

Report

**Community
Manure
Management
Feasibility Study**

Dane County, WI

February 2008

Report for
Dane County, Wisconsin

Community Manure Management
Feasibility Study

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SECTION 5
NONMONETARY ISSUES EVALUATION

The comparisons made in Section 4 are based almost exclusively on capital and long-term costs. However, each of the alternatives has important nonmonetary considerations that must be evaluated alongside the present value cost to assist in the identification of the recommended alternative. Nonmonetary issues become very important for projects such as those contemplated by this study, where the nonmonetary benefits of the project must be weighed against the costs. Decisions regarding project funding including grants and subsidies are often based on nonmonetary issues such as those presented below. This section includes a description of the nonmonetary issues and a summary of the assigned weighting factors and scores.

5.01 NONMONETARY ISSUES REVIEW

Important nonmonetary issues were selected following a review of the Dane County Manure Feasibility Study Committee's goals and issues included in the County's request for proposals. The relative importance of each nonmonetary issue was then established with input from members of the Manure Management Committee and others having knowledge of the issues. The relative importance was quantified in terms of a weighting factor. Independently of the weighting factor determination, the nonmonetary issues for each of the eight shortlist alternatives were assigned a score on a scale of negative one (-1) to positive one (+1), with zero (0) being neutral. A neutral score was assigned to issues that were neither negative nor positive when compared with current general farming practices in the study area. The scores were multiplied by the weighting factors, and these were summed to arrive at the total nonmonetary score for each alternative. Key nonmonetary goals and issues that were used in this evaluation are described below.

Descriptions of all the nonmonetary issues and criteria for scoring are provided in Table 5.01-1. Weighting factors and scores are provided in Table 5.01-2.

A. Phosphorus Reduction

A primary goal of this study is to reduce the amount of P applied to agricultural land in the upper Lake Mendota watershed, as well as P loads to Lake Mendota, while maintaining a productive agricultural community. All of the alternatives discussed in Section 4 will remove P from manure to some extent. Alternatives that received a positive nonmonetary score were those that remove P from manure and provide a means to reduce the amount of P applied to agricultural land in the upper Lake Mendota watershed. The weighting factor for this issue is 8.5.

B. Water Quality Impacts

Surface water quality is a major consideration in the management of manure in the study area and was one of the primary drivers for this study. Erosion of nutrient rich soils and runoff of manure-laden surface water increases the nutrient loading to surface waters including Lake Mendota and the Yahara River chain of lakes. When nutrients become excessive in surface waters, they can lead to excessive algal growth (or eutrophication) that can result in reduced sunlight, loss of aquatic habitat, and a decrease in dissolved oxygen in the water. On a larger scale, the study area is located in the Upper Mississippi watershed. Therefore, N loadings in the study area contribute to Gulf of Mexico hypoxia (low dissolved oxygen) conditions and the coinciding loss of fish, shellfish, and other aquatic life. Recognizing that nutrients can run off soils and enter

TABLE 5.01-1

NONMONETARY ISSUES CRITERIA

Nonmonetary Issue	Weighting Factor	Factors Contributing to a Positive Score	Factors Contributing to a Negative Score
Phosphorus Reduction		Technologies with the best overall potential for P reduction.	Technologies with the lowest overall potential for P reduction.
Water Quality Impacts		Likely reduction in P content of soils in the study area. Reduction in the potential for manure runoff into surface waters. Reduced potential for water pollution because of phosphorus or ammonia.	Increased likelihood of water pollution.
Air Quality Impacts		Reduction in methane, ammonia, and sulfur air emissions compared with current manure management practices in the study area. Reduction in manure hauling.	Increased emissions to air.
Maintaining Green Space and Associated Water Quantity Impacts		Lower cost alternatives to purchase of development rights or farmland preservation programs. Maintenance of productive, environmentally compliant farms discouraging urban sprawl. Maintenance of green space and soil infiltration capacity such that groundwater recharge is maximized and peak runoff/erosion events minimized.	High cost alternatives that could result in loss of productive farms. Alternatives that increase impervious surface area and/or runoff. Elimination of manure as a nitrogen and OM source potentially resulting in higher likelihood of purchasing feed instead of growing feed crops.
Maintaining Working Farmland and the Associated Culture, Lifestyle, and Aesthetics		Lower cost alternatives. Maintenance of productive, environmentally compliant farms discouraging urban sprawl.	High cost alternatives that could result in loss of productive farms. Elimination of manure as a nitrogen and OM source potentially resulting in higher likelihood of purchasing feed instead of growing feed crops.
Nutrient Transportability		Ability to remove and condense P for more cost-effective export. Ability to remove and reduce the volume of P without removing other valuable components of manure (N, K, OM, and micro-nutrients). Ability to use co-op or other established local system to distribute condensed P.	Inability to transport phosphorus out of the watershed. Removal of other beneficial aspects of manure (N, K, OM or micronutrients).
Greenhouse Gases (GHGs) and Potential Credits		Capture and use of methane; reduction of methane, CO ₂ , N ₂ O, and other GHGs emitted to the atmosphere from long-term storage practices. Potential to sell credits to utilities or climate exchanges.	Increased GHG emissions as compared with current manure management practices in the study area.
Production of Renewable Energy		Production, capture, and sale or use of biogas or heat energy.	Increase in energy use without production of renewable energy.

