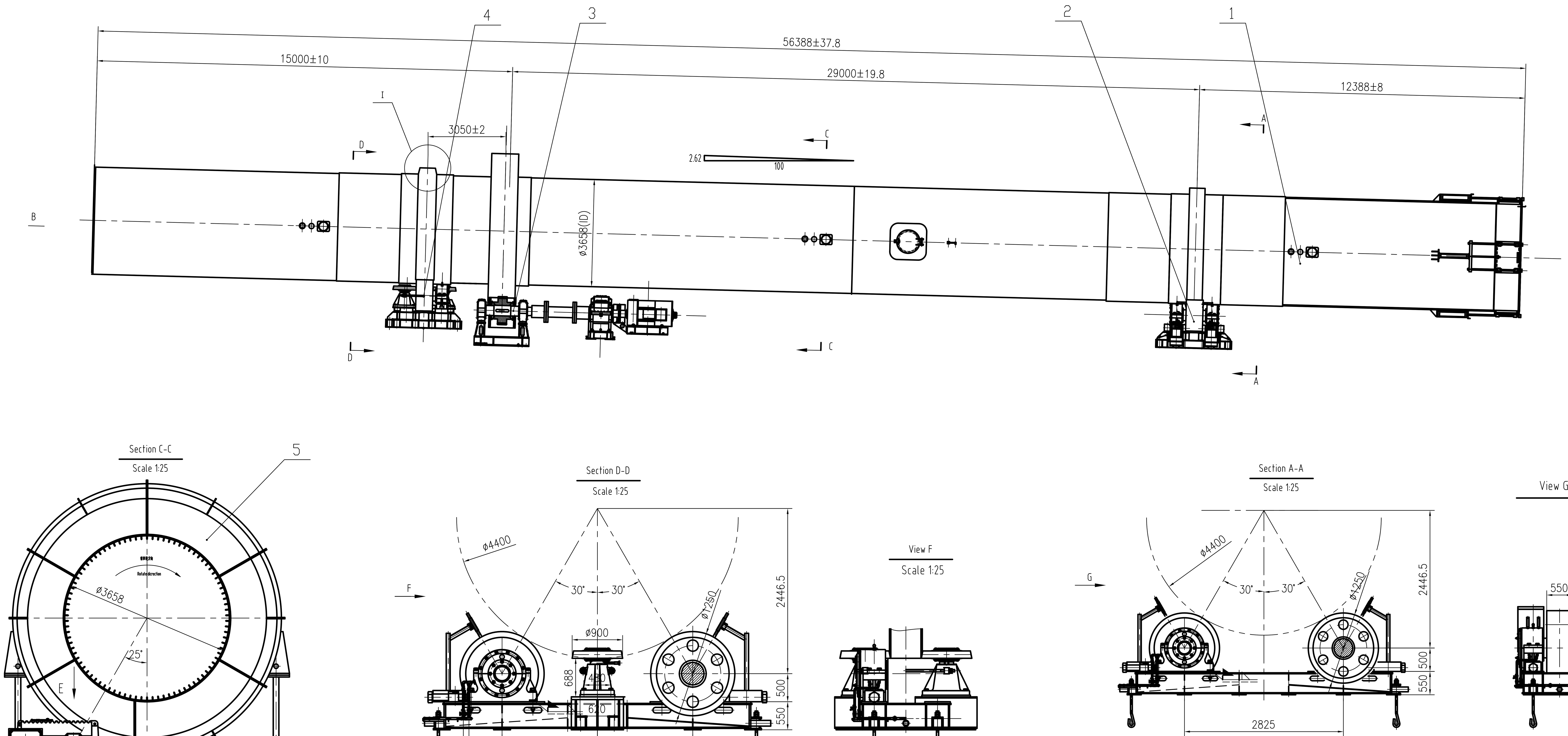
5. Warranty:

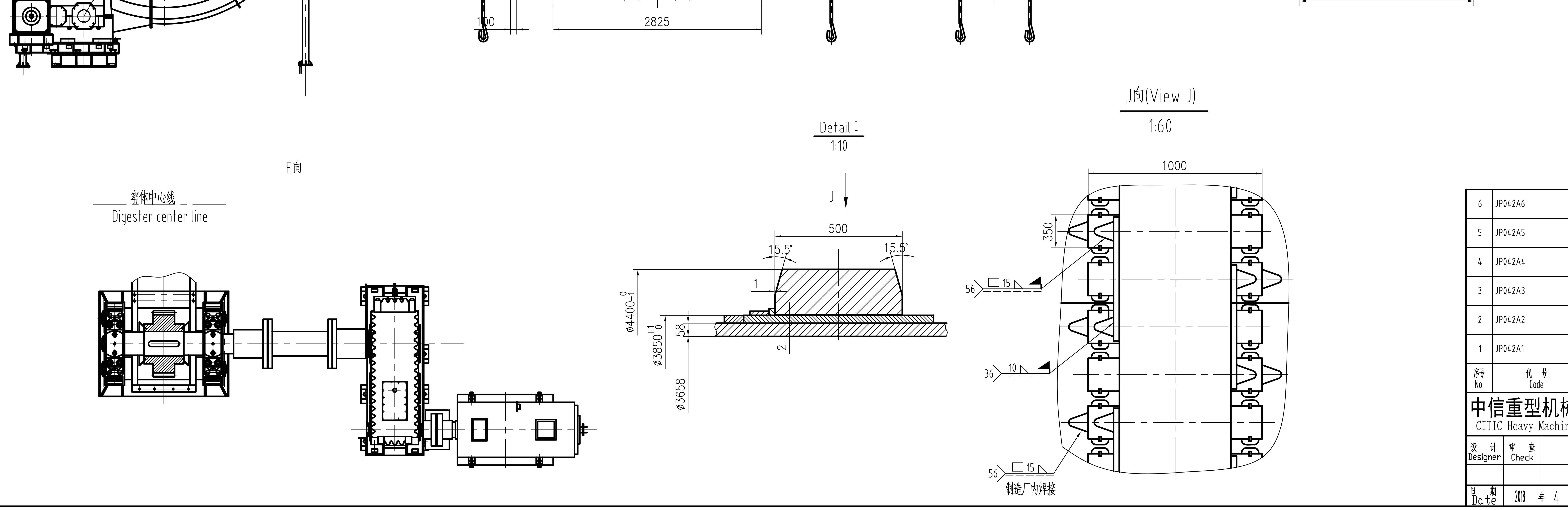
The warranty period for Products amounts to 18 months from FOB Shanghai shipping date or twelve (12) months from the date of commissioning, whichever comes first.

6. Validity

The above quotation is valid for 30 days from the date hereof.
If any question, please do not hesitate to contact us.

Best regards ,
Guo Tingting
CITIC HIC Engineering & Technology Co., Ltd



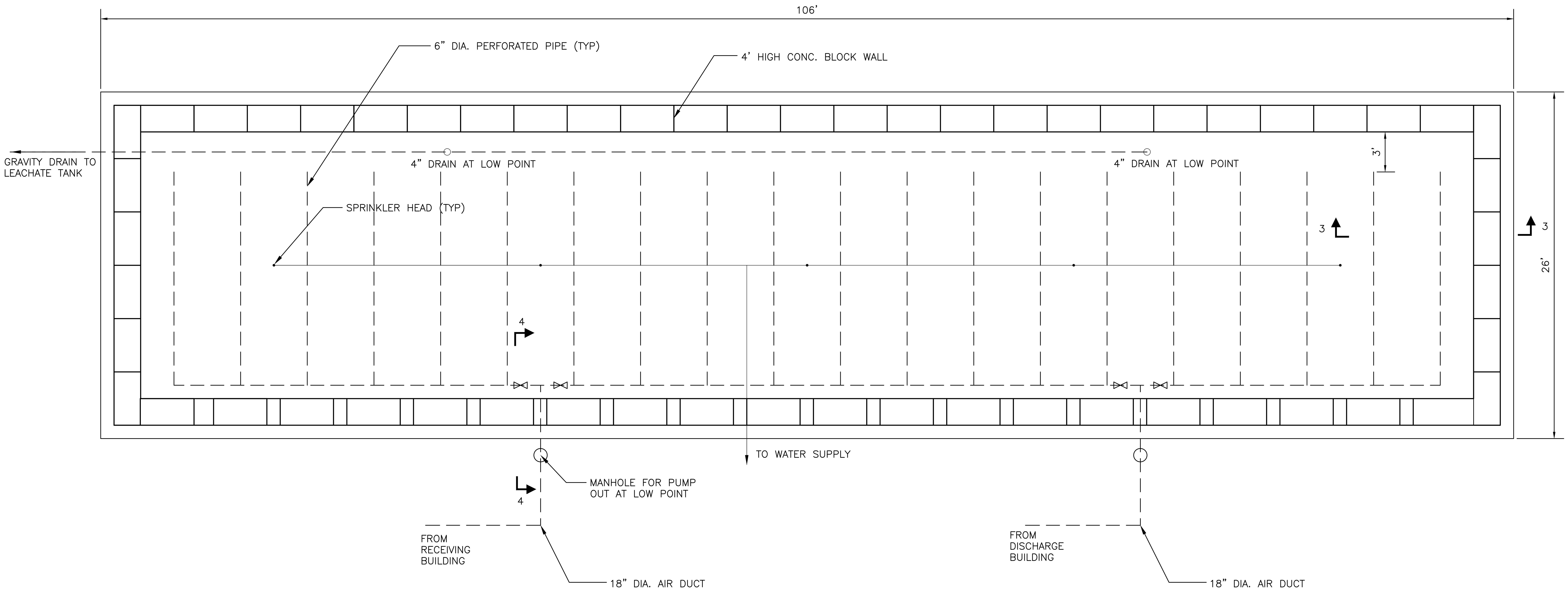


技术参数

规 格 Specification	直 径 Diameter	3.658m(12′)	长度 Length		56.388m(185′)	
斜 度 Inclination	2.62% (正弦Sine)		支承数 Support unit No.		2	
窑体转速 Rotate Speed	0.1~1r/min		筒体板厚 Thick of shell		22、38、58	
传动方式 Driving form	单传动 Single driving	开式齿轮传动 Exposed gear	模数 Modulus	28mm	速比 Ratio of speed	8.84
			齿数 Teeth no.	Z1=23	Z2=200	
电机 Motor	型号 Type	YPS315M3-6,132KW				
减速器 Reductor	型号 Type	JH710-112				

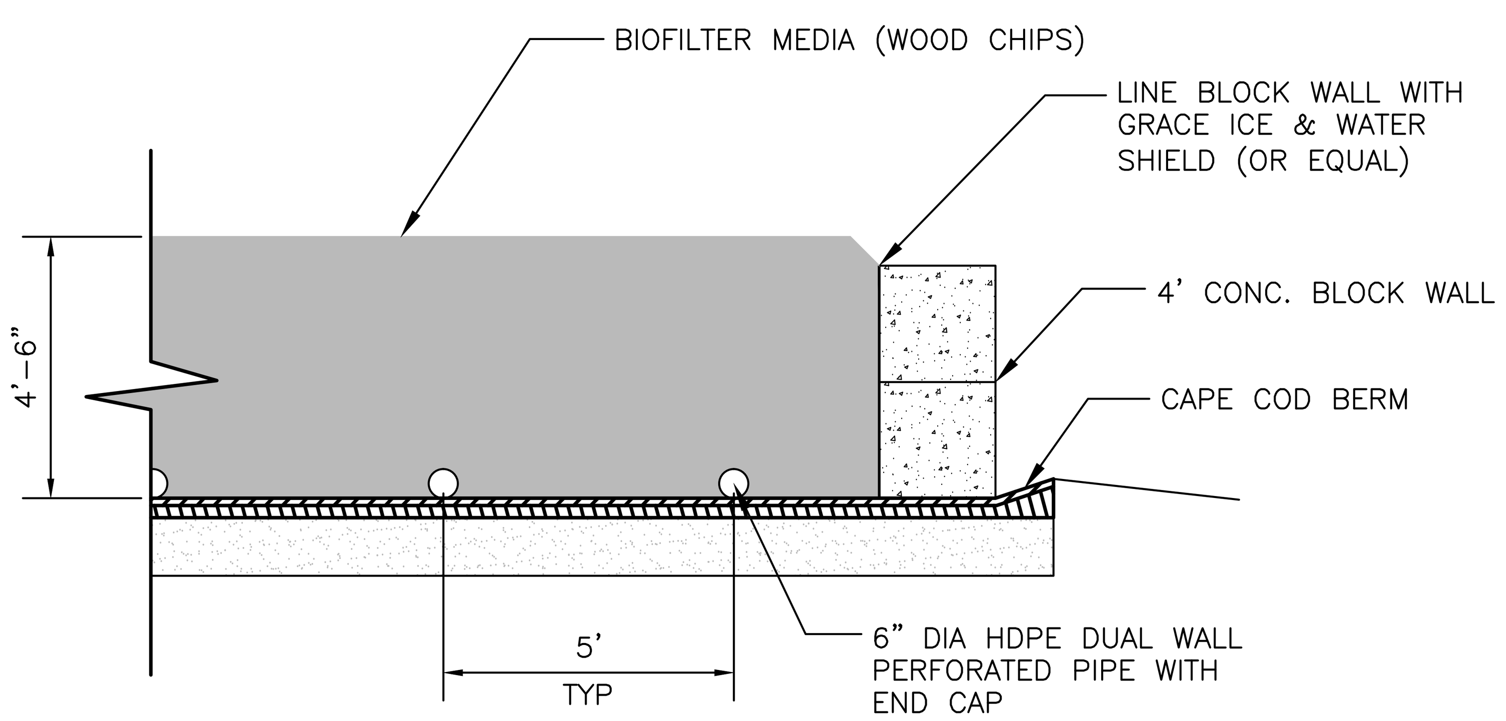
序号 No.	代号 Code	名称 Name	数量 Quantity	材料 Material	单重(Single) 重量 Weight (Kg)	总重(Total)	备注 Remark
6	JP042A6	安装工具 Install tool	1	部件 Part			
5	JP042A5	齿轮罩 Gear Rim Unit	1	部件 Part			
4	JP042A4	带挡轮支撑装置 Support roller with thrst roller device	1	部件 Part			
3	JP042A3	传动装置 Driving device	1	部件 Part			
2	JP042A2	支撑装置 Support roller device	1	部件 Part			
1	JP042A1	筒体装置 Shell assembly	1	部件 Part			

中信重型机械公司 CITIC Heavy Machinery Inc.	Φ3.658X56.388m 发酵筒 Φ3.658X56.388m Waste Digester	第几页 PageNo	1
		共几页 TotalPaper	1
设计 Designer / 审查 Check / 批准 Approve	总图 General drawing	重量（公斤）Weight(Kg): 0	比例 Scale: 1:85
日期 Date: 2018 年 4 月	总图 Part	JP042A	版本号 Version Number



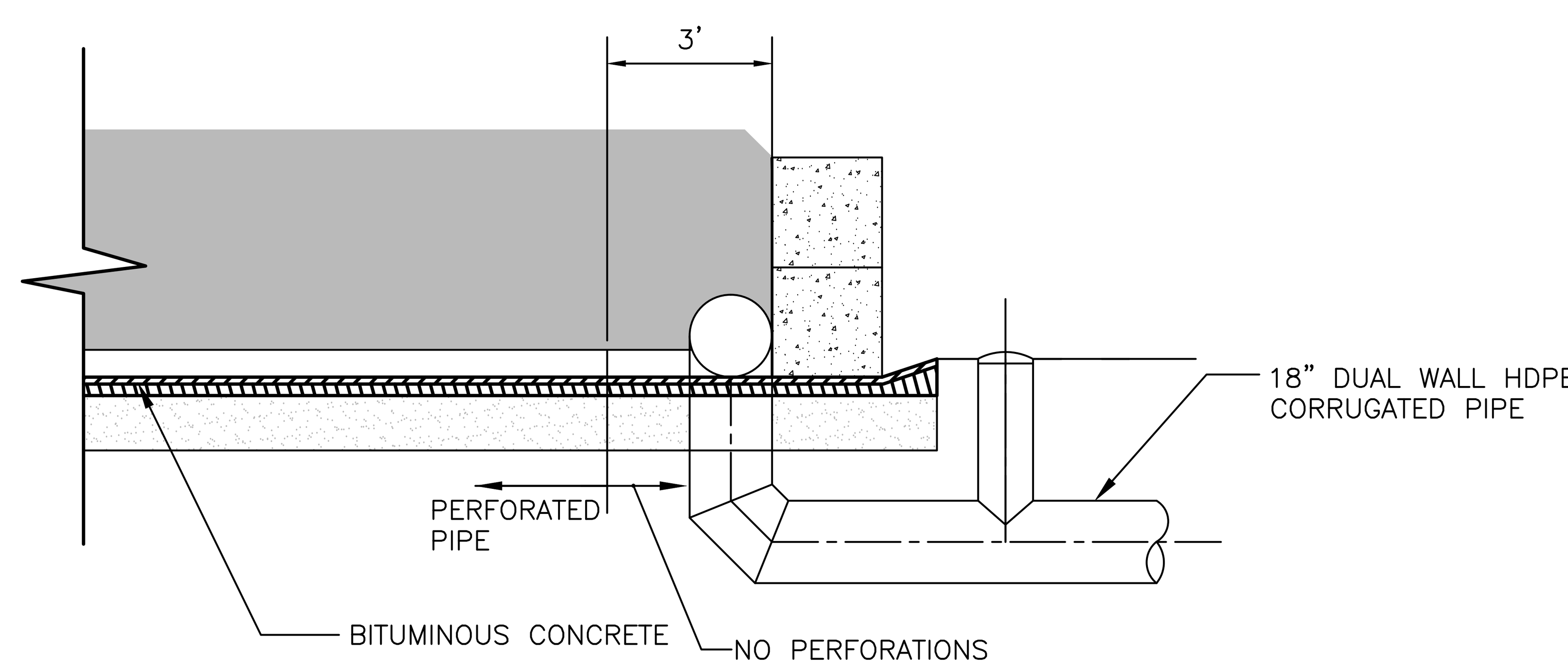
PLAN OF BIOFILTER

SCALE 1/4" = 1'-0"



SECTION 3-3

SCALE 3/8" = 1'-0"



SECTION 4-4

SCALE 3/8" = 1'-0"

0 4 8 12

SCALE 1/4" = 1' - 0"

REV	REVISION RECORD	DESIGN	CHK'D	APPV'D	DATE
A	CONCEPTUAL DESIGN				

STRUCTOR ENGINEERING, INC.
50 OLIVER STREET
NORTH EASTON, MASSACHUSETTS

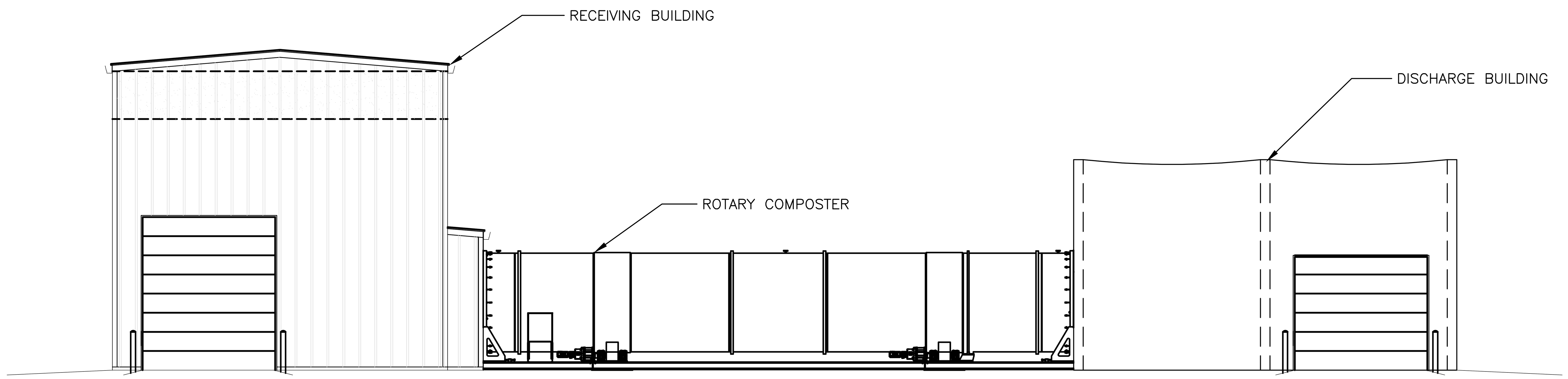
SEAL

PROJECT NO 029
SCALE AS NOTED
DRAWN BY W. HALL
CHECKED BY
APPROVED BY W. HALL
DATE MARCH 2017

CONCEPTUAL COMPOST FACILITY
MARTHA'S VINEYARD REFUSE DISTRICT

BIOFILTER-PLAN AND SECTIONS

DWG NO
A-3



EAST ELEVATION

0 8 16 24
SCALE 1/8" = 1' – 0"

