

FINANCIAL FEASIBILITY ASSESSMENT:

In-Vessel Composting at Days End Farm, Howard County

Prepared for the Maryland Department of Agriculture by the University of Maryland Environmental Finance Center, November 2017

Background

The Maryland Department of Agriculture's Animal Waste Technology Fund (AWTF) provides grants for on-farm demonstration projects of innovative technologies for managing animal manure. These technologies are expected to reduce on-farm waste, improve water quality, and create new revenue streams for farmers in the form of cost savings and marketable byproducts.

Days End Farm Horse Rescue is a nonprofit, volunteer-based organization located in Howard County that cares for horses through rescue, rehabilitation, education and outreach. Founded in 1989, Days End shelters 80 to 120 horses annually, rehabilitating them and preparing them for adoption.¹



Figure 1. Demonstration of Green Mountain Technology's in-vessel composting system at Days End Farm Horse Rescue.

In 2014, Green Mountain Technologies (GMT), a firm that designs and installs commercial-scale composting systems, received an AWTF grant to install an in-vessel Earth Flow composting system at Days End Farm to better manage animal waste (horse manure and used bedding material). The new system became operational in fall 2015. With a volume of 33 cubic yards, it is projected to process 300 tons of waste per year.² Because of the system's automated agitation and moisture control features, it is considered to be more efficient and effective than manual composting.

Expected Benefits

Days End's sheltered horses produce a total of 1.6 tons of waste per day (about 80 pounds per horse, for 40 horses kept in stalls rather than open fields).³ All of this manure and soiled bedding material must be collected, transported and disposed of. Before installing the GMT composting system, Days End Farm landfilled this waste at a cost of \$40 per ton. The new system is expected to defray 300 tons of animal waste per year (about 50% of total manure and bedding produced by sheltered horses)⁴ and therefore reduce landfill costs, which is the primary expected benefit of this technology as deployed on Days End Farm. Secondary benefits relate to the finished compost product, which may be used as a bedding substitute to offset bedding costs (e.g., wood shavings) at the farm, and which could potentially be sold as a soil amendment.

Results: Financial Feasibility Assessment

The Environmental Finance Center (EFC) developed a full cost balance assessment for the GMT composter project at Days End. This assessment contrasts pre- and post-technology expenses and revenue across various modules including labor, operations and maintenance, materials and services, energy, capital costs, and byproducts. EFC developed this assessment through desktop research and interviews with the farmer, the vendor, and other specialists familiar with the technology.

Key finding: Based on available information, the GMT compost project as applied on Days End Farm will result in approximately \$9,600 in annual cost savings, or a simple payback of 13.8 years relative to the initial \$132,000 capital investment (see Table 1). The useful life of the technology is 15-20 years. This result excludes any benefit from selling compost (see Table footnote) as well as any environmental benefits, and it is highly sensitive to the assumption that landfilling (at \$40 per ton) is the next best animal waste management option.

Table 1. Cost assessment results for base scenario (see inputs and assumptions below)

	Pre-Technology	Post-Technology	Balance (positive indicates cost savings or revenue)
Labor costs (\$)	548	1,077	-529
O&M, materials, and services costs (\$)	25,212	14,796	10,417
Energy costs (\$)	0	329	-329
Byproduct revenue (\$)	0	0*	0
<i>Sub-total</i>	<i>\$14,080</i>	<i>\$4,521</i>	<i>\$9,559</i>
			Summary
Capital costs			\$132,161**
Annual cost savings			\$9,559
Simple payback			13.8 years
Return on investment			7.23%

* While Days End Farm had anticipated being able to sell the finished compost product as a soil amendment, a Howard County ordinance prohibits the sale of compost within the county, so this assessment assumes no byproduct revenue.

** Includes \$130,111 from AWTF grant award (excludes lab costs and Year 2 monitoring, evaluation and reporting) plus \$2,050 out-of-pocket cost for Days End Farm for compost storage structure (e.g. hoop house).

Table 2. Critical inputs, value, and corresponding notes

Input Name	Value	Note
Animal waste input per year (tons/year)	292	Equals loading of .8 tons/day times 365 days/year. Higher degree of confidence after a longer performance period.
Tipping fee (\$/ton)	40	Per interview with Days End Farm.
Sawdust for bedding (\$/sqft)	.2	Per Tractor Supply Co.
Additional labor per year post-technology (hours/year)	530	Includes one hour per day to operate composter plus time to lay new bedding (which takes slightly longer than traditional bedding) @ \$1/hour (low because Days End Farm relies largely on volunteer labor).
Percent reduction in volume from input to compost output	40%	Dependent on weather, etc. Higher degree of confidence after a longer performance period.
Value of finished compost (\$/ton)	0	Howard County regulation prohibits sale of compost. See Bill No. 20-2014 [ZRA-149].