Nonmonetary Issue	Weighting Factor	Factors Contributing to a Positive Score	Factors Contributing to a Negative Score
Aesthetics/Nuisances		Improvement in odor potential, noise, and similar nuisances when compared to current manure management practices in the study area.	Increased odors and noise; proximity to residential areas. Poor aesthetics of the selected technology.
Safety Issues Related to Mixing Farm and Commuter Traffic		Maintenance of productive, environmentally compliant farms discouraging urban sprawl.	Alternatives that require producers to continue to haul manure on roads used by commuters.
Impact on Roads/Truck Traffic		Improvement in truck traffic when compared to current manure management practices in the study area.	Increase in truck traffic, increase in nonfarm-owned truck traffic where load limits could apply, and proximity to residential areas.
Animal Disease Control		Pathogen destruction; individual farm systems that keep any pathogens on the farm.	Increased potential for pathogens to be transmitted within the same farm, from one farm to another, or from farms to residential areas.
Status of Technology; Reliability		Well-established for manure or well established for wastes that have characteristics similar to manure.	Few or no successful installations, still in research, development or pilot stage.
Ease of Operation		Simple to operate using staff that have basic training.	Complex and requiring more operations staff and/or staff with high level of education and training.
Expandability		Easy to expand in the future to take additional manure or other organic wastes or to comply with new regulations; easy to expand to production of other products such as ethanol and biodiesel.	Difficult to expand or upgrade because of technology, space, or other limitations.
Ability to Treat Other Feedstocks		Ability to treat organics, particularly if it provides a potential revenue source.	Unable to treat other materials.
Regulatory and Permitting Issues		Similar permitted facilities in Wisconsin. Applicable regulations already exist or DNR willing to permit, perhaps with waivers or exemptions from existing rules. Alternatives that lessen the potential impact of winter landspreading and other regulations on individual farms.	Regulatory “grey area” or no current regulations that apply. No similar permitted facilities in Wisconsin along with DNR’s hesitancy to permit. A “do nothing” or minimal alternative that might lead to increased regulation of farms.
Image of Dane County as a Leader in Sustainability		Alternatives that are innovative, implementable, and low energy users, alternatives that maintain productive farms, green space, and the associated environmental sustainability community alternatives that seek to address a wide range of issues at an acceptable cost.	Alternatives that are more costly, difficult to implement, or that use significant energy. High cost alternatives that could result in loss of productive farms.