REV	REVISION RECORD	DESIGN	CHK'D	APPV'D	DATE
A	CONCEPTUAL DESIGN				

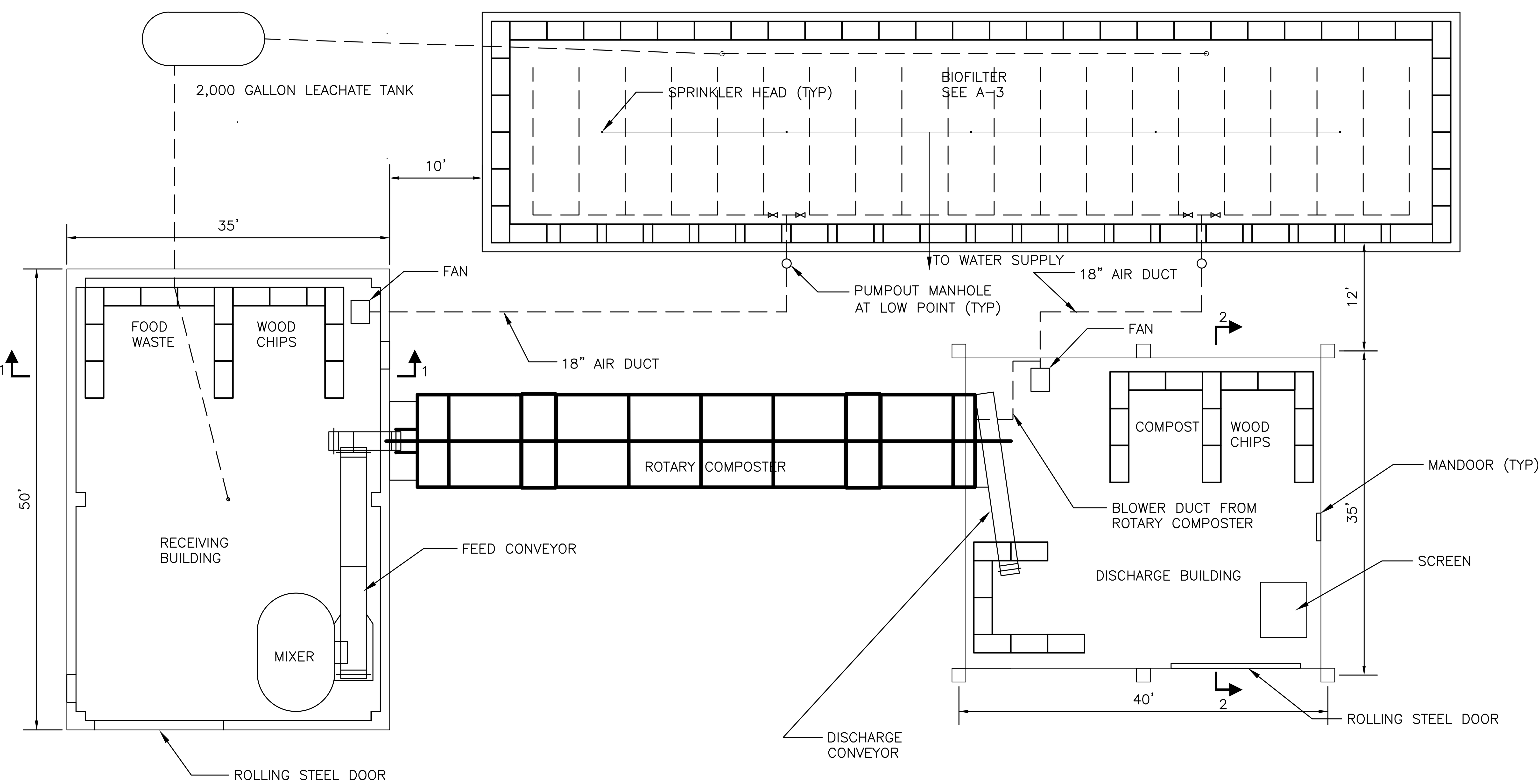
STRUCTOR ENGINEERING, INC.
50 OLIVER STREET
NORTH EASTON, MASSACHUSETTS

SEAL

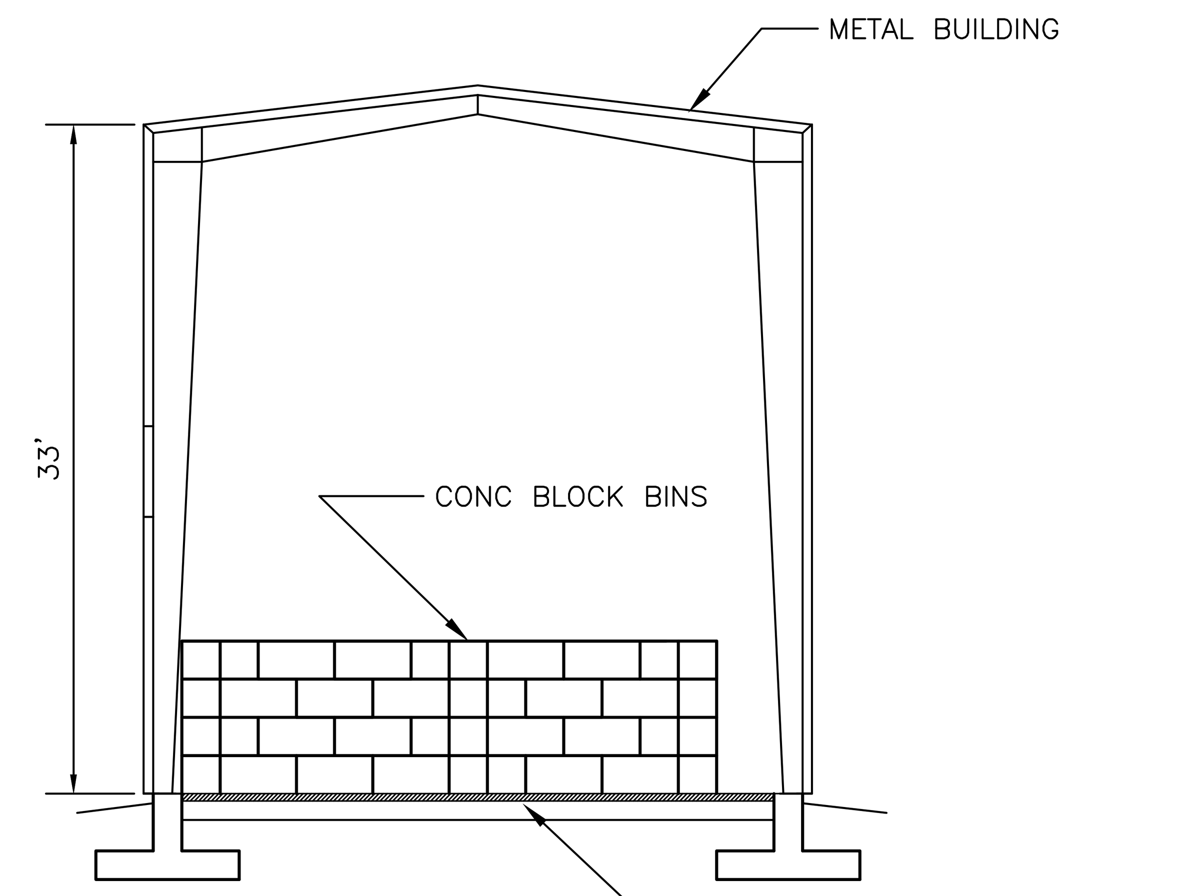
PROJECT NO 029
SCALE AS NOTED
DRAWN BY W. HALL
CHECKED BY
APPROVED BY W. HALL
DATE MARCH 2017

CONCEPTUAL COMPOST FACILITY
MARTHA'S VINEYARD REFUSE DISTRICT
BUILDING ELEVATION

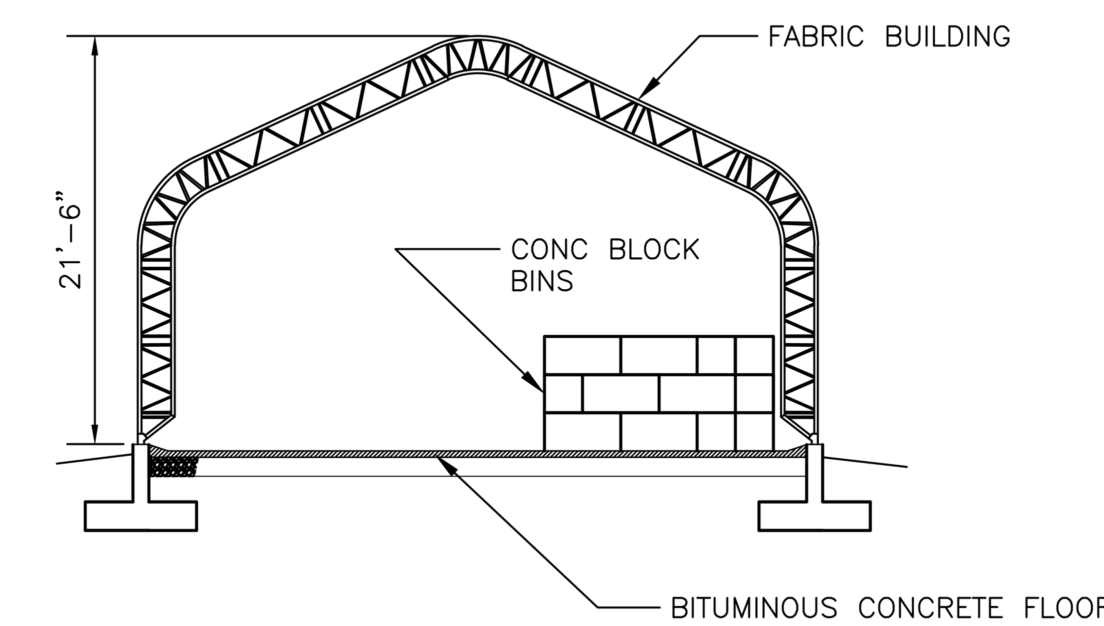
DWG NO
A–2



PLAN



SECTION 1–1



SECTION 2–2

0 8 16 24
SCALE 1/8" = 1' – 0"

REV	REVISION RECORD	DESIGN	CHK'D	APPV'D	DATE
A	CONCEPTUAL DESIGN				

STRUCTOR ENGINEERING, INC.
50 OLIVER STREET
NORTH EASTON, MASSACHUSETTS

SEAL

PROJECT NO 029
SCALE AS NOTED
DRAWN BY W. HALL
CHECKED BY
APPROVED BY W. HALL
DATE MARCH 2017

PROPOSED COMPOST FACILITY
MARTHA'S VINEYARD REFUSE DISTRICT
GENERAL ARRANGEMENT

DWG NO A–1

Appendix E - Cost estimates

			Straddle Turner		ASP		Rotary Drum		Animal Feed	
Martha's Vineyard Composting Facility										
Cost Estimates - Site Development										
Item	Unit Price	Units	Quantity	Costs	Quantity	Costs	Quantity	Costs	Quantity	Costs
Land acquisition										
Site purchase	$ 75,000	Ac	7	$525,000	5.6	$418,012	7	$525,000	0.5	$37,500
Permits and Approvals										
Local- zoning, S&EC, bldg permits		Ea	Allowance	$10,000	Allowance	$10,000	Allowance	$10,000	Allowance	$10,000
MADEP Permitting - solid waste compost		Ea	Allowance	$12,000	Allowance	$12,000	Allowance	$12,000	Allowance	$12,000
EPA Permitting - storm water		Ea	Allowance	$5,000	Allowance	$5,000	Allowance	$5,000	Allowance	$5,000
Clearing and Grading										
Assume no tree/stump clearing needed										
Fine grading of site for drainage	$ 2.00	SY	33,880	$67,760	26,976	$53,951	33,880	$67,760	2,420	$4,840
Erosion and Sediment Control										
Construction entrance	$ 1,000	Ea.	1	$1,000	$1	$1,000	1	$1,000	1	$1,000
Silt fence	$ 1.47	L.F.	1,500	$2,205	$1,500	$2,205	1,500	$2,205	1,500	$2,205
Erosion control fabric	$ 1.71	SY	2,500	$4,275	$2,500	$4,275	2,500	$4,275	2,500	$4,275
Hardscape construction										
Fine grading and subbase compaction	$ 5.88	SY	33,880	$199,220	26,976	$158,620	33,880	$199,220	2,420	$14,230
Asphalt access roads (4" paving over 4" base)	$ 44.60	SY	1,000	$44,600	1,000	$44,600	1,000	$44,600	1,000	$44,600
Assume 15' W x 600' L										
Asphalt working surface (6" paving over 6" base)	$ 58.45	SY	22,017	$1,286,880	17,419	$1,018,170	19,772	$1,155,690	- -	- -
Assume under composting, curing, screening, storage, retail sales										
Concrete slab for recpt & storage (6" reinf.)	$ 6.45	SF	1,600	$10,320	1,600	$10,320	1,600	$10,320	- -	- -
Area = 1,600 SF for receipt, FW/OCC storage bunkers										
Concrete block bunkers for feedstock storage	$ 148.76	Ea	90	$13,388	90	$13,388	90	$13,388	- -	- -
Assume 8' H walls, 2' x 2' x 6' tongue & groove concrete blocks										
$74.38 ea in Oak Bluffs, assume 2x for shipping and installing										
Concrete block ASP bunkers										
Formwork for aeration trenches	$ 17.01	SF	- -	- -	667	$11,346	- -	- -	- -	- -
Concrete aeration floors (6" thick reinf slab)	$ 3.83	SF	- -	- -	11,000	$42,130	- -	- -	- -	- -
Galvanized steel slotted trench covers (5"x 20")	$ 37.95	Ea	- -	- -	1,120	$42,504	- -	- -	- -	- -
Concrete block bunker walls, installed	$ 148.76	Ea	- -	- -	735	$109,339	- -	- -	- -	- -
End wall U-channel, 2" x 12" blocking boards	$ 40.00	Ea	- -	- -	112	$4,480	- -	- -	- -	- -
Pre-engineered metal building on 6" concrete slab	$ 75.00	SF	- -	- -	- -	- -	- -	- -	11,000	$825,000
Asphalt parking lot (4" paving over 4" base)	$ 44.60	SY	- -	- -	- -	- -	- -	- -	2,500	$111,500
Water management										
Run-on berm (8" high compacted earth)	$ 2.00	LF	300	$600	300	$600	300	$600	300	$600
Runoff swales (24" W x 24" D)	$ 3.00	LF	300	$900	300	$900	300	$900	300	$900
Solids separator	$ 5,000	Ea	Allowance	$5,000	Allowance	$5,000	Allowance	$5,000	Allowance	$5,000
Closed bioretention ponds	$ 6.80	SF	40,910	$279,000	32,573	$222,000	40,910	$279,000	3,757	$26,000
Pond liner - 60 mil HDPE	$ 1.19	SF	40,910	$48,683	32,573	$38,762	40,910	$48,683	417	$497
Utilities										
Extend 3-phase power	$ 200	LF	- -	- -	500	$100,000	500	$100,000	500	$100,000

On-site well - assume 4" well, 60' deep	$ 39.28	LF	60	$2,357	60	$2,357	60	$2,357	60	$2,357
On-site septic tank - assume 1K gpd capacity	$ 2.75	gal	1,000	$2,750	1,000	$2,750	1,000	$2,750	1,000	$2,750
on-site drainfield - assume 1 gpd/sf of trench	$ 13.77	SF	1,000	$13,770	1,000	$13,770	1,000	$13,770	1,000	$13,770
Site items										
Construction trailer (8' x 24')	$ 68.50	SF	192	$13,152	192	$13,152	192	$13,152	- -	- -
Landscaping inside facility		Ea	Allowance	$500	Allowance	$500	Allowance	$500	Allowance	$500
Perimeter vegetative screen (1000 units/acre)	$ 250	Ea	620	$154,959	620	$154,959	597	$149,219		
Assume 50' wide perimeter plantings										
Subtotals				$2,178,319		$2,098,078		$2,141,390		$1,187,024
Design Fee	7.5%	Ea		$163,374		$157,356		$160,604		$89,027
Contingency	25%	Ea		$544,580		$524,519		$535,347		$296,756
Totals				$2,886,273		$2,779,953		$2,837,341		$1,572,806
Notes										
Site development costs based on greenfield site										
Compost cost factors from Contractor Schedule of Values, Freestate Farm Composting Facility, Manassas, VA, Oct 2017										
Other cost factors from National Construction Cost Estimator software (Craftsman, 2018) adjusted for Zip Code 02575 (mat'ls +4%, labor +36%, equipment +1%)										
Bioretention Pond - assume handling whole site										
Average runoff coefficient				0.7		0.7		0.7		0.9
Assumed precipitation (P, ft.)				0.2		0.2		0.2		0.2
Contributing drainage area (A, ft2)				304,920		242,781		304,920		21,780
Runoff volume (V, cubic feet)				40,910		32,573		40,910		3,757
Depth of bioretention pond (D, in.)				12		12		12		12
Pond Surface Area (SA, sq ft)				40,910		32,573		40,910		3,757
Cost adjusted to 2018 ($)				$ 278,189		$ 221,497		$ 278,189		$ 25,548
	Rounded			$ 279,000		$ 222,000		$ 279,000		$ 26,000
Notes:										
Assume precipitation = 1-hr, 10-yr storm = 2.3"										
Cost based on $4.00/SF for rain garden in Piedmont soils										
		Source: NCSU Cooperative Extension, "Designing Rain Gardens", 2001								
		Costs adjusted to 2018 with ENR Construction Cost Index								
			March, 2018	10889						
			2001	6343						
			Multiplier	1.7						

				Straddle Turner		ASP		Rotary Drum		Animal Feed		
Item	Specifications	Unit Price	Units	Quantity	Costs	Quantity	Costs	Quantity	Costs	Quantity	Costs	
Well pump & pressure tank	18 gpm @ 400' TDH	$ 22,600	Ea	1	$ 22,600	1	$ 22,600	1	$ 22,600	1	$ 22,600	
Horizontal grinder	Morbark 2600 horizontal electric grinder	$ 320,000	Ea	1	$ 320,000	1	$ 320,000	1	$ 320,000	--	--	
	Shipping, on-island transport	Included										
Straddle windrow turner	Diesel-powered 6' H x 12' W tunnel	$ 308,450	Ea	1	$ 308,450	--	--	--	--	--	--	
	Shipping, on-island transport	Allowance			$ 12,500	--	--	--	--	--	--	
Windrow covers	Vortron TX 714 fabric covers	$ 3,520	Ea	46	$ 161,920	--	--	--	--	--	--	
	Shipping, on-island transport	Included										
Cover hold-downs	Punched tire sidewalls	$ 3.00	Ea	1,015	$ 3,045	--	--	--	--	--	--	
	Shipping, on-island transport	Allowance			$ 2,750	--	--	--	--	--	--	
Yard truck	10CY dump truck	$ 25,000	Ea	1	$ 25,000	1	$ 25,000	1	$ 25,000	--	--	
	Shipping, on-island transport	Allowance			$ 2,000	--	--		$ 2,000	--	--	
ASP equipment	Mixer	$ 273,000	Ea	--	--	1	$ 273,000	--	--	--	--	
	Blowers - Fuji VFZ901A-7W	$ 4,215	Ea	--	--	14	$ 59,010	--	--	--	--	
	Piping - 3" HDPE perforated	$ 5.00	LF	--	--	1800	$ 9,000	--	--	--	--	
	T-fittings and other fittings for piping	Allowance		--	--		$ 3,500	--	--	--	--	
	Timers - Intermatic C8835 Cycle timer	$ 164.50	Ea	--	--	14	$ 2,303	--	--	--	--	
Rotary Drum & mixer	CITIC 11 x 65 rotary drum	$ 1,699,000	Ea	--	--	--	--	1	$1,699,000	--	--	
	Mechanical mixer	$ 273,000	Ea	--	--	--	--	1	$ 273,000	--	--	
	Shipping, on-island transport, installation	Allowance		--	--	--	--	--	$ 600,000	--	--	
	Buildings/equip for mixing, discharge	$ 80	SF	--	--	--	--	3,150	$ 252,000	--	--	
	Biofilter	$ 38	SF	--	--	--	--	2,750	$ 103,950	--	--	
Trommel screen	Screen USA Trom 406	$ 50,000	Ea	1	$ 50,000	1	$ 1	1	$ 50,000	--	--	
	Shipping, on-island transport, installation	Allowance			$ 10,000		$ 10,000		$ 10,000	--	--	
Rubber-tired front-end loaders	140 hp FEL with 2.5 CY bucket	$ 175,000	Ea	1	$ 175,000	1	$ 175,000	1	$ 175,000	--	--	
	2nd bucket for handling product	$ 8,000	Ea	1	$ 8,000	1	$ 8,000	1	$ 8,000	--	--	
	Shipping, on-island transport	Allowance			$ 10,000		$ 10,000		$ 10,000	--	--	
Animal Feed extruder system	SAFE system like Santa Clara CA	SAFE quote		--	--			--	--	1	$ 10,000,000	
Totals	**Totals**				$1,111,265		$ 917,414		$3,550,550		$ 10,022,600	
<u>Data Sources:</u>												
Loader	John Deere 524K with 3 CY bucket											
	James River Equipment, Salem VA											
Straddle turner	Scarab 612, Scarab Int'l White Deer, TX											
	ships on low-boy trailer											
	Shipping $7-$10K											
Rotary drum	CITIC quote 4/11/18											
Mixer for ASP, rotary drum	Freestate Farms quote from ECS 8/2016											
Biofilter for rotary drum	Freestate Farms quote from ECS 8/2016											
Trommel screen	TROM 406 quote from ScreenUSA											
Dump truck	Commercialtrucktrader.com											
Grinder	Quote from Schmidt Equipment, Plymouth MA											
Windrow covers	CompostTex quote 3/15/18											
Cover holders	F&B Rubberized quote 3/15/18											
ASP blowers	W.W. Grainger online quote 5/22/18											
ASP timers	W.W. Grainger online quote 5/22/18											
Piping	W.W. Grainger online quote 5/22/18											

