Minnesota AGRICULTURAL ECONOMIST

NO. 551 NOVEMBER 1973

Feedlot Pollution Control Impact On Northern Dairy Farms

The "Federal Water Pollution Control Act Amendments of 1972" have important implications for dairy farmers. This report provides a guide for individuals who are considering the cost of animal waste management.

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Introduction

GROWING PUBLIC awareness and concern over environmental quality prompted the U.S. Congress to enact the "Federal Water Pollution Control Act Amendments of 1972." The act charged the U.S. Environmental Protection Agency (EPA) to develop a comprehensive national program to eliminate water pollution. The act was passed Oct. 18, 1972, and federal guidelines were to be finalized in October 1973.

This report summarizes, in part, a study prepared by the Economic Research Service, ERS, USDA, to determine the economic impact of runoff control regulations on U.S. dairy farming. Dairy is directly affected because exposed lots are subject to runoff during storms and may have other discharges such as wash water.

Important questions about the impact of these regulations are:

How will dairy farms be affected?

How will production costs be changed?

Will the additional cost force a large number of farms to discontinue milk production?

Background

By 1976, the northern region of the United States—comprising the Lake States, eastern Corn Belt, and the northeast United States—will probably have over 70 percent of U.S. dairy farms.[1]

Stanchion barns with outside lots and solid manure handling systems are most common in this large area. Regardless of herd size, most

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[1]Boyd M. Buxton and David E. Cummins, *Impact of Alternative Dairy Price Support Levels*, report to the Agricultural Stabilization and Conservation Service, ERS, USDA, February 1973.

As dairy program leader for the Commodity Economics Division, Boyd Buxton's responsibilities include research in environmental quality. This report is a regionalized portion of a paper on the economic impact of runoff control regulations on U.S. dairy farms.

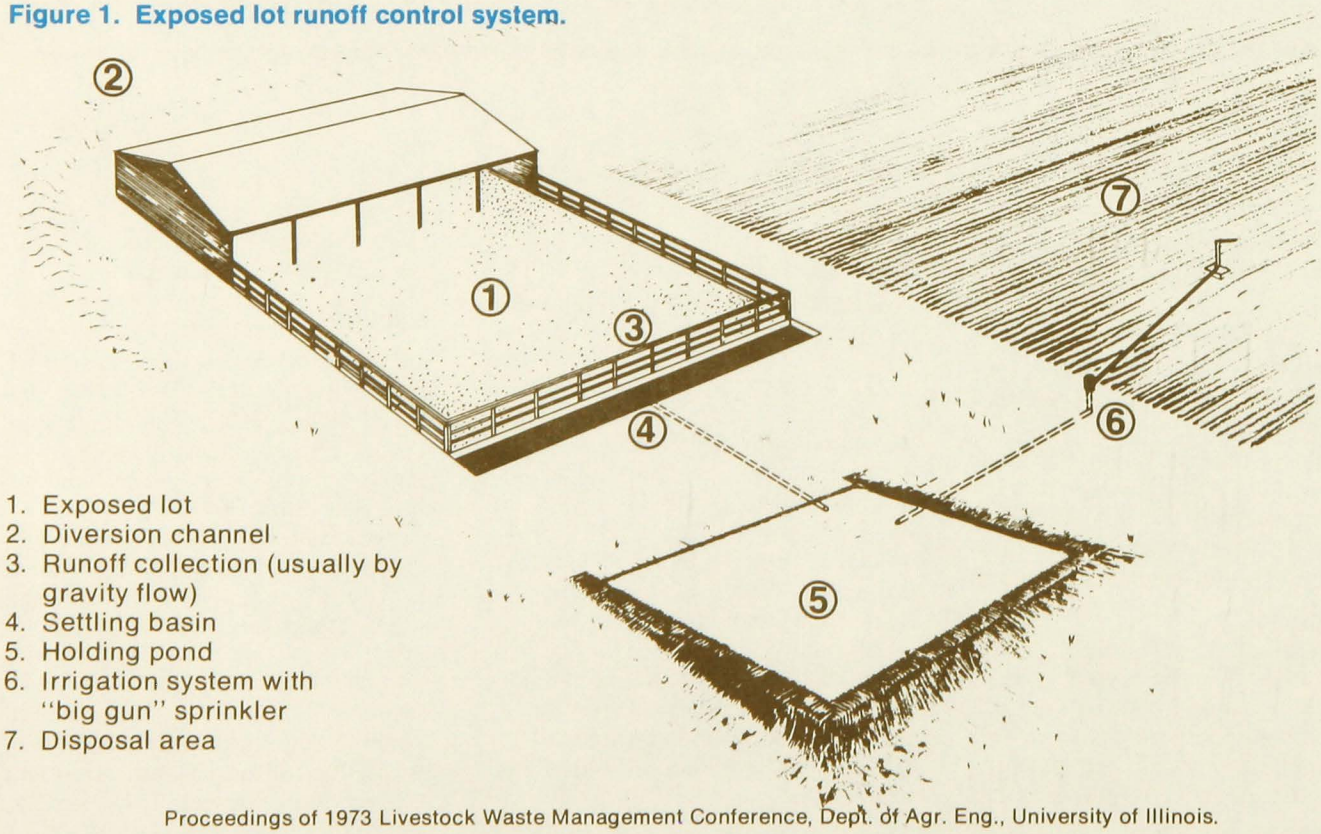
producers in that region have exposed lots. Therefore, their lot runoff may enter surface waters, thus influencing water quality.

