

Livestock Decision Support Tool For The Rural Municipality of Blanshard



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This report provides the Rural Municipality of Blanshard with valuable tools and knowledge that will assist them in making informed decisions regarding sustainable agricultural and rural development, protecting the water and soil resource.

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Abstract

With the recent expansion of the livestock industry in Manitoba, local decision makers and rural municipalities are under pressure to ensure that decisions in regards to livestock operations reflect sustainability in terms of environmental, social and economic issues. A decision support tool was developed for the Rural Municipality of Blanshard to assist the council in making decisions regarding the livestock industry in the rural municipality.

A geographical information system (GIS) was used to integrate resource data, locations and size of livestock operations, and by-laws and regulations regarding livestock development information and spatially display the various issues and implications, such as availability of land for manure application, associated with potential livestock expansion.

Currently, there are 56 livestock operations in the Rural Municipality of Blanshard producing 7,269 animal units. While approximately 85% of the land base (annual cropland, forages and grasslands) of the RM is available for livestock expansion and manure application, regulations and bylaws implementing setbacks of livestock operations from watercourses and rural dwellings and communities decrease the amount of this area available for expansion. Based on proposed municipal by-laws and current provincial regulation, future expansion of the livestock industry in the RM will be limited to smaller operations or those under 300 animal units.

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1.0 Introduction

Agricultural development, particularly livestock expansion, is occurring rapidly in Manitoba. Local governments and other decision makers are under pressure to make decisions on livestock operations which must reflect sustainability in terms of environmental, social and economic issues. Resource based data for land use planning, although not complete, is advanced enough to be immediately useful by local governments in their decision making. Social and economic considerations are equally important, but require additional data and development to be integrated into local decision making.

Livestock operations, dominated by beef operations with several larger hog operations, occur throughout Rural Municipality of Blanshard. The Rural Municipality of Blanshard needs the ability to acquire, interpret, and distribute information to assist in making informed decisions regarding the livestock industry, while at the same time addressing environmental and community concerns.

Geographic Information Systems (GIS) is a relatively new tool that can assist local governments in making sustainable resource development decisions regarding the livestock industry. GIS allows the user to spatially display information and produce maps in an accurate and timely fashion. Using this tool can help local governments and planning districts find the appropriate solutions to resolve complicated resource planning issues and to ensure sustainable development of the livestock industry.

2.0 Project Description and Objectives

To adequately represent current livestock operations relative to land capacity and social constraints, the Rural Municipality of Blanshard needed to develop capabilities that allowed for the acquisition and utilization of information for use in decision making. With the collection of agricultural and residential data by RM staff and councillors, demographic and resource information was combined into a geographic information system (GIS) and analyzed to create map products that spatially illustrated different management options to assist in the sustainable management of agriculture in Blanshard. Information developed will assist local decision makers to analyze current livestock regulations and operations and analyze future livestock expansion proposals.

At completion, the project delivered

- i. a methodology that supports resource based decision making by the Rural Municipality of Blanshard to deal with current and future livestock operations
- ii. a demonstrated capacity of the Rural Municipality of Blanshard to utilize advanced decision making tools on their decision making
- iii. reports for each participating partners that include hard copy (tabular and map form) results of analysis
- iv. digital products and data for continued analysis by the Rural Municipality of Blanshard.

3.0 Methodology

3.1 Needs of the Rural Municipality of Blanshard

Through discussions with the Rural Municipality of Blanshard the following statements about the need and scope of the project were determined. The Rural Municipality of Blanshard wishes to have a decision support tool for land use planning capable of spatially illustrating options, issues, and information relevant to decisions on livestock development within the provincial and municipal regulatory frameworks. This product will not replace the need for site specific assessment of each operation but will assist in general land use planning for the RM. Data needed to complete the project was discussed and agreed upon.

3.2 Data

Basemap Features

The basemap is a digital map that all other information is plotted or corrected to. Essentially the basemap is the frame upon which the rest of the data is placed. This information included the position of roads, lakes, rivers, streams, rail lines and other features. This information is also used in the analysis of environmental setbacks from water bodies, roads and other applicable features. Two separate sources of information were utilized for creating the basemap for the RM of Blanshard. These are the National Topographical Survey (NTS) sheets and the ortho-photos with associated quarter section grid.

