

## SITE REQUIREMENTS FOR THE SELECTION OF LIQUID MANURE STORAGE STRUCTURES IN MANITOBA<sup>1</sup>

SITE CATEGORY	GEOLOGIC & HYDROGEOLOGIC FEATURES DESCRIBING THE SITE CATEGORY	MINIMUM DESIGN REQUIREMENT FOR LIQUID MANURE STORAGE STRUCTURES (All designs must conform to the requirements of the Technical Reference Manual for Liquid Manure Storage Structures)	GROUNDWATER MONITORING REQUIREMENTS
GEOLOGICALLY SECURE	The floor of the manure storage structure is separated from an aquifer <sup>2</sup> by a relatively uniform overburden of low permeability material that is at least 5 m thick and which starts at the floor of the manure storage structure. This overburden material must have a hydraulic conductivity no greater than $1 \times 10^{-9}$ m/s.	Site specific explorations, sampling and laboratory analyses have to be carried out to confirm the geologic and hydrogeologic site characteristics.	Usually not required due to soundness of the site, but may be required at the discretion of the regulatory agency
GEOLOGICALLY VARIABLE OR UNIFORM	Variable geological formations , where low permeability fine grained soils, such as clay or medium textured soils exist with interstratified coarse grained soils that may allow for appreciable water flow to or from adjacent aquifers. This category also includes situations of uniform geological formations consisting of fine grained soils with a permeability of greater than $1 \times 10^{-9}$ m/s and a minimum 5 m of overburden from the floor of the manure storage structure to an aquifer.	Compacted clay or synthetic liners are suitable design options for earthen manure storage structures.	Monitoring system will be required, which include groundwater installation of monitoring wells. The regulatory agency may request a specific monitoring and reporting plan.
GEOLOGICALLY SENSITIVE	Permeable formations (coarse grained soils) or complex geology with interbedded clay and sand or gravel strata where there is less than 5 m of overburden or no overburden of low permeability material from the floor of the manure storage structure to an aquifer.	Engineered steel or concrete storage structures are suitable alternatives. Earthen manure storage structure options are limited and require advanced design including synthetic or composite liners, collections systems and extensive monitoring.	Secondary containment and leachate detection system are required. A monitoring system is also required, inclusive of groundwater monitoring well installation. The regulatory agency may request a specific monitoring and reporting plan.

<sup>1</sup> This table is provided to help engineers and developer identify the likely design requirements for constructing a liquid manure storage structure in Manitoba. Notwithstanding the reader's interpretation of the design requirements for a site, requirements under *The Livestock Manure and Mortalities Management Regulation* MR42/98 supersede those suggested by this table.

<sup>2</sup> As per *The Livestock Manure and Mortalities Management Regulation* MR42/98, an "aquifer" means a water bearing geological formation that is capable of producing water to wells or springs in quantities that are economically useful.