Martha's Vineyard Food Waste Diversion Program

Windrow Composting Operating Cost Estimate

5/25/18

Assumptions				
Labor rate (loaded) per hour			$22.50	per hour
Loader/yard truck machine rate (fuel + insurance + maintenance)			$55.00	per hour
Grinder machine rate			$110.00	per hour
Turner machine rate			$450.00	per hour
Facility is open 6 days/week, 52 weeks/yr			312	days/yr
Operating cost estimate based on peak summer waste generation at full build out				
Neglects any overlap of labor functions between tasks				
Processing Volumes				
	Average Daily Volume			
I/C/I food wastes	16.0	CY/day		
Residential food wastes	25.6			
Leaves	15.6			
Sawdusts	0.4			
Wood chips	18.3			
OCC	11.4			
Compost recycle	6.7			
Overs from screen	15.9			
Totals	109.9	CY/day		
Materials Handling Assumptions				
Assume wastes & products handled by two separate loaders				
Bucket capacity of each loader			3	CY/loader
Grinding done by site staff				
Mixing done by straddle or pull-behind turner				
Materials moved to composting and curing with yard truck				
Materials moved to storage (overs and compost) by loaders				
Materials Handling - Waste Receipt & Storage				
Daily volumes coming into facility			109.9	CY/day
Number of loader "bucket-movements" to keep bunkers & piles managed				
Daily volume / capacity of loader bucket			37	buckets/day
Assume time spent per loader movement			1.1	minutes
Time spent handling feedstocks			40	minutes/day
	Convert to hours		0.7	hours/day
	Labor cost/year		**$ 4,734**	
	Machine cost/year		**$ 11,572**	
Materials Handling - Grinding/shredding				
Assume wood chips/OCC go through grinder			19	CY/day
Assume use of Morbark 2600 200 hp electric grinder				
Assume grinder used one hour per day			1	hr/day
	Labor cost/year		**$ 7,020**	
	Machine cost/year		**$ 34,320**	
Materials Handling - Transport To Composting Pad				
Avg. daily volume going to composting			110	CY/day
Number of loader bucket movements			37	buckets/day
Time to tear down, pick up, transport and load truck			2	min/bucket
Total time needed to move compost to transport truck			86.8	minutes/day
Assume volume capacity of transport truck			10	CY
Number of truck trips/day			11	trips/day
Transport time to curing area			5	minutes/trip
Total time needed to move compost by truck			55	minutes/day
Total time needed to load and move			142	minutes/day

Convert to hours				2.4	hours/day
Labor cost/year				**$ 16,589**	
Machine cost/year				**$ 40,552**	
Building Composting Windrows					
Assume all windrows built with loader				3.0	CY/bucket
Daily volume coming to composting pad				109.9	CY/day
Number of buckets per day				37	buckets/day
Time needed to move feedstocks from unload site to windrow				3.3	minutes/bucket
Time needed to build windrows				121.4	minutes/day
Convert to hours				2.0	hours/day
Labor cost/year				**$ 14,202**	
Machine cost/year				**$ 34,715**	
Materials Handling - Windrow Mixing & Turning - Straddle Turner					
Number of turner passes to mix				1	pass/windrow
Number of turner passes while composting				2	passes/week/windrow
Total number of windrow passes				3	passes/windrow
Number of windrows				23	windrows
Windrow length =				0	linear ft/ windrow
Turner speed = 0.25 mph =				22	ft/min.
Time to make one windrow pass =				0.0	minutes/windrow
Time to turn around =				2.0	minutes/turn
Time to travel down pad to another windrow =				2.0	minutes
Total time needed per windrow				6.0	minutes
Time needed to mix windrows				135.0	minutes
Time needed to turn windrows per week				270.0	minutes/week
Total time spent mixing/turning windrows				405.0	minutes
Convert to hours				6.8	hours
Convert to per day equiv				1.1	$hours/day_{equiv}$
Labor cost/year				**$ 7,898**	
Machine cost/year				**$ 19,305**	
Windrow Irrigation					
	Formula	Units	Value		
Windrow Dimensions					
Length		Ft.	182		
Width		Ft.	12		
Height		Ft.	6		
Volume per linear foot	A = h x (b - h)	CY/LF	1.33		
Volume of material in windrow	Vol/LF x linear feet	CY	243		
Bulk density of mix	assumed	lbs/CY	800		
Weight of windrow	bulk density x volume	lbs	194,221		
Moisture content of sample	assumed	%	40%		
Desired moisture content		%	50%		
Weight of water in windrow	weight x moisture %	lbs	77,688		
Desired weight of water	weight x 50%	lbs	97,111		
Shortfall	Desired - actual	lbs	19,422		
Gallons to be added	Shortfall / 8.34 lbs/gal	gal	2,329		
Average monthly rainfall on Martha's Vineyard			=	3.9	inches/month
Area of windrows in composting			=	50,994	SF
Monthly volume of rain falling on windrows			=	16,616	CF
			=	2,221	gallons/month
Assume rainfall adequate to supply moisture if turned in at every rain event					
Labor cost/year				**$ -**	
Materials Handling - Moving Compost to Curing					
Avg. daily volume going to curing (assume 40% shrink)				66	CY/day
Number of loader bucket movements				22	buckets/day

	Time to tear down, pick up, transport and load truck			2	min/bucket
	Total time needed to move compost to transport truck			52.0	minutes/day
	Assume volume capacity of transport truck			10	CY
	Number of truck trips/day			7	trips/day
	Transport time to curing area			5	minutes/trip
	Total time needed to move compost by truck			33	minutes/day
	Total time needed to load and move			85	minutes/day
		Convert to hours		1.4	hours/day
		Labor cost/year	**$**	**9,943**	
		Machine cost/year	**$**	**24,306**	
Managing Curing Piles					
	Assume curing windrows built with loader			3	CY/bucket
	Daily volume coming to curing			65.9	CY/day
	Number of buckets per day			22	buckets/day
	Time needed to move feedstocks from unload site to windrow			2	minutes/bucket
	Time needed to build windrows			48.6	minutes/day
	Assume turner used to turn windrows once/ every 2 weeks			0.5	pass/week
	Number of windrows			20	windrows
	Windrow length =			250	linear ft/ windrow
	Turner speed = 0.25 mph =			22	ft/min.
	Time to make one windrow pass =			11.4	minutes/windrow
	Time to turn around =			1.0	minutes/turn
	Time to travel down pad to another windrow =			2.0	minutes
	Total time needed per windrow			14.4	minutes
	Time needed to turn windrows per week			143.6	minutes/week
	Total time spent building/turning windrows			386.4	minutes
		Convert to hours		6.4	hours
		Convert to per day equiv		1.3	hours/day$_{equiv}$
		Labor cost/year	**$**	**9,043**	
		Machine cost/year	**$**	**22,104**	
Screening Compost					
	Avg. daily volume going to screening (assume 10% shrink in curing)			59	CY/day
	Assume screen hopper volume = loader bucket volume			3	CY/hr
	Number of loader bucket movements daily			20	buckets/day
	Time to move compost from curing to screening			5	min/bucket
	Total time needed to move compost			98	min/day
		Convert to hours		1.6	hrs/day
	Assume screen througput rate			40	CY/hr
	Screen run time per day (assume no add'l labor needed)			1.6	hrs/day
		Labor cost/year	**$**	**11,504**	
		Machine cost/year	**$**	**28,125**	
Materials Handling - Screened Compost to Storage					
	Avg. daily volume going to storage (assume 10% shrink in curing)			47	CY/day
	Number of loader bucket movements			16	buckets/day
	Time to tear down, pick up, transport and load truck			2	minutes/bucket
	Total time needed to move compost to transport truck			37.4	minutes/day
	Assume volume capacity of transport truck			10	CY
	Number of truck trips/day			5	trips/day
	Transport time to storage area, dump, return			5	minutes/trip
	Total time needed to move compost by truck			23.7	minutes/day
	Total time needed to load and move			61	minutes/day
		Convert to hours		**1.0**	**hours/day**
		Labor cost/year	**$**	**7,157**	
		Machine cost/year	**$**	**17,496**	
Materials Handling - Overs to Storage					
	Avg. daily volume going to storage			12	CY/day

Number of loader bucket movements		4	buckets/day
Time to tear down, pick up, transport and load truck		2	minutes/bucket
Total time needed to move compost to transport truck		9	minutes/day
Assume volume capacity of transport truck		10	CY
Number of truck trips/day		2	trips/day
Transport time to storage area, dump, return		5	minutes/trip
Total time needed to move compost by truck		10	minutes/day
Total time needed to load and move		19	minutes/day
	Convert to hours	**0.3**	**hours/day**
	Labor cost/year	**$ 2,193**	
	Machine cost/year	**$ 5,361**	
Product Marketing & Sales			
Annual compost production volume		19,088	CY/yr
Average daily production volume		61	CY/day
Assume 90% wholesale/10% retail			
Wholesale (assume delivery outsourced)		55	CY/day
Tractor-trailer volume capacity		30	CY
Number of trailers needed daily		2	
Time to load trailers		0.5	hrs/day
Assumed delivery fee		$ 150	per load
	Labor cost/year	$ 3,510	
	Machine cost/year	$ 8,580	
Retail		6	CY/day
Pick-up truck capacity		2	CY
Number of retail sales needed daily		3	per day
Time needed to deal with each customer		0.3	hrs/day
	Labor cost/year	$ 2,106	
	Machine cost/year	$ 5,148	
Totals	**Labor cost/year**	**$5,616**	
	Machine cost/year	**$13,728**	

Labor Summary			Operating Expenses Summary		
			Straddle Turner		
Process	Hrs/Day		Labor Cost	Machine Costs	Total
Waste Receipt	0.7		$ 4,734	$ 11,572	$ 16,307
Grinding/shredding	0.7		$ 7,020	$ 34,320	$ 41,340
Transport to pad	2.4		$ 16,589	$ 40,552	$ 57,141
Building windrows	2.0		$ 14,202	$ 34,715	$ 48,917
Windrow Mixing & Turning	1.1		$ 7,898	$ 19,305	$ 27,203
Windrow Irrigation	0.0		$ -	$ -	$ -
Moving Compost to Curing	1.4		$ 9,943	$ 24,306	$ 34,249
Managing Curing Piles	1.3		$ 9,043	$ 22,104	$ 31,147
Screening Compost	1.6		$ 11,504	$ 28,125	$ 39,630
Moving Screened Compost to Storage	1.0		$ 7,157	$ 17,496	$ 24,653
Moving Overs to Storage	0.3		$ 2,193	$ 5,361	$ 7,554
Product Marketing & Sales	0.8		$ 5,616	$ 13,728	$ 19,344
TOTALS	13.3	Subtotals	**$ 95,899**	**$ 251,584**	$ 347,483

Assume 85% efficiency of site workers			Total	$ 347,483
Number of work-hours needed	15.7	hrs/day	Annual Tons	10,623
FTE's in a 8-hour day	**1.96**	**FTEs**	**Per Ton**	**$ 32.71**

Martha's Vineyard Food Waste Diversion Program		
ASP Composting Operating Cost Estimate		
5/22/18		
Assumptions		
Labor rate (loaded) per hour	$22.50	per hour
Loader, mixer, yard truck & screen machine rate (fuel + insurance + maintenance)	$55.00	per hour
Grinder machine rate	$110.00	per hour
Facility is open 6 days/week, 52 weeks/yr	312	days/yr
Operating cost estimate based on peak summer waste generation at full build out		
Neglects any overlap of labor functions between tasks		
Processing Volumes		
	Average Daily Volume	
I/C/I food wastes	16.0	CY/day
Residential food wastes	25.6	
Leaves	15.6	
Sawdusts	0.4	
Wood chips	18.3	
Paper	11.5	
OCC	11.4	
Compost recycle	6.7	
Overs from screen	15.9	
Totals	121.4	CY/day
Materials Handling Assumptions		
Assume wastes & products handled by two separate loaders		
Bucket capacity of each loader	3	CY/loader
Grinding done by site staff		
Mixing done by straddle or pull-behind turner		
Materials moved to composting and curing with yard truck		
Materials moved to storage (overs and compost) by loaders		
Materials Handling - Waste Receipt & Storage		
Daily volumes coming into facility	121.4	CY/day
Number of loader "bucket-movements" to keep bunkers & piles managed		
Daily volume / capacity of loader bucket	40	buckets/day
Assume time spent per loader movement	1	minutes
Time spent handling feedstocks	40	minutes/day
Convert to hours	0.7	hours/day
Labor cost/year	**$ 4,734**	
Machine cost/year	**$ 11,572**	
Materials Handling - Grinding/shredding		
Assume wood chips/OCC go through grinder	30	CY/day
Assume use of Morbark 2600 200 hp electric grinder		
Assume grinder used one hour per day	1	hr/day
Labor cost/year	**$ 7,020**	
Machine cost/year	**$ 34,320**	
Materials Handling - Mixing		
Daily volumes coming into facility	121	CY/day
Number of loader bucket movements to load mixer	40	buckets/day
Assumed time spent per loading event	2	minutes/bucket
Assumed time to load yard truck	2	minutes/bucket
Time spent handling feedstocks	162	minutes/day
Convert to hours	2.7	hours/day
Mixer run time	1.5	hours/day
Total machine time	4.2	hours/day
Total labor time	2.7	hours/day

Labor cost/year		**$ 18,937**	
Machine cost/year		**$ 72,029**	
Materials Handling - Transport To Composting Pad			
Avg. daily volume going to composting (assume 10% shrink in mixing)		109	CY/day
Number of loader bucket movements		36	buckets/day
Time to tear down, pick up, transport and load truck		2	min/bucket
Total time needed to move compost to transport truck		72.8	minutes/day
Assume volume capacity of transport truck		10	CY
Number of truck trips/day		11	trips/day
Transport time to curing area		5	minutes/trip
Total time needed to move compost by truck		55	minutes/day
Total time needed to load and move		127	minutes/day
Convert to hours		2.1	hours/day
Labor cost/year		**$ 14,913**	
Machine cost/year		**$ 36,453**	
Building ASPs			
Assume all windrows built with loader		3.0	CY/bucket
Daily volume coming to composting bunkers		109.2	CY/day
Number of buckets per day		36	buckets/day
Time needed to install plenum, load bunker, install cap		4	minutes/bucket
Time needed to build ASPs		145.7	minutes/day
Convert to hours		2.4	hours/day
Labor cost/year		**$ 17,043**	
Machine cost/year		**$ 41,660**	
Aerated Static Pile Composting Cost			
Size of blower		14.7	hp
Assume 10 min on/20 min off; hours running each day		8	hrs/day
Assumed electrical consumption at 1 kW = 1 hp		14.7	kilowatts
kWh per day		118	kWh/day
Cost of electricity	Eversource Rate 24 - Medium Gen'l Rate	$ 0.13	per kWh
Annual cost of each motor		$ 5,580	
Annual electricity cost for 14 blowers		**$ 78,122**	
Materials Handling - Moving Compost to Curing			
Avg. daily volume going to curing (assume 30% shrink)		76	CY/day
Number of loader bucket movements		25	buckets/day
Time to tear down, pick up, transport and load truck		2	min/bucket
Total time needed to move compost to transport truck		51.0	minutes/day
Assume volume capacity of transport truck		10	CY
Number of truck trips/day		8	trips/day
Transport time to curing area		5	minutes/trip
Total time needed to move compost by truck		38	minutes/day
Total time needed to load and move		89	minutes/day
Convert to hours		1.5	hours/day
Labor cost/year		**$ 10,439**	
Machine cost/year		**$ 25,517**	
Managing Curing Piles			
Assume curing windrows built with loader		3	CY/bucket
Daily volume coming to curing		76.5	CY/day
Number of buckets per day		25	buckets/day
Time needed to move feedstocks from unload site to windrow		2	minutes/bucket
Time needed to build windrows		51.0	minutes/day
Assume turner used to turn windrows once/ every 2 weeks		0.5	pass/week
Number of windrows		20	windrows
Windrow length =		250	linear ft/ windrow
Turner speed = 0.25 mph =		22	ft/min.
Time to make one windrow pass =		11.4	minutes/windrow

	Time to turn around =			1.0	minutes/turn
	Time to travel down pad to another windrow =			2.0	minutes
	Total time needed per windrow			14.4	minutes
	Time needed to turn windrows per week			143.6	minutes/week
	Total time spent building/turning windrows			398.6	minutes
			Convert to hours	6.6	hours
			Convert to per day equiv	1.3	hours/day$_{equiv}$
			Labor cost/year	**$ 9,326**	
			Machine cost/year	**$ 22,797**	
Screening Compost					
	Avg. daily volume going to screening (assume 10% shrink in curing)			69	CY/day
	Assume screen hopper volume = loader bucket volume			3	CY/loader
	Number of loader bucket movements daily			23	buckets/day
	Time to move compost from curing to screening			4	min/bucket
	Total time needed to move compost			92	min/day
			Convert to hours	1.5	hrs/day
	Assume screen througput rate			40	CY/hr
	Screen run time per day (assume no add'l labor needed)			2	hrs/day
			Labor cost/year	**$ 12,079**	
			Machine cost/year	**$ 10,410**	
Materials Handling - Screened Compost to Storage					
	Avg. daily volume coming off screen			55	CY/day
	Number of loader bucket movements			18	buckets/day
	Time to tear down, pick up, transport and load truck			2	minutes/bucket
	Total time needed to move compost to transport truck			36.7	minutes/day
	Assume volume capacity of transport truck			10	CY
	Number of truck trips/day			6	trips/day
	Transport time to storage area, dump, return			5	minutes/trip
	Total time needed to move compost by truck			27.5	minutes/day
	Total time needed to load and move			64	minutes/day
			Convert to hours	**1.1**	**hours/day**
			Labor cost/year	**$ 7,516**	
			Machine cost/year	**$ 18,372**	
Materials Handling - Overs to Storage					
	Avg. daily volume coming off screen			13.8	CY/day
	Number of loader bucket movements			5	buckets/day
	Time to tear down, pick up, transport and load truck			2	minutes/bucket
	Total time needed to move compost to transport truck			9.2	minutes/day
	Assume volume capacity of transport truck			10	CY
	Number of truck trips/day			1	trips/day
	Transport time to storage area, dump, return			5	minutes/trip
	Total time needed to move compost by truck			6.9	minutes/day
	Total time needed to load and move			16	minutes/day
			Convert to hours	**0.3**	**hours/day**
			Labor cost/year	**$ 1,879**	
			Machine cost/year	**$ 4,593**	
Product Marketing & Sales					
	Annual compost production volume			19,088	CY/yr
	Average daily production volume			61	CY/day
	Assume 90% wholesale/10% retail				
	Wholesale (assume delivery outsourced)			55	CY/day
		Tractor-trailer volume capacity		30	CY
		Number of trailers needed daily		2	
		Time to load trailers		0.5	hrs/day
		Assumed delivery fee		$ 150	per load