TABLE 5.01-2

NONMONETARY SCORING SUMMARY

		Alternative No. and Description:																
		Individual Farm Systems						Community Systems										
		F-1		F-2		F-3		C-1		C-2		C-3		C-4		C-5		
		Fine solids separation with polymer addition		Fine solids separation with ferric chloride and polymer addition		Anaerobic digestion followed by solids separation, with ferric chloride and polymer addition		Fine solids separation with polymer addition		Fine solids separation with ferric chloride and polymer addition		Anaerobic digestion followed by solids separation, with ferric chloride and polymer addition		Fine solids separation with ferric chloride and polymer addition followed by drying/pelletizing		Drying followed by combustion		
Projected P Removal, %		40 to 50%		60 to 80%+		60 to 80%+		40 to 50%		60 to 80%+		60 to 80%+		60 to 80%+		~100%		
Nonmonetary Factors:		Weighting Factor	Score	Extension (WF x S)	Score	Extension (WF x S)	Score	Extension (WF x S)	Score	Extension (WF x S)	Score	Extension (WF x S)	Score	Extension (WF x S)	Score	Extension (WF x S)	Score	Extension (WF x S)
Phosphorus Reduction		8.50	0.0	0.0	0.5	4.3	0.5	4.3	0.0	0.0	0.5	4.3	0.5	4.3	0.5	4.3	1.0	8.5
Water Quality Impacts		9.63	0.0	0.0	0.5	4.8	0.5	4.8	0.5	4.8	1.0	9.6	1.0	9.6	1.0	9.6	1.0	9.6
Air Quality Impacts		5.50	0.5	2.8	0.5	2.8	1.0	5.5	0.0	0.0	0.0	0.0	1.0	5.5	0.0	0.0	0.0	0.0
Maintaining Green Space/Water Quantity		6.75	0.5	3.4	0.5	3.4	0.5	3.4	1.0	6.8	1.0	6.8	1.0	6.8	1.0	6.8	1.0	6.8
Maintaining Working Farmland/Culture		7.63	0.5	3.8	0.5	3.8	0.5	3.8	1.0	7.6	1.0	7.6	1.0	7.6	1.0	7.6	1.0	7.6
Nutrient Transportability		8.25	0.5	4.1	0.5	4.1	0.5	4.1	0.5	4.1	0.5	4.1	0.5	4.1	1.0	8.3	1.0	8.3
Greenhouse Gases and Potential Credits		6.25	0.5	3.1	0.5	3.1	1.0	6.3	0.5	3.1	0.5	3.1	1.0	6.3	0.0	0.0	0.5	3.1
Production of Renewable Energy		5.50	0.0	0.0	0.0	0.0	1.0	5.5	0.0	0.0	0.0	0.0	1.0	5.5	-0.5	-2.8	1.0	5.5
Aesthetics/Nuisances		6.13	0.0	0.0	0.0	0.0	0.5	3.1	0.0	0.0	0.0	0.0	0.5	3.1	0.0	0.0	-1.0	-6.1
Safety Issues - Farm/Commuter Traffic		7.38	0.5	3.7	0.5	3.7	0.5	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.5	3.7	0.5	3.7
Impact on Roads/Truck Traffic		5.38	0.5	2.7	0.5	2.7	0.5	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.5	2.7	0.5	2.7
Animal Disease Control		7.75	0.0	0.0	0.0	0.0	1.0	7.8	-1.0	-7.8	-1.0	-7.8	1.0	7.8	1.0	7.8	1.0	7.8
Status of Technology; Reliability		6.88	1.0	6.9	1.0	6.9	1.0	6.9	1.0	6.9	1.0	6.9	1.0	6.9	-1.0	-6.9	-1.0	-6.9
Ease of Operation		7.50	0.0	0.0	0.0	0.0	-0.5	-3.8	0.0	0.0	0.0	0.0	-0.5	-3.8	-1.0	-7.5	-1.0	-7.5
Expandability		7.50	1.0	7.5	1.0	7.5	0.0	0.0	1.0	7.5	1.0	7.5	0.5	3.8	0.0	0.0	-0.5	-3.8
Ability to Treat Other Feedstocks		4.63	0.0	0.0	0.0	0.0	1.0	4.6	0.0	0.0	0.0	0.0	1.0	4.6	0.5	2.3	1.0	4.6
Regulatory and Permitting Issues		7.38	0.0	0.0	0.0	0.0	-0.5	-3.7	0.0	0.0	0.0	0.0	-0.5	-3.7	-0.5	-3.7	-1.0	-7.4
Image of Dane County -Sustainability Leader		5.00	0.0	0.0	0.5	2.5	0.5	2.5	0.5	2.5	0.5	2.5	1.0	5.0	1.0	5.0	0.0	0.0
Total Score				38		50		61		36		45		73		37		37

area surface waters, Dane County has banned, with certain exemptions, the residential use of commercial fertilizers containing P. The DNR completed a priority watershed study for Lake Mendota in 1996 and 1997 that included a goal of a 50 percent reduction in P loading to the lake from agricultural and urban sources.

Direct runoff of manure into streams has occasionally caused fish kills in Dane County. This results from the high organic and ammonia content of manure and the subsequent decomposition of the organic matter in the stream, which causes a reduction in dissolved oxygen. Fish require a certain level of dissolved oxygen to live. The potential for manure runoff is greatest during periods of prolonged wet weather, periods of snowmelt during the winter and spring, when the ground is frozen and precipitation occurs, and when manure (either liquid or solid) is spread too close to stream riparian areas.

The surface water quality issue was given a weighting factor of 9.63 because of its high importance in Dane County.