Procedure

This study considers regulations which would require dairy farmers to retain, on their own property, all waste water and lot runoff from major storms. Facilities and equipment presently providing the most practical alternatives to control dairy runoff were outlined for representative herd sizes in the region.[2] Investment and annual costs for equipment and facilities to control runoff were estimated from equipment dealer price lists; secondary sources; and from the recommendations of state, university, and Soil Conservation Service engineers.

[2]The authors wish to thank James Moore, Department of Agricultural Engineering, University of Minnesota, for helpful suggestions and guidance in designing the systems.

Figure 1. Exposed lot runoff control system.



1. Exposed lot
2. Diversion channel
3. Runoff collection (usually by gravity flow)
4. Settling basin
5. Holding pond
6. Irrigation system with "big gun" sprinkler
7. Disposal area

Proceedings of 1973 Livestock Waste Management Conference, Dept. of Agr. Eng., University of Illinois.

Aggregate investment for dairy producers in the northern region to comply with pollution control regulations were also estimated.

Assumptions

Storage requirements for the runoff control system depend, in part, on how frequently the holding pond can be emptied, the size of the drainage area, the intensity of storm events, and the amount of runoff actually entering soil.

Facilities and equipment to control lot runoff include:

1. *A diversion terrace* to channel clean water away from the lot and buildings and to channel the polluted water through the settling basin into the holding pond;
2. *A settling basin* to remove solids carried by runoff water before this water enters the holding pond;
3. *Holding pond* to retain and store 100 percent of the runoff from 3 weeks of normal rainfall during the highest rainfall period of the year, plus a 10-year, 24-hour storm event;[3]
4. *Irrigation equipment* to dispose of waste water on land;
5. *A tractor, tractor-mounted loader, and conventional manure spreader* to remove accumulated solids in the settling basin.
6. *Fencing* to prevent livestock from entering the holding pond.

Table 1. Required investment and annual costs for typical northern dairy farms to collect, store, and dispose of runoff from a 10-year, 24-hour storm event.[1]

Additional facilities and equipment needed	Herd size 15	30	80	150
Detention pond	$ 84	$ 167	$ 446	$ 836
Diversion terrace	146	208	346	459
Irrigation equipment	1475	1475	1475	1751
Manure spreader (solid)	—	—	—	—
Tractor	—	—	—	—
Tractor-mounted loader[2]	974	—	—	—
Fencing-detention pond	38	45	48	53
Settling basin	82	162	432	626
Total investment	2799	2057	2747	3725
Total investment/cow	$187	$ 69	$ 34	$ 25
Change in annual cost with 5-year depreciation				
Depreciation	511	382	520	710
Interest	112	82	110	149
Repairs and maintenance	89	64	64	79
Insurance	6	3	3	3
Taxes	—	—	—	—
Electricity	6	11	32	59
Net change-labor	+ 32	+ 35	+ 51	+ 65
Net change-tractor	+ 1	+ 1	+ 2	+ 2
Total	757	578	782	1067
Total cost/cow	50	19	10	7
Total cost/cwt. milk[3]	.42	.16	.08	.06
Change in annual cost with useful life depreciation				
Total	443	350	462	621
Total cost/cow	30	12	6	4
Total cost/cwt. milk	.25	.10	.05	.03

[1]Assumes 3-week storage capacity for normal rainfall during highest rainfall period, plus capacity to store runoff from a 10-year, 24-hour storm event. This is equivalent to 8 inches of runoff from the total drainage area of 450 square feet per cow.

[2]Assumes most producers already have a tractor-mounted loader except for producers with 15-cow herds.

[3]Assumes an average annual milk production of 12,000 pounds per cow.

Estimated investment and annual cost

Investment to control runoff from a 10-year, 24-hour storm (5 inches) would cost individual producers with 15 dairy cows $2,799 or $187 per cow (see table 1). If dairy farm operators planned to recover the investment in 5 years, annual costs would be about $50 per cow. Annual costs would decrease to $30 per cow when the investment is spread over the expected useful life of the facilities and equipment.