					Labor cost/year		$ 3,510		
					Machine cost/year		$ 8,580		
	Retail						6	CY/day	
		Pick-up truck capacity					2	CY	
		Number of retail sales needed daily					3	per day	
		Time needed to deal with each customer					0.3	hrs/day	
					Labor cost/year		$ 2,106		
					Machine cost/year		$ 5,148		
	Totals				**Labor cost/year**		**$5,616**		
					Machine cost/year		**$13,728**		
						Operating Expenses Summary			
			Labor Summary			**ASP Composting**			
			Process	Hrs/Day		Labor Cost	Machine Costs	Consumables	Total
			Waste Receipt	0.7		$ 4,734	$ 11,572		$ 16,306
			Grinding/shredding	0.7		$ 7,020	$ 34,320		$ 41,340
			Mixing	4.2		$ 18,937	$ 72,029		$ 90,966
			Transport to pad	2.1		$ 14,913	$ 36,453		$ 51,365
			Building ASPs	2.4		$ 17,043	$ 41,660		$ 58,703
			Electricity for ASPs	--		--	--	$ 78,122	$ 78,122
			Moving Compost to Curing	1.5		$ 10,439	$ 25,517		$ 35,956
			Managing Curing Piles	1.3		$ 9,326	$ 22,797		$ 32,123
			Screening Compost	1.5		$ 12,079	$ 10,410		$ 22,489
			Moving Screened Compost to Storage	1.1		$ 7,516	$ 18,372		$ 25,888
			Move Overs to Storage	0.3		$ 1,879	$ 4,593		$ 6,472
			Product Marketing & Sales	0.8		$ 5,616	$ 13,728		$ 19,344
			TOTALS	16.6	Subtotals	**$ 109,501**	**$ 291,453**	**$ 78,122**	**$ 479,075**
			Assume 85% efficiency of site workers			Total	$ 479,075		
			Number of work-hours needed	19.5	hrs/day	Annual Tons	10,623		
			FTE's in a 8-hour day	**2.44**	**FTEs**	**Per Ton**	**$ 45.10**		

Martha's Vineyard Food Waste Diversion Program				
Rotary Drum Composting Operating Cost Estimate				
5/25/18				
Assumptions				
Labor rate (loaded) per hour			$22.50	per hour
Loader/yard truck machine rate (fuel + insurance + maintenance)			$55.00	per hour
Grinder machine rate			$110.00	per hour
Turner machine rate			$450.00	per hour
Facility is open 6 days/week, 52 weeks/yr			312	days/yr
Operating cost estimate based on peak summer waste generation at full build out				
Neglects any overlap of labor functions between tasks				
Processing Volumes				
	Average Daily Volume			
I/C/I food wastes	16.0	CY/day		
Residential food wastes	25.6			
Leaves	15.6			
Sawdusts	0.4			
Wood chips	18.3			
MVRD yard waste	11.5			
OCC	11.4			
Compost recycle	6.7			
Overs from screen	15.9			
Totals	121.4	CY/day		
Materials Handling Assumptions				
Assume wastes & products handled by two separate loaders				
Bucket capacity of each loader			3	CY/loader
Grinding done by site staff				
Mixing done by straddle or pull-behind turner				
Materials moved to composting and curing with yard truck				
Materials moved to storage (overs and compost) by loaders				
Materials Handling - Waste Receipt & Storage				
Daily volumes coming into facility			121.4	CY/day
Number of loader "bucket-movements" to keep bunkers & piles managed				
Daily volume / capacity of loader bucket			40	buckets/day
Assume time spent per loader movement			1	minutes
Time spent handling feedstocks			40	minutes/day
	Convert to hours		0.7	hours/day
	Labor cost/year		**$ 4,734**	
	Machine cost/year		**$ 11,572**	
Materials Handling - Grinding/shredding				
Assume wood chips/paper/OCC go through grinder			30	CY/day
Assume use of Morbark 2600 200 hp electric grinder				
Assume grinder used one hour per day			1	hr/day
	Labor cost/year		**$ 7,020**	
	Machine cost/year		**$ 34,320**	
Materials Handling - Transport To Composting Pad				
Avg. daily volume going to composting			109	CY/day
Number of loader bucket movements			36	buckets/day
Time to tear down, pick up, transport and load truck			2	min/bucket
Total time needed to move compost to transport truck			72.8	minutes/day
Assume volume capacity of transport truck			10	CY
Number of truck trips/day			11	trips/day
Transport time to curing area			5	minutes/trip
Total time needed to move compost by truck			55	minutes/day
Total time needed to load and move			127	minutes/day
	Convert to hours		2.1	hours/day
	Labor cost/year		**$ 14,913**	
	Machine cost/year		**$ 36,453**	

Loading/Unloading Rotary Drum				
	Time to unload drum		2.0	hrs/cycle
	Length of cycle		5	days
	Daily equivalent time		0.4	hrs/day
	Time to load drum		2.0	hrs/cycle
	Length of cycle		5	days
	Daily equivalent time		0.4	hrs/day
	Total daily equivalent time		0.8	hrs/day
	Machine cost based on use of loader to load/unload			
		Labor cost/year	**$ 5,616**	
		Machine cost/year	**$ 13,728**	
Operating Rotary Drum				
	50 hp motor running 24/7			
	Electrical voltage		240	volts
	Motor Amperage		130	amps
	Power consumed	W = A x V x SQRT3	54,040	watts
		=	54	kilowatts
	Hours of operation per year		8,760	hrs/year
	Electrical consumption per year		473,390	kWh/year
	Electrical power cost	Eversource Rate 24 - Large Gen'l Time of Use		
		Monthly customer charge	$930.00	per month
		Electric rate	$0.03	per kWh
	Add high maintenance items like grease		$5,000	per year
		Labor cost/year	**$ -**	
		Machine cost/year	**$ 28,852**	
Materials Handling - Moving Compost to Curing				
	Avg. daily volume going to curing (assume 30% shrink)		76	CY/day
	Number of loader bucket movements		25	buckets/day
	Time to tear down, pick up, transport and load truck		2	min/bucket
	Total time needed to move compost to transport truck		51.0	minutes/day
	Assume volume capacity of transport truck		10	CY
	Number of truck trips/day		8	trips/day
	Transport time to curing area		5	minutes/trip
	Total time needed to move compost by truck		38	minutes/day
	Total time needed to load and move		89	minutes/day
		Convert to hours	1.5	hours/day
		Labor cost/year	**$ 10,439**	
		Machine cost/year	**$ 25,517**	
Managing Curing Piles				
	Assume curing windrows built with loader		3	CY/bucket
	Daily volume coming to curing		76.5	CY/day
	Number of buckets per day		25	buckets/day
	Time needed to move feedstocks from unload site to windrow		2	minutes/bucket
	Time needed to build windrows		51.0	minutes/day
	Assume loader used to turn windrows once/ every 2 weeks		6	turns/cycle
	Number of windrows		15	windrows
	Total windrows volume		6883	CY/cure cycle
	Bucket movements		14749	buckets/cycle
	Time to turn one bucket		1.0	minutes/bucket
	Time to turn all windrows/cure cycle		14748.7	minutes/cycle
		Convert to hours	245.8	hours
		Convert to per day equiv	2.7	hours/day_{equiv}
		Labor cost/year	**$ 19,173**	
		Machine cost/year	**$ 46,868**	
Screening Compost				
	Avg. daily volume going to screening (assume 10% shrink in curing)		69	CY/day
	Assume screen hopper volume = loader bucket volume		3	CY/hr
	Number of loader bucket movements daily		23	buckets/day
	Time to move compost from curing to screening		4	min/bucket
	Total time needed to move compost		92	min/day

					Convert to hours		1.5	hrs/day	
	Assume screen througput rate						40	CY/hr	
	Screen run time per day (assume no add'l labor needed)						2	hrs/day	
					Labor cost/year		**$ 12,079**		
					Machine cost/year		**$ 29,527**		
Materials Handling - Screened Compost to Storage									
	Avg. daily volume going to storage						55	CY/day	
	Number of loader bucket movements						18	buckets/day	
	Time to tear down, pick up, transport and load truck						2	minutes/bucket	
	Total time needed to move compost to transport truck						36.7	minutes/day	
	Assume volume capacity of transport truck						10	CY	
	Number of truck trips/day						6	trips/day	
	Transport time to storage area, dump, return						5	minutes/trip	
	Total time needed to move compost by truck						27.5	minutes/day	
	Total time needed to load and move						64	minutes/day	
					Convert to hours		**1.1**	**hours/day**	
					Labor cost/year		**$ 7,516**		
					Machine cost/year		**$ 18,372**		
Materials Handling - Overs to Storage									
	Avg. daily volume going to storage						14	CY/day	
	Number of loader bucket movements						5	buckets/day	
	Time to tear down, pick up, transport and load truck						2	minutes/bucket	
	Total time needed to move compost to transport truck						9.2	minutes/day	
	Assume volume capacity of transport truck						10	CY	
	Number of truck trips/day						2	trips/day	
	Transport time to storage area, dump, return						5	minutes/trip	
	Total time needed to move compost by truck						10.0	minutes/day	
	Total time needed to load and move						19	minutes/day	
					Convert to hours		**0.3**	**hours/day**	
					Labor cost/year		**$ 2,244**		
					Machine cost/year		**$ 5,485**		
Product Marketing & Sales									
	Annual compost production volume						19,088	CY/yr	
	Average daily production volume						61	CY/day	
	Assume 90% wholesale/10% retail								
	Wholesale (assume delivery outsourced)						55	CY/day	
		Tractor-trailer volume capacity					30	CY	
		Number of trailers needed daily					2		
		Time to load trailers					0.5	hrs/day	
		Assumed delivery fee					$ 150	per load	
					Labor cost/year		$ 3,510		
					Machine cost/year		$ 8,580		
	Retail						6	CY/day	
		Pick-up truck capacity					2	CY	
		Number of retail sales needed daily					3	per day	
		Time needed to deal with each customer					0.3	hrs/day	
					Labor cost/year		$ 2,106		
					Machine cost/year		$ 5,148		
	Totals				**Labor cost/year**		**$5,616**		
					Machine cost/year		**$13,728**		
						Operating Expenses Summary			
Labor Summary						Rotary Drum			
			Process	Hrs/Day		Labor Cost	Machine Costs	Totals	
			Waste Receipt	0.7		$ 4,734	$ 11,572	$ 16,306	
			Grinding/shredding	1.0		$ 7,020	$ 34,320	$ 41,340	
			Transport to pad	2.1		$ 14,913	$ 36,453	$ 51,365	
			Loading Rotary Drum	0.4		$ 5,616	$ 13,728	$ 19,344	
			Operating Rotary Drum	-		$ -	$ 28,852	$ 28,852	
			Moving Compost to Curing	1.5		$ 10,439	$ 25,517	$ 35,956	
			Managing Curing Piles	2.7		$ 19,173	$ 46,868	$ 66,041	

Screening Compost		1.5		$ 12,079	$ 29,527	$ 41,606	
Moving Screened Compost to Storage		1.1		$ 7,516	$ 18,372	$ 25,888	
Move Overs to Storage		0.3		$ 2,244	$ 5,485	$ 7,728	
Product Marketing & Sales		0.8		$ 5,616	$ 13,728	$ 19,344	
	TOTALS	12.1	Subtotals	**$ 89,349**	**$ 264,421**	$ 353,771	
Assume 85% efficiency of site workers				Total	$ 353,771		
Number of work-hours needed	14.3	hrs/day		Annual Tons	10,623		
FTE's in a 8-hour day	**1.78**	**FTEs**		**Per Ton**	**$ 33.30**		

Appendix F- *Pro Forma* Analyses

Martha's Vineyard Windrow Composting

Pro Forma Assumptions - 2019
Capacity = 10,000 tons/year

Revenues:

1. Tip fees =		$50.00	per ton
Tip fee tons per year =		2,215	tons/year
2. Compost sales price =			
Commercial sales	$	25.00	per CY
Residential sales	$	35.00	per CY
Commercial =		75%	
Residential =		25%	
3. Compost sales distribution:			
Annual quantity =		10,500	CY/year
Assume sales timing :			
January		0.2%	
February		4.4%	
March		12.8%	
April		15.3%	
May		9.5%	
June		9.1%	
July		2.1%	
August		4.2%	
September		16.2%	
October		14.0%	
November		5.5%	
December		6.7%	
		100.0%	

Cost of Compost Production

1. From spreadsheet "Windrow Opex Estimate"

		Annual Costs
Waste Receipt	$	16,306
Grinding/shredding	$	41,340
Transport to pad	$	57,073
Building windrows	$	48,919
Windrow Mixing & Turning	$	27,203
Windrow Irrigation	$	-
Moving Compost to Curing	$	39,951
Managing Curing Piles	$	34,406
Screening Compost	$	39,625
Moving Screened Compost to Storage	$	35,956
Moving Overs to Storage	$	7,552
Product Marketing & Sales	$	19,344

2. Assume costs are distributed through the year proportional to incoming loads:

January	1.5%
February	1.8%
March	1.6%
April	2.2%
May	7.4%
June	11.5%
July	19.5%
August	24.5%
September	10.2%
October	8.4%
November	5.7%
December	5.8%

3. Assume production costs increase by 3% annually in 2020 and 2021

Administrative Costs

1. Capital cost recovery factor for equipment =		3.75%	per year	< 12-yr life
Estimated capex for equipment =	$	1,101,265		
2. Capital cost recovery factor for site improvements =		5.5%	per year	20 yrs
Estimated capex Phase I =	$	2,905,300		
3. Housekeeping, Monitoring & Recordkeeping				
Remaining time after materials handling		1.6	hrs/day/FTE	
Assume loaded labor rate =	$	22.50	per hour	

Martha's Vineyard Windrow Composting

4,000 ton/year food waste capacity (2019 tip fee tonnage = 2,215 tons; 2019 compost production = 10,500 CY/yr

For the Year Ending 12/31/2019

	January	February	March	April	May	June	July	August	September	October	November	December	YTD
Revenue													
Tip Fees	$1,613	$2,033	$1,729	$2,436	$8,146	$12,760	$21,565	$27,100	$11,327	$9,310	$6,311	$6,421	$110,750
Compost Sales - commercial	$394	$8,663	$25,200	$30,122	$18,703	$17,916	$4,134	$8,269	$31,894	$27,563	$10,828	$13,191	$196,875
Compost Sales - residential	$184	$4,043	$11,760	$14,057	$8,728	$8,361	$1,929	$3,859	$14,884	$12,863	$5,053	$6,156	$91,875
<Other Revenue>	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Sales	$2,191	$14,738	$38,689	$46,614	$35,578	$39,036	$27,629	$39,227	$58,104	$49,735	$22,192	$25,768	$399,500
Cost of Compost Production													
Waste Receipt	$238	$299	$255	$359	$1,199	$1,879	$3,175	$3,990	$1,668	$1,371	$929	$945	$16,306
Grinding/shredding	$602	$759	$645	$909	$3,041	$4,763	$8,050	$10,116	$4,228	$3,475	$2,356	$2,397	$41,340
Transport to pad	$831	$1,048	$891	$1,255	$4,198	$6,576	$11,113	$13,965	$5,837	$4,798	$3,252	$3,309	$57,073
Building windrows	$713	$898	$764	$1,076	$3,598	$5,636	$9,526	$11,970	$5,003	$4,112	$2,787	$2,836	$48,919
Windrow Mixing & Turning	$396	$499	$425	$598	$2,001	$3,134	$5,297	$6,656	$2,782	$2,287	$1,550	$1,577	$27,203
Windrow Irrigation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Moving Compost to Curing	$582	$733	$624	$879	$2,939	$4,603	$7,779	$9,776	$4,086	$3,358	$2,276	$2,316	$39,951
Managing Curing Piles	$501	$632	$537	$757	$2,531	$3,964	$6,700	$8,419	$3,519	$2,892	$1,960	$1,995	$34,406
Screening Compost	$577	$727	$619	$871	$2,915	$4,565	$7,716	$9,696	$4,053	$3,331	$2,258	$2,298	$39,625
Moving Screened Compost to Storage	$524	$660	$561	$791	$2,645	$4,143	$7,001	$8,798	$3,677	$3,022	$2,049	$2,085	$35,956
Moving Overs to Storage	$110	$139	$118	$166	$556	$870	$1,471	$1,848	$772	$635	$430	$438	$7,552
Product Marketing & Sales	$282	$355	$302	$425	$1,423	$2,229	$3,767	$4,733	$1,978	$1,626	$1,102	$1,122	$19,344
Cost of Compost Production	$5,356	$6,750	$5,740	$8,086	$27,044	$42,361	$71,594	$89,967	$37,603	$30,907	$20,950	$21,318	$367,675
Administrative Costs													
Capital Recovery - equipment	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$41,297
Capital Recovery - site improvements	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$159,791
Housekeeping, Monitoring & Recordkeepin	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$20,736
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Admin Costs	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$221,825
Net Income	**($21,650)**	**($10,497)**	**$14,464**	**$20,043**	**($9,952)**	**($21,810)**	**($62,450)**	**($69,225)**	**$2,016**	**$343**	**($17,244)**	**($14,036)**	**($190,000)**

Martha's Vineyard Windrow Composting

Pro Forma Assumptions - 2020

Capacity = 10,000 tons/year

Revenues:

1. Tip fees =	$51.50	per ton
Tip fee tons per year =	2,900	tons/year
2. Compost sales price =		
Commercial sales	$ 25.00	per CY
Residential sales	$ 35.00	per CY
Commercial =	75%	
Residential =	25%	
3. Compost sales distribution:		
Annual quantity =	13,775	CY/year
Assume sales timing :		
January	0.2%	
February	4.4%	
March	12.8%	
April	15.3%	
May	9.5%	
June	9.1%	
July	2.1%	
August	4.2%	
September	16.2%	
October	14.0%	
November	5.5%	
December	6.7%	
	100.0%	

Cost of Compost Production

1. From spreadsheet "Windrow Opex Estimate"

	Annual Costs
Waste Receipt	$ 16,796
Grinding/shredding	$ 42,580
Transport to pad	$ 58,785
Building windrows	$ 50,387
Windrow Mixing & Turning	$ 28,019
Windrow Irrigation	$ -
Moving Compost to Curing	$ 35,271
Managing Curing Piles	$ 32,079
Screening Compost	$ 40,813
Moving Screened Compost to Storage	$ 25,395
Moving Overs to Storage	$ 7,779
Product Marketing & Sales	$ 19,924

2. Assume costs are distributed through the year proportional to incoming loads:

January	1.5%
February	1.8%
March	1.6%
April	2.2%
May	7.4%
June	11.5%
July	19.5%
August	24.5%
September	10.2%
October	8.4%
November	5.7%
December	5.8%

3. Assume production costs increase by 3% annually in 2020 and 2021

Administrative Costs

1. Capital cost recovery factor for equipment =	3.75%	per year	< 12-yr life
Estimated capex for equipment =	$ 1,101,265		
2. Capital cost recovery factor for site improvements =	5.5%	per year	20 yrs
Estimated capex Phase I =	$ 2,905,300		
3. Housekeeping, Monitoring & Recordkeeping			
Remaining time after materials handling	1.6	hrs/day/FTE	
Assume loaded labor rate =	$ 22.50	per hour	

Martha's Vineyard Windrow Composting

4,000 ton/year food waste capacity (2020 tip fee tonnage = 2,900 tons; 2020 compost production = 13,775 CY/yr

For the Year Ending 12/31/2020

	January	February	March	April	May	June	July	August	September	October	November	December	YTD
Revenue													
Tip Fees	$2,175	$2,742	$2,332	$3,284	$10,985	$17,207	$29,081	$36,545	$15,274	$12,554	$8,510	$8,660	$149,350
Compost Sales - commercial	$517	$11,364	$33,060	$39,517	$24,537	$23,504	$5,424	$10,848	$41,842	$36,159	$14,205	$17,305	$258,281
Compost Sales - residential	$241	$5,303	$15,428	$18,441	$11,450	$10,968	$2,531	$5,062	$19,526	$16,874	$6,629	$8,076	$120,531
<Other Revenue>	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Sales	$2,933	$19,409	$50,820	$61,243	$46,973	$51,679	$37,037	$52,455	$76,642	$65,588	$29,345	$34,040	$528,163
Cost of Compost Production													
Waste Receipt	$245	$308	$262	$369	$1,235	$1,935	$3,270	$4,110	$1,718	$1,412	$957	$974	$16,796
Grinding/shredding	$620	$782	$665	$936	$3,132	$4,906	$8,291	$10,419	$4,355	$3,579	$2,426	$2,469	$42,580
Transport to pad	$856	$1,079	$918	$1,293	$4,324	$6,773	$11,447	$14,384	$6,012	$4,941	$3,350	$3,408	$58,785
Building windrows	$734	$925	$787	$1,108	$3,706	$5,805	$9,811	$12,329	$5,153	$4,236	$2,871	$2,922	$50,387
Windrow Mixing & Turning	$408	$514	$437	$616	$2,061	$3,228	$5,456	$6,856	$2,866	$2,355	$1,597	$1,625	$28,019
Windrow Irrigation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Moving Compost to Curing	$514	$647	$551	$776	$2,594	$4,064	$6,868	$8,630	$3,607	$2,965	$2,010	$2,045	$35,271
Managing Curing Piles	$467	$589	$501	$705	$2,360	$3,696	$6,246	$7,850	$3,281	$2,697	$1,828	$1,860	$32,079
Screening Compost	$594	$749	$637	$898	$3,002	$4,702	$7,947	$9,987	$4,174	$3,431	$2,326	$2,366	$40,813
Moving Screened Compost to Storage	$370	$466	$396	$558	$1,868	$2,926	$4,945	$6,214	$2,597	$2,135	$1,447	$1,472	$25,395
Moving Overs to Storage	$113	$143	$121	$171	$572	$896	$1,515	$1,903	$796	$654	$443	$451	$7,779
Product Marketing & Sales	$290	$366	$311	$438	$1,466	$2,296	$3,880	$4,875	$2,038	$1,675	$1,135	$1,155	$19,924
Cost of Compost Production	$5,212	$6,569	$5,586	$7,869	$26,320	$41,227	$69,676	$87,557	$36,596	$30,079	$20,389	$20,747	$357,828
Administrative Costs													
Capital Recovery - equipment	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$41,297
Capital Recovery - site improvements	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$159,791
Housekeeping, Monitoring & Recordkeepin	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$20,736
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Admin Costs	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$221,825
Net Income	**($20,765)**	**($5,645)**	**$26,748**	**$34,888**	**$2,167**	**($8,033)**	**($51,125)**	**($53,588)**	**$21,561**	**$17,024**	**($9,530)**	**($5,193)**	**($51,491)**