C. Air Quality Impacts

Air quality impacts associated with manure management are often a concern. For example, livestock farmers can have issues with dust, odors, ammonia emissions when manure is land applied to the soil surface, and sulfur and other emissions from uncovered lagoons. Fuel emissions caused by transportation and application of manure can also have a negative impact on air quality. Some of the alternatives reviewed in Section 4 would reduce overall emissions by providing pollution control equipment on air discharges, or reducing the frequency and distance of manure hauling. These alternatives were given a positive nonmonetary score. This issue was given a weighting factor of 5.5.

D. Maintaining Green Space and Associated Water Quantity Impacts

Preservation of open, green space is deemed an important issue by Dane County, and it was given a weighting factor of 6.75. Alternatives that result in higher anticipated positive impacts on water quality were assigned higher nonmonetary scores for this issue, because those are the alternatives that will help maintain productive farms and the associated green space. Preservation of green space is important because it would reduce urban sprawl and the associated negative environmental impacts. These negative impacts include increased stormwater peak runoff events and associated erosion, negative modification of local stream hydrology, deterioration of surface water quality, reduced groundwater recharge, increased urban heat, wildlife impacts, and other impacts. The groundwater recharge issue is particularly important in Dane County where groundwater levels are declining because of the way drinking water supplies and wastewater treatment plant discharges are managed. Urbanization would cause fragmentation of farm land, presenting more operational problems for the farmers related to access to land, longer hauling distances, and other issues. Urbanization would have a negative impact on established agricultural support businesses such as veterinarians and seed and feed dealers and cooperatives. Maintaining green space would provide more flexibility in future land use decisions as compared to urbanized land. Green space also provides separation between communities and

helps those communities retain their unique identities. Green space is also related to culture, lifestyle, aesthetics, commuter traffic, safety, and other issues described below.

E. Maintaining Working Farmland and the Associated Culture, Lifestyle, and Aesthetics

This issue is related to preservation of green space, but it focuses more on the nonmonetary benefits associated with working farmland and its culture, lifestyle, and aesthetics. Dane County culture and history are strongly tied to agriculture. The aesthetics and lifestyle of the rural landscape that surrounds the Madison metropolitan area gives Dane County its unique identity. Having working farms provides the opportunity for Dane County residents to obtain local produce, reducing dependence on distant sources that need to be transported using fossil fuels. Alternatives that would help maintain viable farming operations in the County (assuming the alternative is cost-effective) were assigned positive nonmonetary scores. The weighting factor for this issue is 7.63.

F. Nutrient Transportability

The ability to condense P and export it out of the upper Lake Mendota watershed is a key goal of this project. The weighting factor for this issue is 8.25. The ideal alternative would remove and condense P while leaving the N, K, organic carbon, and other valuable components of the manure for use on local farms. If both the P and the N are removed from the manure, the farmers would need to purchase commercial fertilizers to meet the N needs of their crops. These commercial fertilizers are increasingly obtained from foreign sources, resulting in increased costs and the environmental impacts of long-distance transportation.

G. Greenhouse Gases (GHGs)

Farms that handle animal manure, particularly those that have manure storage lagoons, release methane, carbon dioxide (CO₂), N, sulfur, and other compounds to the air. GHGs including methane, nitrous oxides, and CO₂ contribute to global climate change. Projects, such as anaerobic digestion, that reduce the amount of methane and other GHGs from entering the atmosphere were assigned a higher rating with respect to GHG emissions. This nonmonetary issue was given a weighting factor of 6.25.

GHG reductions and the available carbon credits are also discussed in Section 4 as part of the financial evaluations of the alternatives.

H. Production of Renewable Energy

The State of Wisconsin has a goal of working toward energy independence. According to the Wisconsin Office of Energy Independence Internet site, “Our state’s energy independence strategy relies on our ability to become a leader in groundbreaking research and developing technologies to make alternative energies more affordable and available to all Wisconsin citizens.” Projects that result in a net gain in renewable energy or net reduction in conventional energy use were given a positive nonmonetary score. Such projects are also important to local utility companies who need to minimize new power generation and obtain a certain percentage of their energy from renewable sources. The weighting factor for this issue is 5.5.

I. Aesthetics/Nuisances

Alternatives that result in an improvement in odor potential, dust, noise, and similar nuisances when compared to current manure management practices in the study area were given a positive score. This issue is related to siting of manure management facilities, particularly community systems. Such systems should be sited away from developed residential areas to the extent practical. This issue is also related to the aesthetics of the selected alternative itself, in terms of its systems and structures. The weighting factor for this issue is 6.13.