In the RM of Blanshard there is one Provincial Trunk Highway (#24) which travels east-west through the municipality and three Provincial Roads - #250 which is paved and #355 and #354 which are graveled ([Map 1](#)). In the southwest corner, the Canadian National Railway track passes through the RM. There are two abandoned railroad tracks.

[Map 2](#) shows the size and distribution of hydro lines in the RM. New developers can use this information to identify where hydro is available and how far they may have to go to access it. Single phase hydro lines are the most common for residential and farm operations. Three phase lines are for industrial use, which may be required by some large intensive livestock operations. In [Map 3](#), areas which are within one mile of a three phase hydro line are highlighted. It is assumed that one mile would be the limit on how far one would go to access a three phase line. The TransCanada Pipeline also passes through the RM ([Map 2](#)).

Rural Residences

Knowing the locations of rural dwellings is important to municipal council, as locations can be used to determine which areas are excluded from livestock expansion due to the proximity of proposed livestock operations to residences. Locations were determined through ortho-photos, tax roles, and the assistance of municipal staff. Rural dwellings included abandoned yards which may still be habitable. In Blanshard, there are 145 rural dwellings and two communities, Oak River and Cardale ([Map 4](#)).

Livestock Operations

Knowing the location of existing livestock operations is essential for proper land use planning to occur. This information is helpful in making decisions in determining the direction and scope of future expansion of the livestock industry as well as ensuring the sustainable management of existing operations. Livestock locations were determined through the use of ortho-photos, tax roles, and the assistance of municipal staff. Information on operation type and size was acquired from municipal staff and producer interviews.

In the RM of Blanshard, there are 56 livestock operations ([Map 5](#)). Several farm operations reported having more than one livestock type (for example both beef and horses). For the purpose of this study, each farm was considered a single livestock operation, regardless if more than one type of livestock was produced. Total animal units (AU) at the time of the study was 7,269 AU. One animal unit is defined as the number of livestock required to excrete 73 kg (160 lbs) of nitrogen in a 12 month period. While the majority of the livestock operations consist of beef cattle, these operations tended to have small animal unit numbers relative to the hog operations, which make up the majority of the animal units found in the municipality (Table 1).

Table 1. Livestock in the RM of Blanshard

Livestock	# of Operations Reporting	Total AU
beef	43	2,617
hogs	9	4,134
dairy	3	—*
horses	2	— *
sheep/goats	2	—*
poultry	2	—*
Total	61**	7,269
# of farms reporting more than one type of livestock	5	
Total # of livestock operations	56	

* animal unit numbers are suppressed to protect producer confidentiality but are reflected in the total for the RM

**some farms reported more than one type of livestock in their operation

Groundwater Pollution Hazard

Possible groundwater hazard areas were mapped by Manitoba Water Resources using existing aquifer, geological and soils maps and water well and groundwater test hole records. Areas with surface sand or gravel and/or sand and gravel within the uppermost 6 m of the soil profile, or areas with a known unconfined aquifer are considered to have a groundwater pollution hazard. The scale of mapping is 1:250 000 and therefore the boundaries of the possible ground water hazards may not be precise. Further evaluation of site is required to determine extent and severity of hazard. [Map 11](#) illustrates that there a few small areas in the RM of Blanshard which could have a groundwater pollution hazard.

Land use

The way land is presently being utilized affects decisions about manure application and facility placement. Land use can determine the possibilities or limitations for livestock expansion. For example, land that is annually cropped, under forages or in grassland could be available for manure disposal. The amount of these lands available for manure disposal within an economical distance from an operation could limit the size of the proposed livestock operation. Land use information was derived from satellite imagery which has a resolution of 30 m². Satellite imagery was obtained from Radarsat International in 1994. Imagery was then classified by Manitoba Remote Sensing into seven groups. These are Annual Crop Land, Forages, Grasslands, Trees, Water, Wetlands, and Urban and Transportation.