Martha's Vineyard Windrow Composting

Pro Forma Assumptions - 2021

Capacity = 10,000 tons/year

Revenues:

1. Tip fees =		$53.00	per ton
Tip fee tons per year =		4,000	tons/year
2. Compost sales price =			
Commercial sales	$	25.00	per CY
Residential sales	$	35.00	per CY
Commercial =		75%	
Residential =		25%	
3. Compost sales distribution:			
Annual quantity =		19,000	CY/year

Assume sales timing :

January	0.2%
February	4.4%
March	12.8%
April	15.3%
May	9.5%
June	9.1%
July	2.1%
August	4.2%
September	16.2%
October	14.0%
November	5.5%
December	6.7%
	100.0%

Cost of Compost Production

1. From spreadsheet "Windrow Opex Estimate"

		Annual Costs
Waste Receipt	$	17,300
Grinding/shredding	$	43,858
Transport to pad	$	60,548
Building windrows	$	51,899
Windrow Mixing & Turning	$	28,859
Windrow Irrigation	$	-
Moving Compost to Curing	$	36,329
Managing Curing Piles	$	33,042
Screening Compost	$	42,038
Moving Screened Compost to Storage	$	26,157
Moving Overs to Storage	$	8,012
Product Marketing & Sales	$	20,522

2. Assume costs are distributed through the year proportional to incoming loads:

January	1.5%
February	1.8%
March	1.6%
April	2.2%
May	7.4%
June	11.5%
July	19.5%
August	24.5%
September	10.2%
October	8.4%
November	5.7%
December	5.8%

3. Assume production costs increase by 3% annually in 2020 and 2021

Administrative Costs

1. Capital cost recovery factor for equipment =		3.75%	per year	< 12-yr life
Estimated capex for equipment =	$	1,101,265		
2. Capital cost recovery factor for site improvements =		5.5%	per year	20 yrs
Estimated capex Phase I =	$	2,905,300		
3. Housekeeping, Monitoring & Recordkeeping				
Remaining time after materials handling		1.6	hrs/day/FTE	
Assume loaded labor rate =	$	22.50	per hour	

Martha's Vineyard Windrow Composting

4,000 ton/year food waste capacity (2021 tip fee tonnage = 4,000 tons; 2021 compost production = 19,000 CY/yr

For the Year Ending 12/31/2021

	January	February	March	April	May	June	July	August	September	October	November	December	YTD
Revenue													
Tip Fees	$3,088	$3,892	$3,310	$4,662	$15,594	$24,425	$41,281	$51,875	$21,682	$17,821	$12,080	$12,292	$212,000
Compost Sales - commercial	$713	$15,675	$45,600	$54,506	$33,844	$32,419	$7,481	$14,963	$57,713	$49,875	$19,594	$23,869	$356,250
Compost Sales - residential	$333	$7,315	$21,280	$25,436	$15,794	$15,129	$3,491	$6,983	$26,933	$23,275	$9,144	$11,139	$166,250
<Other Revenue>	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Sales	$4,133	$26,882	$70,190	$84,605	$65,231	$71,973	$52,253	$73,820	$106,327	$90,971	$40,817	$47,300	$734,500
Cost of Compost Production													
Waste Receipt	$252	$318	$270	$380	$1,272	$1,993	$3,369	$4,233	$1,769	$1,454	$986	$1,003	$17,300
Grinding/shredding	$639	$805	$685	$964	$3,226	$5,053	$8,540	$10,732	$4,485	$3,687	$2,499	$2,543	$43,858
Transport to pad	$882	$1,112	$945	$1,332	$4,454	$6,976	$11,790	$14,816	$6,192	$5,090	$3,450	$3,511	$60,548
Building windrows	$756	$953	$810	$1,141	$3,817	$5,979	$10,106	$12,699	$5,308	$4,363	$2,957	$3,009	$51,899
Windrow Mixing & Turning	$420	$530	$451	$635	$2,123	$3,325	$5,619	$7,062	$2,951	$2,426	$1,644	$1,673	$28,859
Windrow Irrigation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Moving Compost to Curing	$529	$667	$567	$799	$2,672	$4,186	$7,074	$8,889	$3,715	$3,054	$2,070	$2,106	$36,329
Managing Curing Piles	$481	$607	$516	$727	$2,430	$3,807	$6,434	$8,085	$3,379	$2,777	$1,883	$1,916	$33,042
Screening Compost	$612	$772	$656	$924	$3,092	$4,843	$8,186	$10,286	$4,299	$3,534	$2,395	$2,437	$42,038
Moving Screened Compost to Storage	$381	$480	$408	$575	$1,924	$3,014	$5,093	$6,400	$2,675	$2,199	$1,490	$1,517	$26,157
Moving Overs to Storage	$117	$147	$125	$176	$589	$923	$1,560	$1,960	$819	$673	$457	$465	$8,012
Product Marketing & Sales	$299	$377	$320	$451	$1,510	$2,364	$3,996	$5,022	$2,099	$1,725	$1,169	$1,190	$20,522
Cost of Compost Production	$5,369	$6,766	$5,754	$8,105	$27,110	$42,463	$71,767	$90,184	$37,694	$30,981	$21,001	$21,370	$368,563
Administrative Costs													
Capital Recovery - equipment	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$3,441	$41,297
Capital Recovery - site improvements	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$13,316	$159,791
Housekeeping, Monitoring & Recordkeepin	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$20,736
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Admin Costs	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$18,485	$221,825
Net Income	**($19,721)**	**$1,631**	**$45,950**	**$58,014**	**$19,636**	**$11,024**	**($37,999)**	**($34,850)**	**$50,148**	**$41,504**	**$1,331**	**$7,444**	**$144,112**

Martha's Vineyard Windrow / ASP Composting

Pro Forma Assumptions - 2019
Capacity = 10,000 tons/year

Revenues:

1. Tip fees =		$50.00	per ton
Tip fee tons per year =		2,215	tons/year
2. Compost sales price =			
Commercial sales	$	25.00	per CY
Residential sales	$	35.00	per CY
Commercial =		75%	
Residential =		25%	
3. Compost sales distribution:			
Annual quantity =		10,500	CY/year
Assume sales timing :			
January		0.2%	
February		4.4%	
March		12.8%	
April		15.3%	
May		9.5%	
June		9.1%	
July		2.1%	
August		4.2%	
September		16.2%	
October		14.0%	
November		5.5%	
December		6.7%	
		100.0%	

Cost of Compost Production

1. From spreadsheet "Windrow Opex Estimate"

		Annual Costs
Waste Receipt	$	16,306
Grinding/shredding	$	41,340
Mixing	$	90,966
Transport to pad	$	51,365
Building ASPs	$	58,703
Electricity	$	78,122
Moving Compost to Curing	$	35,956
Managing Curing Piles	$	32,123
Screening Compost	$	22,489
Moving Screened Compost to Storage	$	25,888
Moving Overs to Storage	$	6,472
Product Marketing & Sales	$	19,344

2. Assume costs are distributed through the year proportional to incoming loads:

January	1.5%
February	1.8%
March	1.6%
April	2.2%
May	7.4%
June	11.5%
July	19.5%
August	24.5%
September	10.2%
October	8.4%
November	5.7%
December	5.8%

3. Assume production costs increase by 3% annually in 2020 and 2021

Administrative Costs

1. Capital cost recovery factor for equipment =		3.75%	per year	< 12-yr life
Estimated capex for equipment =	$	917,414		
2. Capital cost recovery factor for site improvements =		5.5%	per year	20 yrs
Estimated capex Phase I =	$	2,779,953		
3. Housekeeping, Monitoring & Recordkeeping				
Remaining time after materials handling		1.6	hrs/day/FTE	
Assume loaded labor rate =	$	22.50	per hour	

Martha's Vineyard ASP Composting

4,000 ton/year food waste capacity (2019 tip fee tonnage = 2,215 tons; 2019 compost production = 10,500 CY/yr

For the Year Ending 12/31/2019

	January	February	March	April	May	June	July	August	September	October	November	December	YTD
Revenue													
Tip Fees	$1,613	$2,033	$1,729	$2,436	$8,146	$12,760	$21,565	$27,100	$11,327	$9,310	$6,311	$6,421	$110,750
Compost Sales - commercial	$394	$8,663	$25,200	$30,122	$18,703	$17,916	$4,134	$8,269	$31,894	$27,563	$10,828	$13,191	$196,875
Compost Sales - residential	$184	$4,043	$11,760	$14,057	$8,728	$8,361	$1,929	$3,859	$14,884	$12,863	$5,053	$6,156	$91,875
<Other Revenue>	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Sales	$2,191	$14,738	$38,689	$46,614	$35,578	$39,036	$27,629	$39,227	$58,104	$49,735	$22,192	$25,768	$399,500
Cost of Compost Production													
Waste Receipt	$238	$299	$255	$359	$1,199	$1,879	$3,175	$3,990	$1,668	$1,371	$929	$945	$16,306
Grinding/shredding	$602	$759	$645	$909	$3,041	$4,763	$8,050	$10,116	$4,228	$3,475	$2,356	$2,397	$41,340
Mixing	$1,325	$1,670	$1,420	$2,000	$6,691	$10,481	$17,713	$22,259	$9,303	$7,647	$5,183	$5,274	$90,966
Transport to pad	$748	$943	$802	$1,130	$3,778	$5,918	$10,002	$12,569	$5,253	$4,318	$2,927	$2,978	$51,365
Building ASPs	$855	$1,078	$916	$1,291	$4,318	$6,763	$11,431	$14,364	$6,004	$4,935	$3,345	$3,404	$58,703
Electricity	$1,138	$1,434	$1,220	$1,718	$5,746	$9,001	$15,212	$19,116	$7,990	$6,567	$4,451	$4,530	$78,122
Moving Compost to Curing	$524	$660	$561	$791	$2,645	$4,143	$7,001	$8,798	$3,677	$3,022	$2,049	$2,085	$35,956
Managing Curing Piles	$468	$590	$501	$706	$2,363	$3,701	$6,255	$7,860	$3,285	$2,700	$1,830	$1,863	$32,123
Screening Compost	$328	$413	$351	$495	$1,654	$2,591	$4,379	$5,503	$2,300	$1,890	$1,281	$1,304	$22,489
Moving Screened Compost to Storage	$377	$475	$404	$569	$1,904	$2,983	$5,041	$6,335	$2,648	$2,176	$1,475	$1,501	$25,888
Moving Overs to Storage	$94	$119	$101	$142	$476	$746	$1,260	$1,584	$662	$544	$369	$375	$6,472
Product Marketing & Sales	$282	$355	$302	$425	$1,423	$2,229	$3,767	$4,733	$1,978	$1,626	$1,102	$1,122	$19,344
Cost of Compost Production	$6,978	$8,795	$7,479	$10,535	$35,239	$55,196	$93,286	$117,226	$48,996	$40,271	$27,298	$27,778	$479,075
Administrative Costs													
Capital Recovery - equipment	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$34,403
Capital Recovery - site improvements	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$152,897
Housekeeping, Monitoring & Recordkeepin	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$20,736
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Admin Costs	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$208,036
Net Income	**($22,124)**	**($11,393)**	**$13,873**	**$18,743**	**($16,997)**	**($33,496)**	**($82,993)**	**($95,335)**	**($8,228)**	**($7,873)**	**($22,442)**	**($19,346)**	**($287,612)**

Martha's Vineyard Windrow / ASP Composting

Pro Forma Assumptions - 2020

Capacity = 10,000 tons/year

Revenues:

1. Tip fees =		$51.50	per ton
Tip fee tons per year =		2,900	tons/year
2. Compost sales price =			
Commercial sales	$	25.00	per CY
Residential sales	$	35.00	per CY
Commercial =		75%	
Residential =		25%	
3. Compost sales distribution:			
Annual quantity =		13,775	CY/year
Assume sales timing :			
January		0.2%	
February		4.4%	
March		12.8%	
April		15.3%	
May		9.5%	
June		9.1%	
July		2.1%	
August		4.2%	
September		16.2%	
October		14.0%	
November		5.5%	
December		6.7%	
		100.0%	

Cost of Compost Production

1. From spreadsheet "Windrow Opex Estimate"

		Annual Costs
Waste Receipt	$	16,796
Grinding/shredding	$	42,580
Mixing	$	93,695
Transport to pad	$	52,906
Building ASPs	$	60,464
Electricity	$	80,465
Moving Compost to Curing	$	37,034
Managing Curing Piles	$	33,087
Screening Compost	$	23,164
Moving Screened Compost to Storage	$	26,665
Moving Overs to Storage	$	6,666
Product Marketing & Sales	$	19,924

2. Assume costs are distributed through the year proportional to incoming loads:

January	1.5%
February	1.8%
March	1.6%
April	2.2%
May	7.4%
June	11.5%
July	19.5%
August	24.5%
September	10.2%
October	8.4%
November	5.7%
December	5.8%

3. Assume production costs increase by 3% annually in 2020 and 2021

Administrative Costs

1. Capital cost recovery factor for equipment =		3.75%	per year	< 12-yr life
Estimated capex for equipment =	$	917,414		
2. Capital cost recovery factor for site improvements =		5.5%	per year	20 yrs
Estimated capex Phase I =	$	2,779,953		
3. Housekeeping, Monitoring & Recordkeeping				
Remaining time after materials handling		1.6	hrs/day/FTE	
Assume loaded labor rate =	$	22.50	per hour	

Martha's Vineyard ASP Composting

4,000 ton/year food waste capacity (2020 tip fee tonnage = 2,900 tons; 2020 compost production = 13,775 CY/yr

For the Year Ending 12/31/2020

	January	February	March	April	May	June	July	August	September	October	November	December	YTD
Revenue													
Tip Fees	$2,175	$2,742	$2,332	$3,284	$10,985	$17,207	$29,081	$36,545	$15,274	$12,554	$8,510	$8,660	$149,350
Compost Sales - commercial	$517	$11,364	$33,060	$39,517	$24,537	$23,504	$5,424	$10,848	$41,842	$36,159	$14,205	$17,305	$258,281
Compost Sales - residential	$241	$5,303	$15,428	$18,441	$11,450	$10,968	$2,531	$5,062	$19,526	$16,874	$6,629	$8,076	$120,531
<Other Revenue>	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Sales	$2,933	$19,409	$50,820	$61,243	$46,973	$51,679	$37,037	$52,455	$76,642	$65,588	$29,345	$34,040	$528,163
Cost of Compost Production													
Waste Receipt	$245	$308	$262	$369	$1,235	$1,935	$3,270	$4,110	$1,718	$1,412	$957	$974	$16,796
Grinding/shredding	$620	$782	$665	$936	$3,132	$4,906	$8,291	$10,419	$4,355	$3,579	$2,426	$2,469	$42,580
Mixing	$1,365	$1,720	$1,463	$2,060	$6,892	$10,795	$18,244	$22,926	$9,582	$7,876	$5,339	$5,433	$93,695
Transport to pad	$771	$971	$826	$1,163	$3,892	$6,096	$10,302	$12,946	$5,411	$4,447	$3,015	$3,068	$52,906
Building ASPs	$881	$1,110	$944	$1,330	$4,447	$6,966	$11,774	$14,795	$6,184	$5,083	$3,445	$3,506	$60,464
Electricity	$1,172	$1,477	$1,256	$1,770	$5,919	$9,271	$15,668	$19,689	$8,229	$6,764	$4,585	$4,666	$80,465
Moving Compost to Curing	$539	$680	$578	$814	$2,724	$4,267	$7,211	$9,062	$3,788	$3,113	$2,110	$2,147	$37,034
Managing Curing Piles	$482	$607	$517	$728	$2,434	$3,812	$6,443	$8,096	$3,384	$2,781	$1,885	$1,918	$33,087
Screening Compost	$337	$425	$362	$509	$1,704	$2,669	$4,510	$5,668	$2,369	$1,947	$1,320	$1,343	$23,164
Moving Screened Compost to Storage	$388	$489	$416	$586	$1,961	$3,072	$5,192	$6,525	$2,727	$2,241	$1,519	$1,546	$26,665
Moving Overs to Storage	$97	$122	$104	$147	$490	$768	$1,298	$1,631	$682	$560	$380	$387	$6,666
Product Marketing & Sales	$290	$366	$311	$438	$1,466	$2,296	$3,880	$4,875	$2,038	$1,675	$1,135	$1,155	$19,924
Cost of Compost Production	$7,188	$9,058	$7,704	$10,851	$36,296	$56,852	$96,084	$120,742	$50,466	$41,479	$28,117	$28,611	$493,448
Administrative Costs													
Capital Recovery - equipment	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$34,403
Capital Recovery - site improvements	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$152,897
Housekeeping, Monitoring & Recordkeepin	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$20,736
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Admin Costs	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$208,036
Net Income	**($21,591)**	**($6,985)**	**$25,780**	**$33,055**	**($6,659)**	**($22,509)**	**($76,384)**	**($85,624)**	**$8,840**	**$6,773**	**($16,108)**	**($11,907)**	**($173,322)**

Martha's Vineyard Windrow / ASP Composting

Pro Forma Assumptions - 2021

Capacity = 10,000 tons/year

Revenues:

1. Tip fees =		$53.00	per ton
Tip fee tons per year =		4,000	tons/year
2. Compost sales price =			
Commercial sales	$	25.00	per CY
Residential sales	$	35.00	per CY
Commercial =		75%	
Residential =		25%	
3. Compost sales distribution:			
Annual quantity =		19,000	CY/year

Assume sales timing :

January	0.2%
February	4.4%
March	12.8%
April	15.3%
May	9.5%
June	9.1%
July	2.1%
August	4.2%
September	16.2%
October	14.0%
November	5.5%
December	6.7%
	100.0%

Cost of Compost Production

1. From spreadsheet "Windrow Opex Estimate"

		Annual Costs
Waste Receipt	$	17,300
Grinding/shredding	$	43,858
Mixing	$	96,506
Transport to pad	$	54,494
Building ASPs	$	62,278
Electricity	$	82,879
Moving Compost to Curing	$	38,145
Managing Curing Piles	$	34,080
Screening Compost	$	23,859
Moving Screened Compost to Storage	$	27,465
Moving Overs to Storage	$	6,866
Product Marketing & Sales	$	20,522

2. Assume costs are distributed through the year proportional to incoming loads:

January	1.5%
February	1.8%
March	1.6%
April	2.2%
May	7.4%
June	11.5%
July	19.5%
August	24.5%
September	10.2%
October	8.4%
November	5.7%
December	5.8%

3. Assume production costs increase by 3% annually in 2020 and 2021

Administrative Costs

1. Capital cost recovery factor for equipment =		3.75%	per year	< 12-yr life
Estimated capex for equipment =	$	917,414		
2. Capital cost recovery factor for site improvements =		5.5%	per year	20 yrs
Estimated capex Phase I =	$	2,779,953		
3. Housekeeping, Monitoring & Recordkeeping				
Remaining time after materials handling		1.6	hrs/day/FTE	
Assume loaded labor rate =	$	22.50	per hour	

Martha's Vineyard ASP Composting

4,000 ton/year food waste capacity (2021 tip fee tonnage = 4,000 tons; 2021 compost production = 19,000 CY/yr