J. Safety Issues Related to Mixing Farm and Commuter Traffic

As residential development increases in Dane County, the opportunity for commuter and farm traffic to mix on local roads increases. This raises a safety concern because of slow moving or wide farm vehicles combined with commuters. Alternatives that reduce the current number and size of manure trucks on the road were given a positive score. This issue was assigned a weighting factor of 7.38.

K. Impact on Roads/Truck Traffic

Alternatives that could result in a decrease in truck traffic over current farming practices were given a positive score for this issue. There is some question whether increases in nonfarm-owned truck traffic could lead to greater concern over the application of load limits on local roads. In any case, increases in truck traffic and trucks carrying heavier loads will result in more wear and tear on local roads. The weighting factor for this issue is 5.38.

L. Animal Disease Control

Animal disease control is considered a major issue on dairy and other farms, and it was given a relatively high weighting factor of 7.75. A white paper on this issue is under development for the Dane County manure management web page. Alternatives that reduce the potential for on-the-farm, farm-to-farm, or farm-to-community spread of disease-causing microorganisms compared with current practices were given positive scores.

M. Status of Technology; Reliability

Alternatives employing technologies that are well-established for manure, or well-established for materials that have characteristics similar to manure, were given positive scores for this issue. Likewise, alternatives that are otherwise considered reliable in their operations were given a positive score. The weighting factor for this issue is 6.88.

N. Ease of Operation

Alternatives that are relatively easy to operate were given positive scores. This issue is related to the need to hire highly skilled workers to operate the manure management system as compared to farm labor; if highly skilled workers were needed, then it contributed to a negative score. The weighting factor for this issue is 7.5.

O. Expandability

Dane County is interested in technologies that can be relatively easily expanded to allow for one or more of the following:

- Increases in manure production from participating farms.
- Increases in the number of participating farms.
- Ability to accept different organic materials in the future such as those from area industries.
- Ability to expand to different technologies in the future, such as more efficient manure management technologies that may emerge, or a colocated biodiesel or ethanol production plant.
- Ability to accept manure from area farms on a contingency or emergency basis, such as during extreme wet weather events when storage lagoons are full.

Alternatives that can be readily expanded were given a positive score. This issue was assigned a weighting factor of 7.5.

P. Ability to Treat Other Feedstocks

Some alternatives are amenable to accepting other organic materials as feedstocks. For example, anaerobic digesters can generally accept any high strength liquid organic material, and accepting such materials can increase the production of methane and energy. The manure management committee feels it is important to maintain a link between area industries and the farming community, and the valuator assigned a weighting factor of 4.63 to this issue. If an alternative was able to accept such feedstocks and potentially generate revenue from it, this issue was given a positive score.

Q. Regulatory and Permitting Issues

The regulatory issues affecting agricultural practices are fairly complex. For example, a CAFO farm cannot be given a permit for a direct discharge of treated effluent to a receiving stream, whereas an individual or industry can. This issue was given a weighting factor of 7.38 because of its importance to the study. A positive score was assigned for alternatives that were similar to other permitted facilities in Wisconsin or where applicable regulations already existed. Positive scores were also given to alternatives that we believed the DNR would be willing to permit, perhaps with waivers or exemptions from existing rules, based on our conversations with DNR staff. Alternatives that lessen the impact of potential CAFO regulations, local ordinances such as those related to winter landspreading, and other regulations on individual farms were also given a positive score. A positive bias was given to community systems since a community solution should lead to a decreased probability of enhanced nutrient management regulations imposed on the farm community.

R. Image of Dane County as a Leader in Sustainability

Dane County is proud of its reputation for being innovative and a leader in sustainable practices. This nonmonetary issue was given a weighting factor of 5.0. Alternatives that are innovative, relatively easy to implement today, low energy users, and that are considered sustainable overall were given a positive score. Alternatives that maintain productive farms and green space and community alternatives or systems that seek to address a wide range of issues at an acceptable cost were likewise given a positive score.

5.02 SUMMARY

Table 5.01-2 presents a summary of the nonmonetary scores developed for each of the eight manure management alternatives. The two anaerobic digestion alternatives have the highest nonmonetary scores, with Alternative C-3 (cluster anaerobic digestion) having the highest overall score of 73 and Alternative F-3 (individual farm anaerobic digestion) having a score of 61. The alternatives with fine solids separation and ferric chloride addition, Alternatives F-2 and C-2, were rated the next highest with scores of 50 and 45, respectively. The remaining alternatives were all assigned similar scores of 37 or 38.