Land use in the RM of Blanshard in shown in [Map 6](#). Table 2 gives the total hectares of the different land uses. In Blanshard the majority of the land is in annual crops (72%), with another 11% in grassland and 1.5% in forages. These three areas (84.5% of the RM) could potentially be available for manure disposal. Only 0.1% of the RM is water and 6.5% of the RM is wetlands.

Table 2. Land use in the RM Blanshard*

Land Use	area (ha)	% of RM
Annual crop land	42,320	72.3
Trees	3096	5.3
Water	74	0.1
Grassland	6631	11.3
Wetland	3827	6.5
Forage	872	1.5
Urban and Transportation	1693	2.9
Total	58,513	

*Data derived from 1994 satellite imagery.

Soils

Soils of a municipality are an important natural resource for the community. The soil database and maps are important for making decisions about agricultural capability of the land, risk of leaching, and the suitability of land for many uses including agriculture, industrial, construction, and recreation. The soils information for the RM of Blanshard is available at a scale of 1:126 720. The soils database contains information about soil texture, drainage, permeability, plus many other characteristics and interpretations.

Surface Texture

Soil texture strongly influences the soils ability to retain moisture, its general level of fertility and ease or difficulty of cultivation. Water moves easily through coarse-textured (sandy) soils so little moisture is retained causing these soils to dry out more quickly than fine textured (clay) soils. As well, sandy soils do not retain plant nutrients as well as clay soils and are lower in natural fertility. Sandy soils often are characterized by a loose or single grained structure, which is very susceptible to wind erosion. Sandy soils, because they are highly permeable, have the potential for nitrate leaching, affecting groundwater quality. Clay soils have a high proportion of very small pore spaces which hold moisture tightly and are usually fertile because they are able to retain plant nutrients. Clay soils transmit water very slowly, therefore these soils are susceptible to excess moisture conditions.

Surface texture in the RM is mainly fine loamy (98%) ([Map 7](#)). There is one small area east of the town of Oak River which has a coarser texture of sand. Table 3 provides a summary of the total area covered by these soil textures.

Table 3. Soil texture in the RM of Blanshard*

Soil Texture	Area (ha)	% of RM
Fine Loamy	56,830	97.9
Sand	14	0.02
Eroded Slopes	1194	2.1
Total	58,038	

*Area has been assigned to the dominant surface texture in each soil polygon

Slope

Slope describes the steepness of the landscape surface and is an important factor in erosion and drainage. The steeper the slope gradient, the greater the potential for water erosion. Runoff of surface applied manure may be a concern in fields with steep slopes. To reduce the potential for water erosion, adequate soil cover must be maintained through the use of perennial forages or the reduction or elimination of tillage in annual crop production.

In the RM of Blanshard, land surface varies from near level and gently undulating to hummocky. The landscape in the municipality is characterized by numerous undrained depressions, varying from small potholes and sloughs to larger meadows, and intermittent and shallow lakes. Surface runoff tends to collect in these depressional areas. Fifty percent of the RM is characterized by irregular, gently undulating topography with slopes ranging from 2-5% (Table 4). Another 47% of the RM has higher local relief with slopes ranging from 5-9% (Map 8).

Table 4. Slope in the RM of Blanshard*

Slope Class	Area (ha)	% of RM
0 - 2 %	62	0.1
2 - 5 %	28,942	49.9
5 - 9 %	27,328	47.1
9 - 15 %	511	0.9
>30 %	1,195	2.1
Total	58,038	

*Area has been assigned to the dominant slope in each soil polygon

Water Erosion Risk

In the soils database, using such data as slope length, slope gradient, and soil erodibility, a risk for water erosion has been calculated. Areas are rated as having severe, high, moderate, low or negligible risk for erosion. Areas with a high and severe risk need special practices to mitigate erosion risk (ie. minimum tillage or high residue cover in early spring). The main concern for manure disposal in areas with high to severe risk of erosion is the potential for nutrients in runoff to impact the quality of local surface water. Management practices to reduce the potential for contaminated runoff include applying manure in spring and fall at rates reflecting soil test recommendations, applying manure by injection, or incorporating manure into the soil as soon as possible, leaving adequate residue cover on the soil surface (50-65% cover) and selecting deep-rooted, high residue or high nitrogen user crops.