For the Year Ending 12/31/2021

	January	February	March	April	May	June	July	August	September	October	November	December	YTD
Revenue													
Tip Fees	$3,088	$3,892	$3,310	$4,662	$15,594	$24,425	$41,281	$51,875	$21,682	$17,821	$12,080	$12,292	$212,000
Compost Sales - commercial	$713	$15,675	$45,600	$54,506	$33,844	$32,419	$7,481	$14,963	$57,713	$49,875	$19,594	$23,869	$356,250
Compost Sales - residential	$333	$7,315	$21,280	$25,436	$15,794	$15,129	$3,491	$6,983	$26,933	$23,275	$9,144	$11,139	$166,250
<Other Revenue>	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Sales	$4,133	$26,882	$70,190	$84,605	$65,231	$71,973	$52,253	$73,820	$106,327	$90,971	$40,817	$47,300	$734,500
Cost of Compost Production													
Waste Receipt	$252	$318	$270	$380	$1,272	$1,993	$3,369	$4,233	$1,769	$1,454	$986	$1,003	$17,300
Grinding/shredding	$639	$805	$685	$964	$3,226	$5,053	$8,540	$10,732	$4,485	$3,687	$2,499	$2,543	$43,858
Mixing	$1,406	$1,772	$1,507	$2,122	$7,099	$11,119	$18,792	$23,614	$9,870	$8,112	$5,499	$5,596	$96,506
Transport to pad	$794	$1,000	$851	$1,198	$4,008	$6,278	$10,611	$13,334	$5,573	$4,581	$3,105	$3,160	$54,494
Building ASPs	$907	$1,143	$972	$1,370	$4,581	$7,175	$12,127	$15,239	$6,369	$5,235	$3,549	$3,611	$62,278
Electricity	$1,207	$1,521	$1,294	$1,823	$6,096	$9,549	$16,138	$20,280	$8,476	$6,967	$4,722	$4,805	$82,879
Moving Compost to Curing	$556	$700	$596	$839	$2,806	$4,395	$7,428	$9,334	$3,901	$3,206	$2,174	$2,212	$38,145
Managing Curing Piles	$496	$626	$532	$749	$2,507	$3,926	$6,636	$8,339	$3,485	$2,865	$1,942	$1,976	$34,080
Screening Compost	$348	$438	$372	$525	$1,755	$2,749	$4,646	$5,838	$2,440	$2,006	$1,359	$1,383	$23,859
Moving Screened Compost to Storage	$400	$504	$429	$604	$2,020	$3,164	$5,348	$6,720	$2,809	$2,309	$1,565	$1,592	$27,465
Moving Overs to Storage	$100	$126	$107	$151	$505	$791	$1,337	$1,680	$702	$577	$391	$398	$6,866
Product Marketing & Sales	$299	$377	$320	$451	$1,510	$2,364	$3,996	$5,022	$2,099	$1,725	$1,169	$1,190	$20,522
Cost of Compost Production	$7,403	$9,330	$7,935	$11,177	$37,385	$58,557	$98,967	$124,365	$51,980	$42,723	$28,960	$29,469	$508,251
Administrative Costs													
Capital Recovery - equipment	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$2,867	$34,403
Capital Recovery - site improvements	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$12,741	$152,897
Housekeeping, Monitoring & Recordkeepin	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$1,728	$20,736
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Admin Costs	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$17,336	$208,036
Net Income	**($20,607)**	**$215**	**$44,919**	**$56,091**	**$10,510**	**($3,921)**	**($64,050)**	**($67,881)**	**$37,010**	**$30,911**	**($5,479)**	**$494**	**$18,213**

Martha's Vineyard Rotary Drum Composting

Pro Forma Assumptions - 2019

Capacity = 10,000 tons/year

Revenues:

1. Tip fees =	$50.00	per ton
Tip fee tons per year =	2,215	tons/year
2. Compost sales price =		
Commercial sales	$ 25.00	per CY
Residential sales	$ 35.00	per CY
Commercial =	75%	
Residential =	25%	
3. Compost sales distribution:		
Annual quantity =	10,500	CY/year
Assume sales timing :		
January	0.2%	
February	4.4%	
March	12.8%	
April	15.3%	
May	9.5%	
June	9.1%	
July	2.1%	
August	4.2%	
September	16.2%	
October	14.0%	
November	5.5%	
December	6.7%	
	100.0%	

Cost of Compost Production

1. From spreadsheet "Drum Opex Estimate"

	Annual Costs
Waste Receipt	$ 16,306
Grinding/shredding	$ 41,340
Transport to pad	$ 57,073
Loading Rotary Drum	$ 19,344
Operating Rotary Drum	$ 28,852
Moving Compost to Curing	$ 39,951
Managing Curing Piles	$ 73,379
Screening Compost	$ 41,606
Moving Cured Compost to Storage	$ 35,956
Move Overs to Storage	$ 7,728
Product Marketing & Sales	$ 19,344

2. Assume costs are distributed through the year proportional to incoming loads:

January	1.5%
February	1.8%
March	1.6%
April	2.2%
May	7.4%
June	11.5%
July	19.5%
August	24.5%
September	10.2%
October	8.4%
November	5.7%
December	5.8%

3. Assume production costs increase by 3% annually in 2020 and 2021

Administrative Costs

1. Capital cost recovery factor for equipment =	3.75%	per year	< 12-yr life
Estimated capex for equipment =	$ 3,040,550		
2. Capital cost recovery factor for site improvements =	5.5%	per year	20 yrs
Estimated capex Phase I =	$ 2,856,368		
3. Housekeeping, Monitoring & Recordkeeping			
Remaining time after materials handling	3.8	hrs/day/FTE	
Assume loaded labor rate =	$ 22.50	per hour	

Martha's Vineyard Rotary Drum Composting

4,000 ton/year food waste capacity (2019 tip fee tonnage = 2,215 tons; 2019 compost production = 10,500 CY/yr

For the Year Ending 12/31/2019

	January	February	March	April	May	June	July	August	September	October	November	December	YTD
Revenue													
Tip Fees	$222	$4,873	$14,176	$16,945	$10,521	$10,078	$2,326	$4,652	$17,942	$15,505	$6,091	$7,420	$110,750
Compost Sales - commercial	$394	$8,663	$25,200	$30,122	$18,703	$17,916	$4,134	$8,269	$31,894	$27,563	$10,828	$13,191	$196,875
Compost Sales - residential	$184	$4,043	$11,760	$14,057	$8,728	$8,361	$1,929	$3,859	$14,884	$12,863	$5,053	$6,156	$91,875
<Other Revenue>	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Sales	$799	$17,578	$51,136	$61,124	$37,953	$36,355	$8,390	$16,779	$64,719	$55,930	$21,973	$26,767	$399,500
Cost of Compost Production													
Waste Receipt	$238	$299	$255	$359	$1,199	$1,879	$3,175	$3,990	$1,668	$1,371	$929	$945	$16,306
Grinding/shredding	$602	$759	$645	$909	$3,041	$4,763	$8,050	$10,116	$4,228	$3,475	$2,356	$2,397	$41,340
Transport to pad	$831	$1,048	$891	$1,255	$4,198	$6,576	$11,113	$13,965	$5,837	$4,798	$3,252	$3,309	$57,073
Loading Rotary Drum	$282	$355	$302	$425	$1,423	$2,229	$3,767	$4,733	$1,978	$1,626	$1,102	$1,122	$19,344
Operating Rotary Drum	$2,404	$2,404	$2,404	$2,404	$2,404	$2,404	$2,404	$2,404	$2,404	$2,404	$2,404	$2,404	$28,852
Moving Compost to Curing	$582	$733	$624	$879	$2,939	$4,603	$7,779	$9,776	$4,086	$3,358	$2,276	$2,316	$39,951
Managing Curing Piles	$1,069	$1,347	$1,146	$1,614	$5,397	$8,454	$14,288	$17,955	$7,505	$6,168	$4,181	$4,255	$73,379
Screening Compost	$606	$764	$650	$915	$3,060	$4,794	$8,102	$10,181	$4,255	$3,497	$2,371	$2,412	$41,606
Moving Screened Compost to Storage	$524	$660	$561	$791	$2,645	$4,143	$7,001	$8,798	$3,677	$3,022	$2,049	$2,085	$35,956
Screening Compost	$113	$142	$121	$170	$568	$890	$1,505	$1,891	$790	$650	$440	$448	$7,728
Product Marketing & Sales	$282	$355	$302	$425	$1,423	$2,229	$3,767	$4,733	$1,978	$1,626	$1,102	$1,122	$19,344
Cost of Compost Production	$7,532	$8,867	$7,900	$10,146	$28,298	$42,963	$70,951	$88,542	$38,407	$31,996	$22,463	$22,815	$380,879
Administrative Costs													
Capital Recovery - equipment	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$114,021
Capital Recovery - site improvements	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$157,100
Housekeeping, Monitoring & Recordkeepin	$4,104	$4,104	$4,104	$4,104	$4,104	$4,104	$4,104	$4,104	$4,104	$4,104	$4,104	$4,104	$49,248
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Admin Costs	$26,697	$26,697	$26,697	$26,697	$26,697	$26,697	$26,697	$26,697	$26,697	$26,697	$26,697	$26,697	$320,369
Net Income	**($33,430)**	**($17,986)**	**$16,539**	**$24,280**	**($17,043)**	**($33,306)**	**($89,259)**	**($98,461)**	**($385)**	**($2,763)**	**($27,188)**	**($22,746)**	**($301,748)**

Martha's Vineyard Drum Composting

Pro Forma Assumptions - 2020
Capacity = 10,000 tons/year

Revenues:

1. Tip fees =	$51.50	per ton
Tip fee tons per year =	2,900	tons/year
2. Compost sales price =		
Commercial sales	$ 25.00	per CY
Residential sales	$ 35.00	per CY
Commercial =	75%	
Residential =	25%	
3. Compost sales distribution:		
Annual quantity =	13,775	CY/year
Assume sales timing :		
January	0.2%	
February	4.4%	
March	12.8%	
April	15.3%	
May	9.5%	
June	9.1%	
July	2.1%	
August	4.2%	
September	16.2%	
October	14.0%	
November	5.5%	
December	6.7%	
	100.0%	

Cost of Compost Production

1. From spreadsheet "Drum Opex Estimate"

	Annual Costs
Waste Receipt	$ 16,796
Grinding/shredding	$ 42,580
Transport to pad	$ 52,906
Loading Rotary Drum	$ 19,924
Operating Rotary Drum	$ 29,717
Moving Compost to Curing	$ 37,034
Managing Curing Piles	$ 68,022
Screening Compost	$ 42,854
Moving Cured Compost to Storage	$ 26,665
Move Overs to Storage	$ 7,960
Product Marketing & Sales	$ 19,924

2. Assume costs are distributed through the year proportional to incoming loads:

January	1.5%
February	1.8%
March	1.6%
April	2.2%
May	7.4%
June	11.5%
July	19.5%
August	24.5%
September	10.2%
October	8.4%
November	5.7%
December	5.8%

3. Assume production costs increase by 3% annually in 2020 and 2021

Administrative Costs

1. Capital cost recovery factor for equipment =	3.75%	per year	< 12-yr life
Estimated capex for equipment =	$ 3,040,550		
2. Capital cost recovery factor for site improvements =	5.5%	per year	20 yrs
Estimated capex Phase I =	$ 2,856,368		
3. Housekeeping, Monitoring & Recordkeeping			
Remaining time after materials handling	3.8	hrs/day/FTE	
Assume loaded labor rate =	$ 23.18	per hour	

Martha's Vineyard Rotary Drum Composting

4,000 ton/year food waste capacity (2019 tip fee tonnage = 2,215 tons; 2019 compost production = 10,500 CY/yr

For the Year Ending 12/31/2020

	January	February	March	April	May	June	July	August	September	October	November	December	YTD
Revenue													
Tip Fees	$299	$6,571	$19,117	$22,851	$14,188	$13,591	$3,136	$6,273	$24,195	$20,909	$8,214	$10,006	$149,350
Compost Sales - commercial	$517	$11,364	$33,060	$39,517	$24,537	$23,504	$5,424	$10,848	$41,842	$36,159	$14,205	$17,305	$258,281
Compost Sales - residential	$241	$5,303	$15,428	$18,441	$11,450	$10,968	$2,531	$5,062	$19,526	$16,874	$6,629	$8,076	$120,531
<Other Revenue>	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Sales	$1,056	$23,239	$67,605	$80,809	$50,175	$48,063	$11,091	$22,183	$85,562	$73,943	$29,049	$35,387	$528,163
Cost of Compost Production													
Waste Receipt	$245	$308	$262	$369	$1,235	$1,935	$3,270	$4,110	$1,718	$1,412	$957	$974	$16,796
Grinding/shredding	$620	$782	$665	$936	$3,132	$4,906	$8,291	$10,419	$4,355	$3,579	$2,426	$2,469	$42,580
Transport to pad	$771	$971	$826	$1,163	$3,892	$6,096	$10,302	$12,946	$5,411	$4,447	$3,015	$3,068	$52,906
Loading Rotary Drum	$290	$366	$311	$438	$1,466	$2,296	$3,880	$4,875	$2,038	$1,675	$1,135	$1,155	$19,924
Operating Rotary Drum	$2,476	$2,476	$2,476	$2,476	$2,476	$2,476	$2,476	$2,476	$2,476	$2,476	$2,476	$2,476	$29,717
Moving Compost to Curing	$539	$680	$578	$814	$2,724	$4,267	$7,211	$9,062	$3,788	$3,113	$2,110	$2,147	$37,034
Managing Curing Piles	$991	$1,249	$1,062	$1,496	$5,003	$7,837	$13,245	$16,645	$6,957	$5,718	$3,876	$3,944	$68,022
Screening Compost	$624	$787	$669	$942	$3,152	$4,937	$8,345	$10,486	$4,383	$3,602	$2,442	$2,485	$42,854
Moving Screened Compost to Storage	$388	$489	$416	$586	$1,961	$3,072	$5,192	$6,525	$2,727	$2,241	$1,519	$1,546	$26,665
Move Overs to Storage	$116	$146	$124	$175	$586	$917	$1,550	$1,948	$814	$669	$454	$462	$7,960
Product Marketing & Sales	$290	$366	$311	$438	$1,466	$2,296	$3,880	$4,875	$2,038	$1,675	$1,135	$1,155	$19,924
Cost of Compost Production	$7,351	$8,620	$7,701	$9,836	$27,093	$41,035	$67,643	$84,366	$36,704	$30,608	$21,546	$21,881	$364,384
Administrative Costs													
Capital Recovery - equipment	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$114,021
Capital Recovery - site improvements	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$157,100
Housekeeping, Monitoring & Recordkeepin	$4,227	$4,227	$4,227	$4,227	$4,227	$4,227	$4,227	$4,227	$4,227	$4,227	$4,227	$4,227	$50,725
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Admin Costs	$26,821	$26,821	$26,821	$26,821	$26,821	$26,821	$26,821	$26,821	$26,821	$26,821	$26,821	$26,821	$321,846
Net Income	**($33,115)**	**($12,201)**	**$33,083**	**$44,152**	**($3,738)**	**($19,792)**	**($83,372)**	**($89,004)**	**$22,038**	**$16,514**	**($19,317)**	**($13,315)**	**($158,068)**

Martha's Vineyard Drum Composting

Pro Forma Assumptions - 2021

Capacity = 10,000 tons/year

Revenues:

1. Tip fees =	$53.00	per ton
Tip fee tons per year =	4,000	tons/year
2. Compost sales price =		
Commercial sales	$ 25.00	per CY
Residential sales	$ 35.00	per CY
Commercial =	75%	
Residential =	25%	
3. Compost sales distribution:		
Annual quantity =	19,000	CY/year
Assume sales timing :		
January	0.2%	
February	4.4%	
March	12.8%	
April	15.3%	
May	9.5%	
June	9.1%	
July	2.1%	
August	4.2%	
September	16.2%	
October	14.0%	
November	5.5%	
December	6.7%	
	100.0%	

Cost of Compost Production

1. From spreadsheet "Drum Opex Estimate"

	Annual Costs
Waste Receipt	$ 17,300
Grinding/shredding	$ 43,858
Transport to pad	$ 54,494
Loading Rotary Drum	$ 20,522
Operating Rotary Drum	$ 30,609
Moving Compost to Curing	$ 38,145
Managing Curing Piles	$ 70,063
Screening Compost	$ 44,140
Moving Cured Compost to Storage	$ 27,465
Move Overs to Storage	$ 8,199
Product Marketing & Sales	$ 20,522

2. Assume costs are distributed through the year proportional to incoming loads:

January	1.5%
February	1.8%
March	1.6%
April	2.2%
May	7.4%
June	11.5%
July	19.5%
August	24.5%
September	10.2%
October	8.4%
November	5.7%
December	5.8%

3. Assume production costs increase by 3% annually in 2020 and 2021

Administrative Costs

1. Capital cost recovery factor for equipment =	3.75%	per year	< 12-yr life
Estimated capex for equipment =	$ 3,040,550		
2. Capital cost recovery factor for site improvements =	5.5%	per year	20 yrs
Estimated capex Phase I =	$ 2,856,368		
3. Housekeeping, Monitoring & Recordkeeping			
Remaining time after materials handling	3.8	hrs/day/FTE	
Assume loaded labor rate =	$ 23.87	per hour	

Martha's Vineyard Rotary Drum Composting

4,000 ton/year food waste capacity (2019 tip fee tonnage = 2,215 tons; 2019 compost production = 10,500 CY/yr

For the Year Ending 12/31/2021

	January	February	March	April	May	June	July	August	September	October	November	December	YTD
Revenue													
Tip Fees	$424	$9,328	$27,136	$32,436	$20,140	$19,292	$4,452	$8,904	$34,344	$29,680	$11,660	$14,204	$212,000
Compost Sales - commercial	$713	$15,675	$45,600	$54,506	$33,844	$32,419	$7,481	$14,963	$57,713	$49,875	$19,594	$23,869	$356,250
Compost Sales - residential	$333	$7,315	$21,280	$25,436	$15,794	$15,129	$3,491	$6,983	$26,933	$23,275	$9,144	$11,139	$166,250
<Other Revenue>	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Sales	$1,469	$32,318	$94,016	$112,379	$69,778	$66,840	$15,425	$30,849	$118,989	$102,830	$40,398	$49,212	$734,500
Cost of Compost Production													
Waste Receipt	$252	$318	$270	$380	$1,272	$1,993	$3,369	$4,233	$1,769	$1,454	$986	$1,003	$17,300
Grinding/shredding	$639	$805	$685	$964	$3,226	$5,053	$8,540	$10,732	$4,485	$3,687	$2,499	$2,543	$43,858
Transport to pad	$794	$1,000	$851	$1,198	$4,008	$6,278	$10,611	$13,334	$5,573	$4,581	$3,105	$3,160	$54,494
Loading Rotary Drum	$299	$377	$320	$451	$1,510	$2,364	$3,996	$5,022	$2,099	$1,725	$1,169	$1,190	$20,522
Operating Rotary Drum	$2,551	$2,551	$2,551	$2,551	$2,551	$2,551	$2,551	$2,551	$2,551	$2,551	$2,551	$2,551	$30,609
Moving Compost to Curing	$556	$700	$596	$839	$2,806	$4,395	$7,428	$9,334	$3,901	$3,206	$2,174	$2,212	$38,145
Managing Curing Piles	$1,021	$1,286	$1,094	$1,541	$5,154	$8,072	$13,643	$17,144	$7,166	$5,889	$3,992	$4,062	$70,063
Screening Compost	$643	$810	$689	$971	$3,247	$5,086	$8,595	$10,801	$4,514	$3,710	$2,515	$2,559	$44,140
Moving Screened Compost to Storage	$400	$504	$429	$604	$2,020	$3,164	$5,348	$6,720	$2,809	$2,309	$1,565	$1,592	$27,465
Move Overs to Storage	$119	$151	$128	$180	$603	$945	$1,597	$2,006	$839	$689	$467	$475	$8,199
Product Marketing & Sales	$299	$377	$320	$451	$1,510	$2,364	$3,996	$5,022	$2,099	$1,725	$1,169	$1,190	$20,522
Cost of Compost Production	$7,572	$8,879	$7,932	$10,131	$27,906	$42,266	$69,672	$86,897	$37,805	$31,527	$22,192	$22,537	$375,316
Administrative Costs													
Capital Recovery - equipment	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$9,502	$114,021
Capital Recovery - site improvements	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$13,092	$157,100
Housekeeping, Monitoring & Recordkeepin	$4,354	$4,354	$4,354	$4,354	$4,354	$4,354	$4,354	$4,354	$4,354	$4,354	$4,354	$4,354	$52,247
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Admin Costs	$26,947	$26,947	$26,947	$26,947	$26,947	$26,947	$26,947	$26,947	$26,947	$26,947	$26,947	$26,947	$323,368
Net Income	**($33,050)**	**($3,508)**	**$59,137**	**$75,300**	**$14,924**	**($2,373)**	**($81,195)**	**($82,996)**	**$54,237**	**$44,356**	**($8,742)**	**($273)**	**$35,816**

Appendix G - Sustainable Alternative Feed Enterprises proposal

SAFE
SUSTAINABLE ALTERNATIVE FEED ENTERPRISES

April 10, 2018

MARTHA'S VINEYARD – FOOD RECOVERY SYSTEM

Proposal Number: 2018xxxx-SAFE

Proposal Date: mmm dd yyyy

Prepared For: Bob Spencer, Environmental Planning Consultant / Martha's Vineyard – Food Recovery Project - Budgetary consideration only.