Investment costs per cow would be much lower for larger farms. Total investment would be $2,057 for 30-cow herds, $2,747 for 80-cow herds, and $3,725 for 150-cow herds. Annual costs per cow would be $19, $10, and $7, respectively.

If the investment is recovered over a 5-year period, the cost would increase 42 cents per 100 pounds of milk for 15-cow herds and 6 cents per 100 pounds for 150-cow herds.

Storm event equivalent to 50 percent of normal rainfall

Investment in facilities and equipment to control the equivalent of 14 inches of rainfall (50 percent of the normal 28 inches of rainfall) would be about $10 more per cow than investment to control a 10-year, 24-hour storm (see table 2). Annual cost would increase by

[3]The assumption of storing "normal rainfall" is equivalent to overdesigning the capacity of the holding pond to retain runoff because the intensity of rainfall greatly affects the amount of runoff. In addition, density of the lot surface, slope, and rainfall variation make it difficult to measure the exact amount of runoff from exposed lots in this region. Hence, 100 percent of normal rainfall was assumed to be stored. A 10-year, 24-hour storm event is the amount of rainfall (in inches) that would fall during a 24-hour period with a frequency of recurring once in a 10-year interval.

Stephen Ziegler inspects a runoff control system on a Washington County dairy farm. Runoff from the exposed lot is funnelled by a diversion channel through a settling basin to the holding pond. Effluent from the holding pond is periodically irrigated onto cropland or pasture.

Table 2. Increase in investment, annual cost, and cost of producing milk (1) without storage capacity for major storm event; (2) with capacity for 10-year, 24-hour storm event; and (3) with capacity to store the equivalent of 50 percent of annual precipitation for investment costs recovered in 5 years and over useful life in the northern region.

	5-Year recovery			Recovery over useful life		
Herd size	Normal rainfall[1]	10-year, 24-hour storm event	Storm event equivalent to 50% of normal rainfall	Normal rainfall[1]	10-year, 24-hour storm event	Storm event equivalent to 50% of normal rainfall
15-cow herd						
Investment (total)	$2729	$2799	$2927			
(per cow)	181	187	195			
Annual cost/cow	49	50	53	$29	$30	$31
Cost/cwt. of milk	.41	.42	.44	.24	.25	.25
30-cow herd						
Investment (total)	1928	2057	2310			
(per cow)	64	69	77			
Annual cost/cow	18	19	21	11	12	13
Cost/cwt. of milk	.15	.16	.18	.09	.10	.11
80-cow herd						
Investment (total)	2460	2747	3698			
(per cow)	31	34	46			
Annual cost/cow	9	10	13	5	6	7
Cost/cwt. of milk	.07	.08	.11	.04	.05	.06
150-cow herd						
Investment (total)	2919	3725	5258			
(per cow)	19	25	36			
Annual cost/cow	6	7	10	3	4	5
Cost/cwt. of milk	.05	.06	.08	.03	.03	.04

[1]Assumes a partially paved lot surface area of 450 square feet per cow with a 3-inch normal rainfall during the wettest 3 weeks of the year.

about $3 per cow with an increase of about 2 cents per 100 pounds of milk produced (if investment costs are recovered in a 5-year period). Recovering investment costs over the expected useful life of the facilities and equipment results in an increase of only about $1 per cow for annual costs with a 1 cent increase in the cost of milk produced.

Therefore, doubling the storage requirement of the holding pond does not result in a corresponding doubling of investment and production costs. Once the initial investment in facilities and equipment has been made, the storage requirement may be increased with a relatively small increase in annual costs.

Impact on net farm income

The higher annual cost of controlling runoff—including operating expenses and repayment of the original investment—means a direct decrease in net cash income for dairy farm operators who would be required to invest in pollution control facilities and equipment. The 1976 estimated net cash income for dairy farms in selected locations was compared to the increased annual cost of the needed pollution control equipment and facilities (see table 3).

Net cash income per farm would be reduced about 2 percent for farms with 80 or more cows and 5 to 6 percent for small farms with 30 or less cows. Net cash income could be reduced 9 to 10 percent on low-income farms with 30 or less cows and even more on less efficient farms.

Dairy farms with potential runoff problems

A recent survey conducted by the National Milk Producers Federation provided some insight of the number of dairy farmers with a potential runoff problem.

Of the 919 producers responding in the northern region, 38 percent indicated that runoff from the surface of their outside lots (1) entered a continuously flowing ditch, stream, creek, canal, or river which flows through the lot itself; (2) directly entered surface water which bordered the lot; or (3) entered surface water through a dry ditch, grass waterway, and/or surface tile inlet.

The severity of the problem is intensified by additional runoff entering a lot from the drainage area above the lot and from roofs of buildings adjacent to the lot. Sixteen percent of the respondents indicated that runoff from above the lot flowed into the lot. Sixty-two percent of the producers who indicated a potential lot discharge problem also had space available for a holding pond without relocating the lot. Seventy-nine percent either had space available or could refence part of the existing lot to accommodate a holding pond.