In the RM of Blanshard, about half (50%) of the municipality is considered to have a moderate risk for water erosion, 32% has a high risk and about 3% has a severe risk of erosion (Table 5, Map 9). Areas with high to severe risk for erosion require the previously discussed management practices/recommendations for manure disposal.

Table 5. Water Erosion Risk in the RM of Blanshard*

Water Erosion Risk	Area (ha)	% of RM
Negligible	3,604	6.2
Low	5,330	9.2
Moderate	29,133	50.2
High	18,330	31.6
Severe	1,641	2.8
Total	58,038	

* Based on the weighted average USLE predicted soil loss within each polygon, assuming a bare unprotected soil.

Agricultural Capability

When considering a site for a livestock operation, the amount and the productivity of the land available for manure disposal is important. Manure application rates will depend on the type of vegetation (different crops have different nutrient requirements) and the ability of the land to produce vegetation. Less productive soils will require a lower application rate to prevent leaching of nutrients.

Using the Seven Class Canada Land Inventory System, land has been classed according to its agricultural capability. Classes 1 to 3 represent prime agricultural land, Class 4 land is marginal for sustained cultivation, Class 5 land is capable of perennial forages and improvement is feasible, Class 6 land is capable of producing native forages and pasture but improvement is not feasible, and Class 7 is considered unsuitable for dryland agriculture. Improvements could include removal of scrub or trees, removal of stones, drainage, altering soil structure or dyking.

In the RM of Blanshard, 47 % of the land is rated as Class 2 and another 44% is rated as Class 3 (Table 6). These classes are prime agricultural land with topography being the main limiting factor to crop production. Another 6% of the RM is rated at Class 5 and is more suitable for perennial forages. The Class 6 land is areas where there are eroded slopes ([Map 10](#)).

Table 6. Agricultural capability in the RM of Blanshard

Class	Area (ha)	% of RM
Class 2	27366	47.2
Class 3	25427	43.8
Class 4	446	0.8
Class 5	3604	6.2
Class 6	1195	2.1
Total	58038	

4.0 Analysis and Discussion

4.1 Manure Disposal Sensitivity

There are certain characteristics of soil and landscape which may make areas unsuitable for manure disposal if no mitigation practices are carried out. Areas with coarse textured soils, groundwater hazards, high and severe risk of erosion, wetlands and or intermittent water bodies, may pose problems for surface or ground water contamination from manure. These areas need a more detailed on-site evaluation so recommendations can be made for the appropriate manure disposal methods to reduce the potential for nutrient contamination. For example, in areas with high or severe risk for erosion, reduction of application rates and maintaining adequate residue cover is required.

[Map 11](#) shows areas where increased scrutiny is necessary before manure is applied. This map is not meant as a restriction to manure disposal, only to illustrate areas which could have sensitivity for manure disposal. Due to the large scale of this data, on-site inspections are necessary to determine the exact nature of the hazard, and to make recommendations on practices that will mitigate the site specific hazards. For example areas in or near a ground water pollution hazard should be further investigated to better delineate the extent and severity of the hazard. With the implementation and use of the appropriate manure disposal method, application rate, farming practices etc., the potential for nutrient contamination of surface water and ground water can be greatly reduced or eliminated.

4.2 Municipal By-Laws

Zoning and by-laws are tools used by the municipality to control and direct development of livestock industry to the betterment of the community as a whole. The RM of Blanshard is in the process of developing municipal by-laws regarding livestock operations. These by-laws stipulate the minimum distance new or expanding livestock operations can be located from rural residences and the communities of Oak River and Cardale, based on animal units and manure type. The total number of animal units involved in a new or expanding livestock operation will be based on the cumulative total of new and existing AU's across species. The RM has stipulated different setback distances from rural dwellings than from rural communities for smaller operations (10-300 animal units (AU)) producing liquid or non-liquid manure, while for larger operations (greater than 301 AU) setback distances are the same for both rural dwellings and rural communities. A summary of the proposed setback requirements for the RM of Blanshard is found in Table 7.