The following is not a formal proposal, but budgetary data and explanation of project work required to construct a food recovery facility capable of handling approximately 300 tons per day of post-consumer food scraps from commercial establishments. The flow of material, yield of recovered product, mass balance and flow of material is based on this assumption.

The cost data is representative of a system that is capable of handling the throughput you describe, however no analysis for your specific site, your processing needs, operational constraints have been taken into account. As such your costs could be significantly different. Also, equipment deliver lead times are based on end of year 2017 estimates and may be longer now. Raw material costs are also expected to rise based on steel tariffs not anticipated when this was generated.

CONFIDENTIAL

CONFIDENTIALITY STATEMENT

THE INFORMATION CONTAINED WITHIN THIS DOCUMENT IS THE INTELLECTUAL PROPERTY OF SUSTAINABLE ALTERNATIVE FEED ENTERPRISES, INC (SAFE). THE CONTENT PROVIDED IS CONSIDERED CONFIDENTIAL AND PROPRIETARY IN NATURE. THE INFORMATION IS NOT TO BE COPIED OR CIRCULATED TO ANY SECONDARY PARTIES OR UNINTENDED SOURCES WITHOUT THE EXPRESSED WRITTEN CONSENT OF S.A.F.E.

The following is for budgetary and planning considerations only. Any work, service, or sale shall be initiated and executed under the terms of a separate Purchase Agreement or Service Contract **NOT** contained herein.

April 09, 2018

Mr. Bob Spencer

Dear Bob,

SAFE is pleased to offer this budgetary estimate for Martha's Vineyard for a food recovery facility. We appreciate the opportunity to collaborate with you and your team to design and implement what we believe is the complete solution to food waste recovery.

This information is based on generic information from our experience building and operating our facility in Santa Clara, CA as well as design work and research we have collected from engineers, contractors, and vendors on constructing a facility to process up to 300 tons per day of raw food waste from post consumer commercial entities, source separated to achieve less than 25% contamination. Our operational projections are based on our experience processing food waste, processing logs, lab tests, at our Santa Clara plant.

If asked to submit a proposal, we anticipate it would look similar to the following where we would map out a design phase to get the project off on the right foot. This thorough exercise can focus on fully developing detailed equipment specification first and expediting purchase agreements with suppliers to secure our place in their supply chain.

The intent of the following is to establish a starting place from which to engage on this project, to provide budgetary guidance, and get detailed information in your hands about the specific pieces of equipment that make up the system. We envision a collaborative process with your team to dial in operational parameters, equipment specifications, and pricing to meet your needs. Don't hesitate to reach out with any questions. We are excited by the prospect of working with you on this project and we look forward to doing what we can to best serve you in this endeavor.

Creg Shaffer

President / CEO
Sustainable Alternative Feed Enterprises, Inc.

PROJECT PROPOSAL -DRAFT

PROJECT DESCRIPTION

SAFE suggests a project to design, plan, build, and commission a food-scraps recovery and processing facility. The facility will house a system and processes designed and patented by Sustainable Alternative Feed Enterprises, Inc. (SAFE) to accept source separated food scraps. Generate produced by SAFE pre-processing facilities (budgetary numbers for pre-processing in separate document). The project proposed is based on SAFE's development, testing and experience building and operating similar systems in Santa Clara, California.

Due to the complexity and the cost of such a project, SAFE encourages a two-phase design approach that begins with a rigorous planning and design phase conducted by experienced industrial contractors and experts in plant design, The SAFE system, and the waste industry engaged by SAFE to work collaboratively with knowledgeable staff in operational requirements.

PROJECT PLAN – SUMMARY

PROJECT PHASE	DELIVERABLES
PHASE IA: SITE SELECTION / VALIDATION AND DESIGN - Conceptual Design / Drafting - Cost analysis	a. Capacity / Throughput modeling b. Preliminary equipment specs / costs c. System Requirements Document
PHASE IB: SITE SELECTION / VALIDATION AND DESIGN - Engineering - Architectural Drafting - Site permitting analysis	a. Complete bid package, RFQ b. Complete supply list, P&IDs c. Plant design specs, equipment layout, architectural rendering
PHASE II: CONSTRUCTION PLANNING & AQUISITION - Product characterization - Finalize equipment specs - Finalize equipment quotes	a. Industrial contractor signed to project b. Final process map c. Initial operating plan and estimated capital, startup, and operating costs d. Final mechanical requirements e. Equipment Purchase Orders f. Equipment delivery plan
END PLANNING AND DESIGN PROJECT	

At the conclusion of the *Planning and Design Phase*, outlined above, stakeholders will have detailed information regarding the overall project, plant construction, equipment delivery and installation, expected operating schedules, associated timelines, and finalized costs based on specific selections relative to non-required/ancillary equipment.

PROJECT PHASE	DELIVERABLES
PHASE III: SITE PREPARATION – TENANT IMPROVEMENTS - Building modifications per structural and mechanical plans - Building inspections, process regulatory reviews	a. Local regulatory approvals b. Local certificate of occupancy c. SAFE sign-off for equipment placement and process flow.
PHASE IV: EQUIPMENT INSTALLATION - Equipment delivery, placement, anchorage. - System mechanical integration - System electrical hookups - System controls integration - Operator interface (HMI) testing	a. Equipment install b. Piping and Plumbing in place c. Electrical hookups to equipment d. Low voltage control wiring, and control panel wiring complete e. Operator interfaces installed and sign-off f. Complete Alarm and Safety shut-offs
PHASE V: SYSTEM COMMISSIONING / TURNOVER - Equipment Unit Testing - System Integration Testing - Process rework, bug fix - Operator training	a. Isolated process Sign-off b. Integrated, full process sign-off c. System Turn-over

PHASE I AND II TIMELINE AND COSTS

To ensure the highest degree of success we propose a preliminary engagement to complete the first two phases. This level of effort and due diligence will produce significant and required insight into every detail of the buildout and system implementation project. It will provide the complete design and budget for the site improvements, the complete equipment and supply lists, and the budget for capital expenditures.

Phase One (Site Design & Planning) is expected to take approximately six weeks and achieve the major milestones required for site selection, forecasting project costs, and stakeholder buy-in for site prep & acquisition.

		Weeks													
Phase I: Site Design & Planning		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Activity 1	Conceptual Design														
Task 1.a	Validate Site and Throughput Requirements														
Milestone	Site and Throughput Requirements:														
Milestone	Conceptual Design Complete: Required Payment for Phase I:														
Task 1.b	Analysis and Planning - Project Specific														
Task 1.c	Refine Design														
Task 1.d	Refine Estimated Costs - Corresponde to Updated Design														
Milestone	Updated Design & Costs: Stakeholder Sigh-Off														
Activity 2	Engineering														
Task 2.a	Document site specific engineering requirements														
Task 2.b	Draft Architectural Plans														
Activity 3	Finalize Build Plan														
Task 3.a	Develop bid package														
Milestone	Final Bid Package: Stakeholder Sign-Off														

Phase Two, Construction Planning & Equipment Acquisition, will focus on selecting the general contractor and industrial contractors for the site tenant improvements and the system implementation, as well as generating the precise equipment specifications and generating purchase orders.

Phase II: Construction Planning & Acquisition		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Activity 4	Building Contractor Selection														
Task 4.a	Select / Contract with Building Contractor (Customer)														
Activity 5	Validate product characteristics														
Task 5.a	Analyze Local Product														
Activity 6	Finalize Equipment Order														
Task 6.a	Finalize equipment specs														
Task 6.b	Finalize all costs and timelines														
Milestone:	Approve project budget, Order Equipment, Required Payment Phase II														
Activity 7	Equip Delivery & Install Planning														
Task 7.a	Set plan and timelines for equipment delivery, rigging, and setup.														

Timelines and milestones are heavily dependent on factors that are often beyond the control of the project team. Our timelines, milestones, and costs assume typical turnaround times for site selection, local enforcement agency approvals and availability of TDI staff. Activities will be completed by team members assigned to project tasks as needed for hours required to meet deliverables and milestones.

PRELIMINARY PROJECT TEAM

To Be Determined – SAFE Team including Creg V Shaffer

SAFE CEO and Project Director

Mike Holman – MRH Enterprises

SAFE System Design Partner – Industrial Contractor

Owner of AWD industrial contractors, Mikes experience covers nearly all aspects of the design, planning, and implementation of complex processing systems relevant to this project.

John Pastusek

SAFE Chief Engineer

JDP Manufacturing specializes in vacuum vessels along with full extrusion line design and manufacturing. His expertise has focused on the process planning and production design for D&J Technologies engineering and manufacturing. John understands the full technical specifications of the SAFE system and will guide the project team's technical design efforts and system specifications.

Innovative Food Specialists, LLC

SAFE Partner for Animal Feed

IFS understands the system process requirements for manufacturing marketable feed products from various food and feed by-products and waste streams. On this project, IFS will analyze and monitor food scrap samples from the generators covered by this project to ensure the sydstem and processes deliver a product suitable for feed markets.

Bill Freeman

SAFE Partner for Finance, Accounting and Tax Matters

Nicole Rinauro

SAFE Project Process Manager

Nicole brings life-long waste industry and project management experience to SAFE. Growing up in a family business that included hauling, transfer, and landfill operations; she will assist with RFQ, RFI and bid package assembly. She will ensure that effective training and operational hand-offs are accomplished including clear and relevant documentation.

TOTAL COSTS AND ASSUMPTIONS

The planning and design project will start immediately with verification of the project location for system compatibility and continue through complete conceptual design, layout and construction project planning. The design phase is expected to run approximately 12 to 16 weeks.

PROJECT ASSUMPTIONS

1. Project goal is to design a food recovery facility capable of taking food scrap mash from a SAFE pre-processing facility and delivered to the processing site via tanker truck or direct piping. Note: this project is designed for food scraps processing only.
2. Mash delivered to the plant will be a pumpable consistency.
3. Project team members will have access to the site / area as needed for on-site research, planning and design activities.
4. Customer staff will be available to provide information about food scrap volumes available, and ramp-up estimates.
5. Documents and deliverables will be the property of Customer, but used only for the construction, commissioning and operation documents for this site.
6. Buyerl will assign a project lead from the company to be the principal contact for the project.

ASSUMPTIONS ON SCOPE OF SUPPLY

The following is a conceptual layout based on a working floor plan for a system with similar required through-put. The system cost estimate detailed below is for budgetary planning based on this concept.

NOTE: The cost projections are as of year end 2017 and will need to be revised based on manufacturing supply chain bottlenecks and effects of higher raw material costs specifically steel.

CONCEPTUAL LAYOUT (TBD):

INITIAL PRODUCT FLOW ASSUMPTION ()

The estimates below assume a throughput of up to 50 tons per day.

The SAFE dryer system is built and mounted on several equipment skids built by SAFE's suppliers and manufacturing affiliates. Each equipment skid will be integrated mechanically and operationally under the supervision of SAFE's technicians. Integrating product and thermal fluid piping, utilities, exhausting, and discharge are all required to support the system. A cost estimate of on-site installation and integration of the system skids and components is provided, for budgetary planning. Actionable cost quotes will be dependent on the design customized to meet the actual documented requirements, the specific site's constraints, and the safe and sustainable operation of the system. The Planning and Design phase will detail all install and integration materials, structures and parts. Specifications of supply and returns, required parts will be supplied by SAFE as well as startup, testing, commissioning, maintenance instruction and training.

LIST 1: DRYER SYSTEM (OBJECT 5 ON LAYOUT)

Designed to dry food waste mash produced by the SAFE pre-processing system after passing through the separation process where free water and FOG has been removed to a target moisture level near 75%. Output moisture requirement is 12%. Dwell time, temperature, pressures are set and monitored by the system control and user interface. Alarms and programmed system shut-offs are programmed in to protect the equipment in the case of operating parameters outside established thresholds.

Item	QTY	Description	Net Price USD
1-A	2	***Product Feed System*** • Type - Progressing Cavity Pump – 1 ea. • Scraped surface heat exchanger • Product and thermal fluid valves and instruments • Product divert valve and inlet valve including orifices • Mass flow transmitter • Double orifice inlet plate and manual bypass valves • Automated orifice plug bypass loop • Duplicate orifices	
1-B	4	***Twin Screw Vacuum Drying Conveyors*** Twin screw vacuum drying conveyors, including the following features: • 15' long with dual 24" diameter, hollow flight screws • Constructed of 2205 duplex stainless steel • ASME "U" stamped for 90 psi @ 350 degrees Fahrenheit • Rotation safety sensors • Housing sight glasses with wipers 6" diameter – 4 per conveyor section • Housing product temperature transmitters – 2 per conveyor section • Outlet vapor transitions with insulated blankets – 3 per conveyor section. • Flexible hoses included for connection to vapor header • Rotary unions – 2 per conveyor section • Hot oil supply and return manifolds (insulated) including all valves and gauges, temperature/pressure • Flexible braided SS hoses with fire sleeves connecting the manifolds to each zone • Teflon insulation blankets covering each conveyor • Material for 2205 duplex SS on augers and troughs product contact zones • Skid interconnecting piping, valves, instrumentation (see exclusions) • Independent control and safety system panel (remote control included)	

List 1: Dryer System – Continued

Item	QTY	Description	Net Price USD
1-C	**1**	***Conveyor Discharge, Lump Breaker, Conveyor*** • 9" Dia. (was 6") Discharge Incline Auger w/ Rotation Sensors – 1 ea. • Airlock, Hopper Style w/ 2 sections – 1 ea. • Pneumatic Valves and Level Switches, Airlock – Lot • Lump Breaker after the Airlock VFD w/integrated control • Product Removal Inclined Belt Conveyor after the Airlock Lump Breaker VFD w/integrated control	
1-D	1	***Utility System Skid*** • Utility Skid, 304 SS Framework w/ mounted Main Control Cabinet – 1 ea. • Vapor Condenser, Horizontal U-Tube Style – 1 ea. • Surge Tank mounted under the Condenser w/ Level Switches • Vapor Condenser, Horizontal U-Tube Style – 1 ea. • Vacuum Pump, Liquid Ring – 1 ea. • Seal Water System including Outlet Collection Tank • Condensate Pump – 1 ea. • Seal Water Discharge Pump – 1 ea. • Water Recirculation Pump, Cooling Tower – 1 ea. • Valves and Instrumentation, Utility Skid – Lot • Interconnecting Piping and Pre-wired, Utility Skid – Lot	
1-E	1	***Cooling Tower System*** • Evapco, ESWB Closed Circuit Cooler, 3.6 MMBTUHR (location based) – 1 ea. • Lift Pump, Cooling Tower – 1 ea. • Air Circulation Fan, Cooling Tower – 1 ea. • Water Supply and Level System – Lot • Instrumentation and Valves – Lot	
1-F	1	***Thermal Fluid Heater System – TBD, Must be electric or propane.*** •	

List 1: Dryer System – Continued

1-G 1 ***Automated Control System***

- Electrical Engineering Design and Programming
- Main Electrical Control Panel
- Remote Skid Enclosures
- Panel View Display mounted on Main Panel
- I/O, Power Supply, Ethernet Connection
- VFD's, Starters, Breakers
- I/O for Remote Control of Thermal Fluid System
- Remote Viewing and Firewall Equipment
- Utility Skid pre-wired to Main Panel
- System Transmitters and Switches

Catwalks for Drying Chambers

- OSHA compliant conveyor catwalk
- Progressive stepped catwalk to follow conveyor incline
- 304L SS construction; frame, kickplates, and handrails
- Interior connection to frame plates
- Exterior legs to floor
- Stairwell with landing to the first level platform
- Handrail around ends and exterior of platforms
- Chemgrate deck and tread plates

Dryer System Total $3,094,000

LIST 2: DECANTING SYSTEM ()

This system uses g-force to separate liquid materials based on mass using two machines; a 2 phase decanter and a high speed centrifuge. The first (decanting step) separates mash into 2 outputs, centrate (free water & FOG) and solids (wet cake). It is not a complete dewatering but it gives us the ability to take food scraps mash of various moisture levels and pull off free water to the specified 72% moisture. The free water pulled off is called centrate and contains FOG at this stage. The second step runs the centrate through a higher g-force Centrifuge. The centrifuge separates the FOG from the water as well as removing much of the suspended solids. FOG is pulled off into the oil tanks. The solids out of the centrifuge are called sludge and that material is pumped to and mixed with the wet cake coming off the decanter. The separation system below is also doubled up entirely, for maximum redundancy and capacity. Based on information provided, the flow rates to decanting are assumed to be 24 GPM. For the centrifuge, 18 GPM is assumed.

Item	QTY	Description	Net Price USD
872-A	1	***Decanter Centrifuge System:*** ***<u>2-Phase Decanter Centrifuge</u>*** • 20 HP main motor • TM21 hard-surfaced conveyor • All 316 stainless steel 14" bowl • All stainless steel vessel • Vibration sensor with auto shut-off • Air actuated 3-way valve for feed/circulate	
2-B	1	***Decanter Centrifuge System: Decanter Control System*** • NEMA4 enclosure(s) • Main power disconnect • VFD drive for man motor • VFD drive for back-drive motor • VFD drive for feed pump • Vibration alarm with shut-down • Over-torque alarm with feed interlock • Fully automatic control system with PLC and HMI • Touch screen control with graphic interface **Subtotal 2-Phase Decanter**	$ 367,510
2-C	1	***Skid Accessories*** • Approximately 5' x 10' welded steel base • Control panel mounted and wired • 1.5" all steel welded flanged piping • Stainless steel wafer check valves • 1 ½ " steel control valves (feed control) • Decanter inlet/outlet connectors with flexible hoses • Vibration dampers • Vibration isolating pipe supports • Heavy phase sight-glass • ¼" sample ports with valves • Air actuated 3-way valve for feed/circulate • 56 gal/minute progressive cavity feed pump	
2-D	1	***Separated Fluid Collection Tank*** • Approximately 250 gal capacity • Level sensor for automatic pump cycling • 1 ½ " all steel welded flanged piping • Integrated into above skid and controls • 56 gal/minute progressive cavity discharge pump • VFD for pump speed control **Subtotal decanter skid**	$ 221,650

List 2: Decanting System - Continued

Item	QTY	Description	Net Price USD
2-E	1	***Self-Cleaning High Speed Centrifuge System:*** ***Self-Cleaning Centrifuge*** • 460/60 motor (≈15HP) • Clutch drive, horizontal • Nickel plate non-SS bowl parts	
2-F	1	***Self-Cleaning High Speed Centrifuge System:*** ***Centrifuge Control Panel*** • NEMA4 enclosure • Main power disconnect • DOL starter for main motor • VFD drive for feed pump • Fully automatic control system with PLC and HMI • Elaborate manual overrides for most functions • PB control with status indicator lights • Touch screen control with graphic interface	
2-G	1	***Self-Cleaning High Seed Centrifuge System:*** ***Centrifuge Skid Accessories*** • 1 ½" all steel welded flanged piping • 1 ½" steel control valves (feed control) • Vibration dampers • Vibration isolating pipe supports • Heavy phase sight glass • ¼" sample ports with valves • Air actuated 3-way valve for feed/circulate • 56 gal/minute progressive cavity feed pump	
2-H	1	***Self-Cleaning High Speed Centrifuge System:*** ***Product Pre-Heater*** • 60kW low-watt-density electric heater • Digital temperature display (main control panel) • Multi-bank design for incremental loading • Pressure relief valve • Over-heat shut-off	
		Subtotal High Speed Centrifuge	$ 280,280
		Decanting System Total	$ 869,440

LIST 3: PUMPS AND FILTERS

The items in this section are dependent on final design based on customer requirements. Below the budgetary quote allows for the most effective flow of material and cleaning solutions to maximize the useful life of the equipment, the safety of the operation and ability to maintain continual operations through cleaning and maintenance cycles. The pumps must be able to move high volumes of product at low pressures. This conceptual design allows for CIP of any tank or supply line without shutting down the separation and dehydration functions.