Annual O&M costs (\$/year)	2,400	Per GMT interview; set at 3% of capital cost.
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Critical model inputs and assumptions: The results for the base scenario are sensitive to inputs. In order of relative importance, the most important inputs include: the cost of landfilling as the next cheapest alternative, the total amount of animal waste managed by the composter per year, the value of compost as a marketable product, and the rate at which animal waste is converted to compost, among others (see Table 2).

Scenario analysis findings: The base scenario outlined above employs inputs for the Days End Farm financial model that may not be applicable to other farms looking to invest in composting technology. Namely, farms in Maryland counties other than Howard County might readily sell compost, which would introduce a new revenue stream and improve the payback period (see Scenarios A, B, D in Table 3). Likewise, it is important to question the assumption that landfilling animal waste at \$40/ton is the next best animal waste management option (see Scenarios C + D in Table 3). While landfilling may be viable for smaller horse farms that can afford to avoid the hassle of managing manure, larger farms may find it necessary to deal with waste in a more cost effective way (e.g., on-site composting with manual turning or land application by cooperating farmer); this less expensive starting point would translate to lowered cost savings opportunity and a longer payback period.

Table 3. Base scenario financial results plus four alternative scenarios with modified inputs

	Scenario A \$40/ton tipping fee + \$30/ton for compost + revised manure input rate of 350 tons/year*	Scenario B \$40/ton tipping fee + \$30/ton for compost*	Base Scenario See inputs above*	Scenario C \$20/ton tipping fee	Scenario D \$0/ton tipping fee + \$30/ton for compost sale
Annual cost savings + revenue (\$)	16,314	13,062	9,558	3,718	1,382
Simple payback (years)	8.1 < 20 useful life	10.1 < 20 useful life	13.8 < 20 useful life	35.5 > 20 useful life	95.6 > 20 useful life

* Shaded scenarios indicate a simple payback less than the useful life of the technology, a common measure of cost effectiveness.

Discussion: Transferability and Policy Considerations

The analysis above pertains specifically to Days End Farm. As discussed below, a number of factors affect whether these findings are transferable to other farms in the state, and whether investment in this composting technology will be cost effective on a given farm.

Default manure management conditions: While many dairy farmers see cow manure as a valuable resource, either as a source of nutrients for their own crops or as a source of revenue if it is sold to other farms, horse manure does not have the same nutritive value as a crop fertilizer. In addition, many small horse farms lack the capacity to manage manure onsite via alternatives to landfilling such as manual composting or land application. For these reasons, landfilling manure is fairly common in the recreational horse industry. However, if a farm has a cheaper default manure management option

than landfilling - as is often the case for dairy and poultry operations which have a more robust market for raw manure - the cost savings of an in-vessel composting system would not be as significant.

Value of byproducts: The inability to sell finished compost is unique to the Days End Farm project analysis and other farms in Howard County. In other Maryland counties, a similar system would be more likely to generate revenue from the sale of compost (See Scenarios A, B and D in Table 3, above). Again, it is important to consider a farm's default manure management technique and whether the operation can generate revenue by selling manure. This would likely be especially true for dairy operations, since cow manure has greater value as a crop fertilizer than does horse manure. The ability to sell compost and the market price of compost are secondary factors in importance relative to the cost (and revenue) associated with default manure management. Aside from compost's potential to be marketed as a soil additive, the final product may have value as bedding material for horses. Each ton of compost used as a bedding substitute saves approximately \$4, or \$1,200 over the course of a year with production of 300 tons of compost.

Siting conditions and labor costs: Capital costs and long-term operation and maintenance costs will be influenced by a candidate farm's starting conditions. In particular, electrical and support infrastructure may need to be installed in order to operate an in-vessel composting system, which would drive up the costs of installation. Conversely, if the system can be sited in a convenient location close to animal stables, a great deal of time and energy can be saved over the life of the project. Finally, a critical difference between the Days End Farm analysis and other farms is that Days End Farm relies largely on volunteer labor (at an assumed rate of \$1 per hour). Based on an estimated 500 additional hours per year of labor to operate the technology - compared to the labor required to load and truck manure to landfill - if another farm had to hire and compensate an employee at \$10 per hour, there could be an additional operating cost of \$5,000 per year. Of course, this number will vary depending a farm's default manure management approach and its associated labor requirements.