Table 7 - Proposed by-laws for the RM of Blanshard

AU Range*	Manure Type	Setback of livestock operations and lagoons from:	
		rural dwellings	rural communities
10-100	liquid	1/4 mile	½ mile
101-300	liquid	3/4 mile	3/4 mile
10-50	non-liquid	0	1/4 mile
51-300	non-liquid	1/4 mile	½ mile
301-600	all types	1 ½ miles	1 ½ miles
601-800	all types	2 miles	2 miles
801 & up	all types	2 ½ miles	2 ½ miles

*AU (animal unit) range according to proposed municipal by-laws

Provincial environmental regulations also affect the development and operation of livestock operations. Confined livestock areas that are greater than 10 animal units must be located at least 100 m from any surface watercourse or water body. As well, manure storage facilities must be located at least 100 m from any surface watercourse, sinkhole, spring or well.

Maps 12 to 17 illustrate the area available for siting new or expanding livestock operations according to the AU (animal unit) range. Also shown in these maps are the 100 m (328 ft) setbacks from water bodies and water courses, as required by provincial regulations within which no confined livestock operation over 10 AU or manure storage facility can be located. Table 8 summarizes the amount of land available for expansion in hectares and percentage of the RM land base for the various animal unit ranges. The amount of land available is calculated using only land classified as annual crop land, forages or grassland.

Table 8: Total area available for new or expanding livestock operations (according to proposed municipal by-laws and land use maps).**

AU Range*	Manure Type	Available Area (ha)**	% of RM
10-100	liquid	38 811	67%
101-300	liquid	13 445	23%
10-50	non-liquid	44 059	76%
51-300	non-liquid	38 811	67%
301-600	all types	379	.7%
601-800	all types	0.2	

* AU range according to proposed municipal by-laws

** Available area for new or expanding livestock operations was calculated using only annual crop land, forages or grassland as classified from satellite imagery (1994).

Maps 12 and 13 illustrate the area in which new or expanding livestock operations that are 10-300 AU in size and producing liquid manure could be located. Operations producing 10-100 AU have setback requirements of 0.25 miles from rural dwellings and 0.5 miles from rural communities (Map 12). For operations producing 101-300 AU, the setback requirements for rural dwellings and communities is 0.75 miles (Map 13). Area available for 10-100 AU and 101-300 AU livestock operations producing liquid manure is 38,811 ha (67 % of the RM) and 13,445 ha (23% of RM) respectively (Table 8).

Maps 14 and 15 illustrate the areas where non-liquid manure producing livestock operations of 10-300 AU in size could be located. New or expanding livestock operations producing 10-50 AU in non-liquid manure have a 0.25 mile setback requirement for rural communities but no setback requirement for rural dwellings (Map 14). For operations which will produce 51-300 AU of non-liquid manure, the minimum setback is 1/4 mile from rural dwellings and 1/2 mile from rural communities. (Map 15). Area available for the 10-50 AU and 51-300 AU operations producing non-liquid manure is 44,059 ha (76% of RM) and 38,811 ha (73% of RM) respectively (Table 8).

For new or expanding livestock operations which will produce 301-600 AU of manure (liquid or non-liquid), the minimum setback is 1.5 miles from both rural dwellings and communities. Map 16 illustrates that this leaves only 379 ha (or 0.7% of RM) available for this size of operation. Map 17 shows areas available for new or expanding livestock operations 601-800 AU in size, which require a two mile setback from rural dwellings and rural communities. Only 1.14 ha in the RM is not buffered, of which, only 0.2 ha is suitable (annual crop land). There is no area available for any new or expanding livestock operations greater than 801 AU, which require a 2.5 mile setback from both rural dwellings and rural residences.

5.0 Summary and Conclusions

With the growth of the livestock industry in Manitoba and the increase in concern for the environment, municipal councillors are under pressure to make informed decisions that address environmental, social and economic issues. By having information such as land resources, current location of residences and livestock operations, and infrastructure available in a useable form, councillors will be able to make wise decisions regarding the livestock industry in their municipality.