Item	QTY	Description	Preliminary Allowance USD
3-A	1	***Tanker Offload Pump*** • High capacity low pressure, 200 GPM (type – gear pump)	
3-B	1	***Mash Tanks to Process / CIP*** • PD, VFD to 50 GPM, low shear (type – gear pump)	
3-B	1	***Wet Cake Tanks to Process / CIP*** • PD, VFD to 25 GPM, low shear (moyno pump)	
3-C		***Grit/Silica Filters, Traps***	
		Total Pumps and Filtration	$258,700

LIST 4: TANKS

The items in this section are dependent on final design based on customer requirements. The proposed tank set focuses on providing adequate staging and storage capacity for operating 1-dryer line. It does not provide for surge capacity beyond the daily requirement. Recommended tanks below will meet safety requirements for access, cleaning and permitting. Not included below is the valving and piping required to integrate the various tanks with the processing and CIP equipment. Equipment integration costs are estimated in the Equipment Install / Fabrication / Hook-up line item.

Item	QTY	Description	Preliminary Allowance USD
4-A	1	***Mash Tanks ()*** • 3,000 gal stainless cone-bottom agitated, CIP	$ 52,000
4-B	1	***Wet Cake Staging Tanks ()*** • 2,500 gal ss cone-bottom agitated, CIP	52,000
4-C	1	***Condensate Cooling Tanks*** • 3,000 gal FRP tanks	5,200
4-D	1	***Process Water Equalization Tank*** • 3,000 gal FRP tank, level sensors SAF control integrated	29,250
4-E	1	***Clean Oil Storage*** • 3,000 gal clean oil storage tank, holding prior to shipping	16,250
		Total Tanks	$ 154,700

LIST 5: EXTRUDER SYSTEM ()

The final processing step of the system is sterilizing the product and achieves the final moisture level to ensure product stabilization. The flow rate anticipated into the extruder needs to exceed the exit flow rate out of the two dryers (). This dryer system will generate approximately one (1) ton per hour of hot dried output (meal) at about 12% moisture. Prior to running through the extruder, the meal will load into a ribbon blender/mixer to breakup any clumps and make a uniform and consistent feed into the extruder. Maintaining consistent moisture and uniformity is essential for the extruder to reach and maintain the required temperature and pressure.

Product exiting the extruder will be hot (about 300 degree F). Out of the extruder, the product will be conveyed to the cooling drum via a vented conveyor in order to allow steam release and containment. The cooling drum will manage up to 4,000 lbs per hour of material that is 10% moisture or less.

Item	QTY	Description	Net Price USD
5-A	1	***Extruder with feeder 125 hp drive*** • 125 hp (94 kW) main drive motor • Remote mount control panel w/digital readout and A/C frequency drive • Variable speed feeder motor	$ 75,703
5-B		***Wear Parts Package*** • Custom wear parts package of selected parts to fit specific application	6,332
5-C		***Dry Meal Cooler*** • Gear driven main drive motor • 1800 CFM fan motor • Cyclone and airlock assembly • Airlock motor	38,905
5-D		***Water Injection System*** • Water injection manifold, injector and flow meter	4,061
5-E		***Vendor Startup Service*** • A 5 day professional service by technology specialist for operator use training and maintenance	7,280
5-F		***Mixer/Blender Pre-Extruder*** • 304 stainless steel mixer clump breaker • 50 cu. ft. capacity • Motor, gear box, • Feeder mechanism to extruder	127,400
		Total Extruder System	$ 259,682

LIST 6: CLEAN IN PLACE (CIP) SYSTEM

SAFE proposes installing and integrating a fully functional cleaning system including a multi-tank skid with heat exchangers and solvent injectors to allow for CIP functions critical to maintaining sanitary conditions, maximizing the longevity of the equipment, and conducive to feed production guidelines, safety, and maximizing up-time.

Item	QTY	Description	Net Price USD
6-A	1	***CIP System*** • Skid mounted, integrated with system piping, tanks, vessels, pre-heaters. • Interior pipe, fitting, tank, vessel, flushing / cleaning system • Engineered and custom built for specific plant layout • Pressurized to ensure residue removal with minimal chemicals, water usage, operating costs. • Custom CIP program designed to optimize cycle times based on work flow and safety protocol. • Stainless steel tanks (2 tank system) • Circulation pump • Heat exchanger	
		CIP System	$ 162,500

LIST 7: SUSPENDED AIR FLOTATION SYSTEM (SAF) – WATER TREATMENT SYSTEM

SAFE is proposing the installation of Heron Innovators Suspended Air Flotation system for treatment of the mechanically separated free water from the liquid phase of the decanter and the heavy phase of the high speed centrifuge. The proposed system is capable of removing 90+ percent of the Total Suspended Solids (TSS), and essentially all the remaining FOG. The proposed and costs below provide for a 30 GPM influent from the separation system. The proposed skid will also provide for balancing discharge water.

Item	QTY	Description	Net Price USD
7-A		***SAF Skid Base*** • 50 gpm self-priming feed pump; VFD control • 304 stainless steel flotation cell • Skimmer assembly w/electric motor drive and VFD • Flocculation tank, mixers motor and VFD drive • Maintenance platform • Control Panel • Skid mounted unit (assembled) read to operate	
7-B		• Expand water launder to include SS working tank • Level sensor • Discharge pump • Process and ID loop for automated manual operation.	
7-C		***PH Control*** • PH Controller • Insertion-style probe • Caustic safety tank • Metering pump • Process and ID loop for automated and manual operation.	
7-D		***Electric Lobe Solids Pump*** • 2" Borger lobe pump • Gear box/gear reducer • 2HP 480V/3P electric motor • Powder coated skid assembly • P&ID loop for automated and manual operation	
		SAF System	$ 351,000

LIST 8: CENTRAL INTEGRATED CONTROL SYSTEM

Important to the efficient control of the system is the ability of the staff to operate and monitor all components of the system. Each manufacturer will provide control and I/O interfaces. Given our experience with the system, SAFE's technical experts and suppliers will coordinate to custom build and implement a consolidated control panel specific to this site's operating parameters. This feature will provide centralized, user friendly monitoring and control interfaces, including remote monitoring and control of specific functions. It will eliminate the need for each supplier to provide a complete UI. It will provide a uniform interface and integrated e-stop functions across the various system skids, and eliminate the need for operators to learn multiple and disparate control interfaces.

Item	QTY	Description	Net Price USD
8-A		***Integrated Control System*** • Integrated equipment start/stop • Integrated alarm monitoring • Integrated system shut-off • Electrical engineering design and programming	
8-B		***Main Electrical Control Panel*** • Panel view display mounted on main panel • I/O, power supply Ethernet connection • I/O for remote control of each system • Remote viewing and firewall equipment • Utility skids wired to main panel • System transmitters and switches	
		Central Control System	$ 520,000

LIST 9: REQUIRED ANCILLARY EQUIPMENT

Item	QTY	Description	Net Price USD
9-A		***Air Compressor*** • Compressor, rotary, 20HP, 120 gal, 150 PSI, 65.6 cfm, 460vac, 3	$ 20,434
9-B		***N-2 Nitrogen Blanket System*** • Hot oil heater, required fire suppression system	12,968
9-C		***Flex Auger/Conveyors*** • Estimated 2, type – Model 90 flex auger systems, 100 lbs/minute, at 40 lbs per sf, 18% moisture max	37,082
9-D		***Stainless/Vented Conveyors*** • T-304 stainless steel, double flanged troughs, flanged covers, 1 HP, 3/60/230/460V, electric motor	69,017
9-F		***Dry Storage Bags / Scales / Racks or Bulk Hopper option*** • 110 cu yrd, 24 ton capacity	130,000
9-G		***Water Heater / Softer System*** • Hot, soft water needed for Centrifuge ops	13,813
9-H		***Bulk Totes*** • 250 gal poly storage (over flow / temp storage)	8,409
9-I		***Forklift*** • 4000LB electric, 36V battery with water sys-tank and charger	56,621
9-J		***Moisture Analyzer*** • Required measuring instrument	21,198
9-K		***Tools, testing lab, supplies*** • Required product testing equipment and equipment maintenance tools	63,180
		Total Ancillary Equipment	$ 432,721

LIST 10: SUGGESTED ANCILLARY EQUIPMENT

Item	QTY	Description	Net Price USD
10-A		***System Monitoring Sensors***	$ 53,625
10-B		***Office Equipment, Networking and Signage***	19,500
10-C		***Computers, Software and SAFE Data Capture Application***	7,313
10-D		***Shop floor desks, tables, chairs, cabinets***	4,063
10-E		***Floor Scrubber***	6,825
10-F		***Pressure Washer***	1,300
10-G		***Equipment Safety Barriers***	4,875
10-H		***Job Box***	3,250
			$ 100,750

SUMMARY OF EQUIPMENT COSTS

Below is the summary of SAFE's equipment set for the conceptual layout provided. Included in the summary below is SAFE's costs for providing required technical configuration, monitoring equipment acquisition and delivery, directing and conducting full scale unit, system, integration, and performance testing. The budget shown allows for 120 man days on-site.

Description	Net Price USD
Dryer System (2 Lines)	$ 3,094,000
Decanting System	869,440
Water Treatment System (SAF)	351,00
Tanks	154,700
Pumps/Filters	258,700
Clean-in-Place Utility Skid	162,500
Integrated Controls	520,000
Extruding System Including Cooling	259,682
Ancillary Equipment	533,471
Technical Configuration, Testing, Commissioning	216,000
Subtotal – Equipment Costs	$6,419,492

ESTIMATE OF SYSTEM EQUIPMENT INSTALLATION AND ENGINEERING COSTS

Description	Net Price USD	
Equipment Installation/Fabrication/Hook-up	1,150,000 *	
Permitting, Engineering, Architecture	205,000	
Subtotal Estimate of Install Costs	$ 1,355,000	*

****Implementation costs shown are an estimate to be determined by the planning and design phase of this project.***

Not Included in this Proposal:
- Fire Protection/Sprinkler System
- Building Modification/Civil Work
- Taxes
- Electrical feed to new MCC panels
- Seismic (SAFE can provide seismic if client prefers)
- Additional training package
- Preventive maintenance package
- Unforeseen local code deviations from national code standards, if any
- ANY ITEM NOT SPECIFICALLY SET FORTH HEREIN, INCLUDING WITHOUT LIMITATION SITE WORK OR STRUCTURAL MODIFICATIONS OR IMPROVEMENTS, BUILDING OR UTILITY PERMITS, SALES TAXES IF APPLICABLE, OR SHIPPING COSTS

SAFE reserves the right to modify any equipment specification as new technologies are available, while maintaining the production capacity and maintaining for improving product quality.

***This is an estimate only. Any unforeseen increase in raw materials including material import fees, extraordinary costs or fees beyond our control attributable to a change in law, or increases resulting from customization or a customer-generated change order, if any, will be assessed at the time a purchase order is issued and will be reflected in final contract documents. If SAFE does do the work, all work, including parts, will come under the same warranty provided for other items in this sales order.*

Grand Total $USD	$ 7,774,492

Sales tax not included
Quote is good for 30 days.

PAYMENT SCHEDULE

TBD

PROJECT PLAN

Proposed Project Plan

Activity	Task	Work	Deliverables
Phase I: Site Design & Planning			
Activity 1	Conceptual Design		
	Task 1.a	Validate Site and Throughput Requirements	System requirements document, Site Selected
Milestone	Site and Throughput Requirements:		Stakeholder Sign-off
Milestone	Conceptual Design Complete: Required Payment for Phase I:		
	Task 1.b	Analysis and Planning - Project Specific	Infrastructure plan: Utility supply, accessibility, traffic, permitting requirements.
	Task 1.c	Refine Design	Updated design specs, tonnage, storage, utilities, emissions, discharge
	Task 1.d	Refine Estimated Costs - Corresponde to Updated Design	Updated Project Costs
Milestone	Updated Design & Costs: Stakeholder Sigh-Off		
Activity 2	Engineering		
	Task 2.a	Document site specific engineering requirements	Engineering analysis & Prelim P&ID
	Task 2.b	Draft Architectural Plans	Final Equipment Layout
Activity 3	Finalize Build Plan		
	Task 3.a	Develop bid package	Contractor Bid Pachage
Milestone	Final Bid Package: Stakeholder Sign-Off		Bid package illustrations
Phase II: Construction Planning & Acquisition			
Activity 4	Building Contractor Selection		
	Task 4.a	Select / Contract with Building Contractor (Customer)	Building Contractor Signed
Activity 5	Validate product characteristics		
	Task 5.a	Analyze Local Product	Final process map, initial operating plan and estimated costs.
Activity 6	Finalize Equipment Order		
	Task 6.a	Finalize equipment specs	Final mechanical requirements & equipment specs
	Task 6.b	Finalize all costs and timelines	Buildout illustrations, Complete supply list, P&IDs
Milestone:	Approve project budget, Order Equipment, Required Payment Phase II		
Activity 7	Equip Delivery & Install Planning		
	Task 7.a	Set plan and timelines for equipment delivery, rigging, and setup.	Equipment delivery schedule, riggers contract, anchor engineering

PROJECT PLAN (CONTINUED)

	Activity	Task	Work	Deliverables
Phase III: Site Preparations / Tenant Improvements				
	Activity 8	Building / Tenant Improvements		
		Task 8.a	Site Construction / Preparation Work	Complete building / T.I.s for equipment install
	Milestone:	Site Inspection		Sign-offs: LEA, SAFE, Stakeholder
Phase IV: Equipment Installation				
	Activity 9	Equipment delivery, rigging, anchorage		
		Task 9.a	Ship / receive, rig, anchor equipment set	Equipment set in place
	Activity 11	Process mechanical integration		
		Task 11.a	Process piping and plumbing work	Completed process piping and plumbing
		Task 11.b	Final Mechanical Docs & Inspection	Mechanical Sign-off / Certification
	Activity 12	Process electrical hookups		
		Task 12.a	Process power supply, drops, connection	Completed equipment power connections
		Task 12.b	Final Electrical Docs & Inspection	Electrical Sign-off / Certification
	Activity 13	Process controls integratoin		
		Task 13.a	Low Voltage Control Integration	Completed control panel wiring
		Task 13.b	Process programming, Alarms, Safety Shutoff Testing	Completed Alarm and Safety Shut-off Programs
		Task 13.c	Controls User Interface testing.	Control System & Operator Docs
	Milestone:	System Installed		Sign-offs: SAFE, Stakeholder
		Task 13.c	Final User Interface Testing / Docs	M & O Documents
Phase V: Commision / Turnover / Training				
	Activity 14	Commission Equipment		
		Task 14.a	System Unit Testing	Isolated Process Sign-off
		Task 14.b	System Integration Testing	Integrated, full process, Sign-off
		Task 14.c	Processing Fixes	Fix Testing Failures
		Task 14.d	Unit Test Fixes	Testing Sign-off
	Activity 15	Training / Trunover		
		Task 15.a	Operator training	

This estimate is for budgetary and planning considerations only. Any work, service, or sale shall be initiated and executed under the terms of a separate Purchase Agreement or Service Contract not contained herein.

END OF DOCUMENT

SAFE Pre-Processing System Estimate

SAFE — Sustainable Alternative Feed Enterprises

Estimate Prepared for: Martha's Vineyard - 50 TPD

March 1, 2018

Note: Material cost are rising rapidly, these estimates will need to be formally quoted prior to an order.

Item	Qty.	Description	Model	HP	Size	Cost ($USD) for a Single Line
		CPG - EQUIPMENT LIST				
1	1	**Feed Ramp**				$75,205
	1	~ CP Ramp			48"H x 50'L	
	1	~ Transition to Eliminate Leaking				
2	1	**Receiving Pod**			10'W x 30'L	$181,441
	1	~ Dual Augers	SC-1 16"	15 x 2	16"D x 24'L	
	2	~ Augers to move material				
3	1	**Auger Conveyor Transition**				$42,491
	1	~ Single Auger Shredder Feed Conveyor	SC-1 24"	15 x 2	24"D x 24'L	
	1 lot	~ Transition Chutes				
4	1	**Shredder Pod**			8'W x 24'L	$330,351
	1	~ Shredder Shred Tech	ST 75E	30 x 2	10 TPH	
	2	~ Auger under Shredder	SC-1 16"	10	16"D x 17'L	

	1	~ Auger to Press 20 Degree Incline	SC-1 16"	10	16"D x 15'L	
	1	~ Auger to Press	SC-1 16"	10	16"D x 15'L	
	1	~ Storage Tank 37 cubic yards			8.5'W x 26'L	
	1	~ Lower Feed Auger 5 Degree Incline	SC-1 16"	15	16"D x 20'L	
	1	~ Upper Leveling Auger	SC-1 16"	10	16"D x 20'L	
5	1	**Press Pod**			8.5'W x 26'L	$587,162
	1	~ Vincent Press 24"				
	1	~ Single Auger to Compactor 24 Degree Incline	SC-1 16"	10	16"D x 22'L	
	1	~ Single Auger to Compactor	SC-1 16"	10	16"D x 42'L	
	1	~ Bi-Directional Single Auger to Compactor	SC-1 16"	10	16"D x 20'L	
6	1	**Screen Pod**			8'W x 20'L	$99,080
	2	~ Screen	Sweco MX-44S88			
	4	~ Surge Tanks				
7	1	**Tank Pod**			8.5'W x 26'L	$33,700
	3	~ Tanks 3000 Gallon each	Translucent Chemical			

CPG - TOTAL EQUIPMENT: ***$1,349,430***

Estimated Power Consumption

kW Total:	64 kW	Peak Load
kW @40%:	26 kW	Running Load

Item	Qty.	Description	Model	HP	Size	Cost ($USD) for a Single Line
		CPG - OTHERS				
ICP		**Electrical Controls - Advanced MRF - UL508a Compliant**			Siemens	$99,000
ENG		**Engineering**			CP Staff	Included
PE		**Certified Professional Engineering (Stamp and Certified Documents)**				Not Included
MECH		**Mechanical Installation - Non Union - No Prevailing Wages** **Includes: Three CP techs for five days. Any additional days will be charged at $1,420 per tech. Price includes all necessary lifting equipmnet and tools to complete the installation.**				$66,000
ELEC		**Electrical Installation - Non Union - No Prevailing Wages** **NOTE: All electrical drops will be the responsibility of the customer**				$33,000
SUP		**Project Management: One PM assigned as main contact through start up and testing.**				$30,250
START		**Startup and Testing: Included in PM line item, PM to be onsite for three days of testing. Any additional days to be charged at $1,420.**				Included
FRT		**Freight and Truck Loading** **Note: Due to the current volatility of transportation costs, all freight quotes are an estimate and not guaranteed. Shipping costs will be re-evaluated at the time of shipment and adjustments may be made**			Estimate Only	$37,065

CPG - TOTAL "OTHERS": ***$265,315***

CPG SUBTOTAL: PODS, CONVEYORS, CONTROLS

$1,614,744

NOT INCLUDED IN PROPOSAL - CPG
~ Fire protection / Sprinkler system
~ Building modification / Civil work
~ Sort cabins / HVAC
~ Permitting
~ Taxes
~ Mobilization
~ Electrical feed to new MCC panels

****All Items Noted As "Existing" or "By Others" or any other indicator that infers not provided by CP Mfg.**
During the course of the project, if CP MFG. finds that items listed on this sales order as "Existing" or infered not by CP Mfg need to be replaced, modified, repaired, painted or in any way upgraded, we will provide the customer with a written explanation and quote in order to carry out this work. It will be up to the customer to approve this work at the additional cost or perform the work itself. If CP does do the work, all work, including parts, will come under the same warranty provided for other items in this sales order.

Item	Qty.	Description	Model	HP	Size	Cost ($USD) for a Single Line
AWD - PIPING, PUMP, & VALVE PACKAGE						
		Note: The following estimate is based on conceptual design and only to be used for budgetary purposes.				
A		Process lines between screw press and first set of hold tanks.				
B		Process lines between first set of hold tanks sweco filters.				
C		Process lines between sweco filters to second group of hold tanks.				
D		Valve groups to allow flexibility of flow to each location required.				
E		Pumps and regulators for pumping at each location				
F		Hangers and supports as required for piping				
G		Air main and piping drops to each location.				
H		Air compressors and dryers as required				
I	1	Air receiver and filter				
J	1	Process line from receiving building to dry processing building				
K	1	High pressure washer with hot water boiler				

AWD - SUBTOTAL: PIPING, PUMPS, & VALVES ***$736,340***

NOT INCLUDED IN PROPOSAL - AWD

- ~ Seismic design, engineering, materials, and labor
- ~ Electrical and controls
- ~ Cleaning and drain lines
- ~ Stamped engineered drawings, Permits and Fees
- ~ Rentals
- ~ Mobilization
- ~ Freight

GRAND TOTAL: ***$2,351,084***

Note: Material cost are rising rapidly, these estimates will need to be formally quoted prior to an order.