Cost share and other sources of revenue: The capital costs related to installing a similar composting system could be reduced if this technology were to become eligible for financial assistance through the Maryland Agricultural Water Quality Cost-Share Program, which subsidizes best management practices for water quality management on farms. There are currently about 30 approved best management practices (BMPs) through this program, including practices such as planting streamside buffers, contour farming, and installing waste treatment lagoons. Farms with 15 animal units can receive grants to cover up to 87.5% of the cost to install such conservation measures, with a total cap of \$150,000 for non-manure BMPs and up to \$450,000 if manure BMPs are included.⁵ This could significantly defray installation costs, if the program were to be amended. Another potential source of revenue is the Maryland Nutrient Trading Program and accompanying markets, if more robust trading activity were to occur; composting would need to be designated an eligible generator of nutrient credits, perhaps for its ability to stabilize and reduce nitrogen.

Regulatory drivers: Under Maryland's new Phosphorus Management Tool regulations, farms with high soil phosphorous levels will be more strictly limited in applying manure to their land, and thus will have a stronger impetus to find alternative uses for the manure they produce. Most farms subject to this regulation are poultry producing farms in the Lower Eastern Shore counties of Somerset, Wicomico, and Worcester, where an estimated 28% of the land area is not enriched with phosphorous and unrestricted in manure use, compared 79% for the state as a whole.⁶ However, poultry litter is not

ideal for composting because of its low moisture content, and further, composting only serves to *stabilize* phosphorus, not reduce its quantity, so it is unlikely that composting would be viable solution for such farms to comply with PMT.

A separate set of regulations affect farms statewide by prohibiting the application of any nutrient-containing material during winter months. MDA anticipates that more than 200 dairy farms statewide need additional manure storage capacity in order to comply with this rule; in total this will require more than \$40 million in investments.⁷ For farms that need additional storage, finding a way to reduce overall organic material volume - which composting does effectively - could be very helpful.

Private financing outlook: In the absence of public funding, it is unlikely that Days End Farm would make the investment in this composting technology. Assuming the farm had sufficient cash on hand, and it did not need to acquire any debt to complete the project, the internal rate of return on the project (i.e., ~1.04%) suggests the investment is not competitive with alternative investments the farm might make elsewhere in the economy. Moreover, for the farm to be cash positive for the duration of the project while taking on debt, it would need to secure a 15-year loan (assumed life of the system) for the entire cost of the system at an interest rate of less than 1%. Interest rates in the 1 - 1.5% range are currently available via MDA's Low Interest Loans for Agricultural Conservation program. However, even if the farm received *interest-free* financing on a 15-year loan, the net annual savings would be only about \$750. Given the information at hand, it appears unlikely that this project would occur at Days End Farm and similar operations in Maryland without public financial support.

Conclusion

The GMT composting system applied on Days End Farm can be considered a cost-effective investment in innovative animal waste technology, as the simple payback on the investment is less than the useful life of the technology. Expanding the scope of analysis to consider broader transferability to other horse farms in the state, it appears the technology would be more feasible (not necessarily feasible) without grant funding if: (1) The farm's default manure management approach is landfilling; (2) The finished compost can be sold as a soil additive or used to offset bedding costs on the farm; or (3) The farm is able to take advantage of subsidized interest rates via the Low Interest Loans for Agricultural Conservation to finance the project. The technology would be even more viable if it were to become eligible for cost share assistance via the Maryland Agricultural Water Quality Cost-Share Program, and if composting were to be designated an eligible generator of credits via the state's Nutrient Trading Program.

References

¹ DeEttre Hillman, Days End Horse Rescue. Interview with EFC, 11/2/17.

² Michael Bryan-Brown, Green Mountain Technologies. Days End Farm Tour, 6/14/2016.

³ This total includes waste produced by horses housed in enclosed stalls, not by horses who live outside in paddocks.

⁴ Michael Bryan-Brown, Green Mountain Technologies. Days End Farm Tour, 6/14/2016.

⁵ Maryland Department of Agriculture. Maryland Agricultural Water Quality Cost-Share Program website. Available: http://mda.maryland.gov/resource_conservation/Pages/macs.aspx.

⁶ Maryland Department of Agriculture. March 2016. "Preliminary Phosphorous Soil Test Results." Available: http://www.mda.maryland.gov/documents/Preliminary-P-Data_03.2016.pdf. State figure updated per Louise Lawrence, 2/15/17.

⁷ Louise Lawrence, Maryland Department of Agriculture. Interview with EFC, 7/14/16.