Aggregate cost for producers

Assuming 40 percent of dairy producers in the northern region were required to construct runoff control facilities designed to retain a 10-year, 24-hour storm event, the total cost of controlling lot runoff would be $202 million (see table 4).

Almost 23 percent of the estimated $202 million required to control runoff would come from operators of herds with less than 20 cows (see table 4). By excluding such farms with a potential problem from complying with regulations, total investment would be reduced

Table 3. Estimated decrease in projected 1976 net cash income for selected sizes and locations of dairy farms to control runoff in the northern region[1]

	Herd size (cows)	Net cash income (estimated 1976)[2]	Annual cost of runoff control facilities[3]	Percent of net cash income
New York	less than 40	$15,113	$ 578	3.8
	70-84	26,784	782	2.9
	150 +	55,163	1072	1.9
Pennsylvania	20-29	12,336	600	4.9
	70-89	30,711	782	2.5
	110 +	49,196	1072	2.2
Michigan (southern)	less than 30	9,208	578	6.3
	75-99	38,819	782	2.0
Wisconsin				
(low income)	less than 30	6,077	578	9.5
(high income)	less than 30	16,494	578	3.5
Minnesota (southern)	25-34	17,413	578	3.3
	55 +	38,863	782	2.0

[1] The 1976 net cash income projections assume milk prices equivalent to about 75 percent of parity and projected increase in input prices. From net cash income (gross income minus cash farm operating expenses and interest payments), the operator must take depreciation of farm capital and money to retire farm debt. It includes the return to operator and unpaid family labor, owned capital, and management.

[2] In 1976 dollars (not deflated), estimates prepared by George Frick and reported in *Impacts of Alternative Dairy Price Support Levels*, an unpublished report to the Agricultural Stabilization and Conservation Service by the Economic Research Service, USDA, January 1973.

[3] Based on current investment costs.

Table 4. Aggregate investment cost for dairy producers in the northern region to control lot runoff.

	Cost to control lot runoff from 10-year, 24-hour storm event
	(million dollars)
40% of producers	202
Exempting producers with less than 20 cows	155

by $47 million to about $155 million.

Summary and implications

The added cost of runoff control facilities cannot be immediately passed on to consumers, but must be absorbed by producers. If small producers with relatively high production costs are forced out of production, leaving the more efficient producers, it is conceivable that the dairy industry may be more efficient with no consumer price increases.

If individual producers expand production so their net incomes remain unchanged, they can achieve lower cost per cow in meeting the higher standards. This would also dampen any possible increase in consumer prices. Higher costs, therefore, will directly reduce net farm income in the short run and stimulate adjustments in the dairy industry in the long run with somewhat uncertain effects on consumer prices.

Runoff control regulations that reduce net cash income relatively more on small farms than on large farms, together with the probable greater difficulty in obtaining money for an investment of several thousand dollars on small farms than on large farms, will hasten the exit of small producers and stimulate the structural shift to fewer and larger farms. This structural shift will be in addition to the change already projected to 1976 which was used as a base for this study.

This analysis indicates that exempting dairy farm operators having less than 20-cow herds from pollution regulations would reduce the region's aggregate capital investment by 23 percent. A much smaller total capital outlay is implied if smaller producers are exempted. These small producers also stand to lose the most since their investment and annual cost per cow and milk production costs would be increased the most and they can least afford it.

The greatest financial impact of controlling runoff would be on farms with fewer than 20 cows. Investment would be almost $200 per cow, increasing annual cost per cow by $50 to $65. In the short run, the cost of producing 100 pounds of milk would be increased by 45 cents.

The impact on a farm with 20 or more cows is significant, but much less dramatic than on a farm with fewer than 20 cows. Investment per cow would be $69 for a 30-cow herd and $25 for a 150-cow herd. The corresponding short run increase in cost of producing 100 pounds of milk would be about 16 and 6 cents, respectively.

This study attempts to reflect the upper limit of investment costs to control feedlot runoff. Many producers may already own equipment included in the calculations. Some producers may build facilities at a lower cost than what was assumed in this study. However, this analysis was designed to provide a guide for individuals who are considering the cost of animal waste management.

Minnesota AGRICULTURAL ECONOMIST

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Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

OFFICIAL BUSINESS

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Roland H. Abraham, Director of Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota 55101.

Prepared by the Agricultural Extension Service and the Department of Agricultural and Applied Economics. Views expressed herein are those of the authors, but not necessarily those of the sponsoring institutions. Address comments or suggestions to Associate Professor John J. Waelti, Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, Minnesota 55101.

NO. 551 NOVEMBER 1973

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