Currently in the RM of Blanshard, there are 56 livestock operations, the majority of which raise beef cattle. The total animal units produced in the municipality is 7,269. While the majority of the livestock operations raise beef cattle, over half of the animal units are produced by the hog operations in the municipality.

Land available for manure disposal includes annual crop land, forages and grassland. In Blanshard, this area makes up about 85% of the RM, though the actual available area for manure application would be reduced by the buffered areas that are recommended to be kept around water courses, sinkholes, springs, wells and residential property lines during manure disposal. Manure disposal practices should also take into account the soil and landscape characteristics to eliminate the risk for manure contamination of surface waters and groundwater. Approximately 34% of the land in the municipality has a high to severe risk of water erosion. In these areas, management practices should include limiting applications rates to soil test recommendations, applying manure by injection, incorporating manure as soon as possible, leaving adequate residue cover on the soil surface (50-65% cover) and selecting deep-rooted, high residue or high nitrogen-use crops. There are also a few areas in the RM which have a groundwater pollution hazard. These areas should be investigated to determine the extent and nature of the hazard so recommendations can be made with regard to manure disposal.

While there is land available for manure disposal, the extent of any expansion of the livestock industry is limited municipal by-laws. In the RM of Blanshard, there are 2 communities and 145 rural dwellings. By-laws stipulate the minimum distance a new or expanding livestock operation can be located from these communities and rural dwellings. Based on the proposed by-laws, the RM of Blanshard has room for livestock expansion for smaller livestock operations only (under 300 AU). For proposed operations under 100 AU producing liquid manure, 67% of the RM is available, while operations 101-300 AU in size producing liquid manure have only 23% of the RM available for possible siting. For operations producing non-liquid manure, the setback requirements are smaller, providing more area available for siting. For operations under 50 AU, 76% of the RM is available while 67% of the RM is available for proposed operations 51-300 AU in size. Any livestock operations wanting to expand or establish which will be greater than 301 AU in size will be severely limited as to where they can be located with only 0.7% or less of the RM available.

This information in this report will not replace the need for site specific assessment of each operation but will assist in generalized land use planning for the whole RM. Potential new or expanding livestock operations can use the GIS maps showing the areas available for

establishment. Once a site location which satisfies the municipal by-laws and provincial regulations has been identified for new or expanding livestock operation, a more detailed and on-site evaluation will need to be carried out to determine if the chosen site is suitable for a manure storage facility, and to determine the availability and suitability of land for manure disposal. This can be done through the technical review process available to the municipality.

5.1 Future Direction

Using GIS as a tool for displaying, integrating and interpretation of information has immediate value for the RM of Blanshard in planning for livestock operations. An improved ability to bring information together in an easily understood format not only assists in decision making, but will also facilitate public input into decisions through discussions generated when collecting information. The RM will also be able to use GIS in their day to day operations (road maintenance, drainage, etc) and when planning for future development, be it agricultural or industrial.

Information and data obtained in this study will remain in the hands of the RM of Blanshard. Updating data will be the responsibility of the municipality. Analysis can be provided by groups with technical expertise such as consulting companies or government agencies (such as PFRA).

6.0 Acknowledgments

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7.0 Data Sources

Ortho-Photos and Quarter section grid: Linnet Geomatics International Inc., Winnipeg, Manitoba. 1:60 000, 1995

National Topographic Survey: Department of Energy, Mines and Resources, Surveys and Mapping Branch, Ottawa Canada. 1:50 000

Soils: Ehrlich, W.A., Pratt, L.E., and Poyser, E.A., 1956, Report of Reconnaissance Soil Survey of Rosburn and Virden Map Sheet Area. Soils Report No. 6 Manitoba Soil Survey. Published by Manitoba Dept. of Agriculture

Land Use: Satellite imagery obtained from RSI. Landsat TM (30 m pixel resolution) Date of image: Sept. 22, 1994. Classification from the Manitoba Remote Sensing Centre. Winnipeg, Manitoba

Livestock operations, Residence, Business, Recreational and Urban areas, Municipal By-laws: RM of Blanshard, Oak River, Manitoba

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