Technical Reference Document for Liquid Manure Storage Structures

ROLE & RESPONSIBILITIES OF THE ENGINEER

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SECTION 1 - PURPOSE AND SCOPE

1.1. Certain Provincial and Municipal Regulations require professional Engineers to design livestock manure storage structures. This document outlines the role and responsibilities of the Engineer when designing and certifying the construction of a livestock manure storage structure. Notwithstanding the requirements outlined in the *Standards for Liquid Manure Storage Structures*, the Engineer must ensure that the design meets any other standards that apply.

SECTION 2 - QUALIFICATIONS

2.1. The Engineer responsible for the design, inspection and certification of a manure storage structure shall be registered with the professional engineering association of the province in which he or she is practicing.

SECTION 3 - REGULATORY CONSIDERATIONS

3.1. Relevant Codes, Regulations and Acts – Each Province has a slightly different approach to setting building and construction standards. The various relevant codes, regulations and Acts cited herein are listed in Section 8.

3.2. Manitoba – In Manitoba, the Engineer designing a manure storage structure is advised to follow the National Farm Building Code of Canada (NBC) as a matter of good practice. Presently farm buildings, including manure storage structures, are exempt from the Manitoba Building Code (MBC) and are therefore not regulated by the building authority having jurisdiction (i.e. the Municipal Building Inspector).

3.2.1. Manitoba Conservation is the regulatory agency responsible for permitting livestock manure storage structures. Section 6 of the Manitoba Livestock Manure and Mortalities Management Regulation MR 42/98 states that a permit is required prior to construction of a manure storage structure. Manitoba Conservation must review and approve the manure storage structure design and site.

SECTION 4 - ROLE AND RESPONSIBILITIES OF THE ENGINEER

4.1. Responsibilities of the Engineer – The Engineer is responsible for complying with all relevant Acts and regulations of the province in which he or she is practicing. In addition to professional responsibilities and regulatory requirements, the Engineer has specific responsibilities related to the contract with the developer client.

4.2. Responsibilities of the Client – It is the responsibility of the client and the developer, where applicable, to ensure that the contract between the developer and the Engineer is adequately covering the design, supervision and construction requirements set out herein and any other standards or document of the Technical Reference Manual for Liquid Manure Storage Structure that apply.

4.3. Information Requirements - In conjunction with each design the Engineer shall submit the following information to the regulatory agency for the evaluation of an application for a new, expanded or modified livestock manure storage structure:

4.3.1. Site plan showing the location of the manure storage and distances to:

- property lines;
- closest residence not associated with the operation;
- closest community;
- public roads;
- manure source (barn);
- known water wells, sinkholes and water courses;
- bore hole locations for soil and site evaluation;
- proposed system for detecting pollution or leaks (if applicable); and
- underground utilities.

4.3.2. Detailed construction drawings, drawn to scale, signed and sealed by the Engineer, including:

- the manure storage facility;
- piping for manure transfer and handling;
- any associated structures;
- access ramps (if applicable);
- material specifications;
- construction notes; and
- site specific operational notes (if the design is dependent on specific operation and management factors).

4.3.3. For steel or concrete manure storage structures, a design summary including:

- storage wall load profile (empty);
- storage wall load profile (full);
- storage top loading (where applicable);
- transportation patterns, vehicular loading and any limitations to vehicular traffic; and
- foundation design criteria.

4.3.4. For earthen manure storage structures, a design summary including:

- a cross section of the storage berms, showing clearly the presence of a liner and its type, if applicable;
- details of erosion control around pipe inlets, pumping or agitation pads and overflow or transfer devices; and
- erosion control provisions for the exposed surfaces of the berms.

4.3.5. Geotechnical information including:

- bore hole logs for the proposed location of the storage structure;
- depth to seasonal high ground water;
- description of soil testing and analyses;
- all applicable soil test results; and
- requirements for construction.

4.3.6. Design assumptions regarding the storage capacity estimate; including:

- storage period;
- livestock manure production over the storage period;
- accumulation of solids;
- additional waste water;
- precipitation over the storage period (less evaporation); and
- freeboard.

4.3.7. Recommendations for regular inspection, maintenance and repair, including

- the frequency of inspection, critical features to inspect and method of the inspection (visual, monitoring data etc);
- method on how and when to inspect for liquid levels in the manure storage.
- detailed instructions on how to inspect for erosion damage;
- procedures for regular maintenance and preventative repairs; and
- contingency plans that include procedures for the repair of damaged features.

4.4. Requirements for Manure Storage Design and Construction – All manure storage structure designs and construction shall take into account the following:

4.4.1. Manure storage structures shall be designed to contain the total amount of manure estimated to be produced over the required storage period plus precipitation over the storage period (less evaporation), accumulation of solids, any additional liquids to be stored (such as milkhouse wash water) and an allowance for freeboard. Estimated manure production and the required storage period shall be based on published provincial data or statistics from operations using similar livestock production systems.

4.4.2. Siting, design specifications and construction procedures shall follow the principles contained in the appropriate Technical Reference Document for Liquid Manure Storage Structures:

- *Above Ground Steel Storage Structures*
- *Concrete Manure Storage Structures*

- *Earthen Manure Storage Structures*
- *Design and Construction of Compacted Clay Liners*
- *Design and Construction of Synthetic Liners*

4.4.3. The manure storage structure designs shall contain provisions for loading, agitating, and emptying.

SECTION 5 - SAFETY

5.1. Safety Responsibilities – The Engineer shall provide recommendations regarding:

5.1.1. Signage – Signs that clearly describe the risk of manure gas and any other potential hazard and which prohibit entry into the manure storage structure, shall be posted in accordance with ASAE S441 and include phone numbers of people to contact in case of an emergency.

5.1.2. Breathing Apparatus – A breathing apparatus should be available when working in areas with concentrated manure gases.

5.1.3. Restricted Access – Access limiting devices shall be included for above ground structures.

SECTION 6 - QUALITY ASSURANCE

6.1. Inspection – During construction, the manure storage structure shall be inspected by the Engineer to ensure that it was built as designed and is in compliance with all applicable standards, codes and regulations.

6.2. Final Inspection – The Engineer shall make arrangements with the regulatory agency for a joint final inspection after completion of the construction and before commissioning of the manure storage structure.

SECTION 7 - ISSUANCE OF CERTIFICATES

7.1. Certificate – Certificate – The Engineer shall provide the appropriate regulatory agency with a final letter of certification indicating that the manure storage structure has been completed in conformance with submitted **engineering plans** and **meets required codes, regulations and Technical Reference Document mentioned herein.**

7.1.1. The letter of certification shall be affixed with the Engineer's seal in a manner acceptable to the guidelines of the Association of Professional Engineers and Geoscientists of the Province of Manitoba.

7.2. Construction Report - The letter of certification must be accompanied with a prepared construction report meeting the requirements under the section "Issuance of Certificates" of the relevant document of the Technical Reference Manual for Liquid Manure Storage Structures.

7.2.1. Certification can be provided if construction details do not conform to engineering plans submitted provided these details were approved by the regulatory agency and referenced in a construction report.

SECTION 8 - REFERENCES

Document	Abbreviation used
National Building Code of Canada	NBC
National Farm Building Code of Canada	NFBC
Manitoba Building Code, 1990 edition	MBC
Livestock Manure and Mortalities Management Regulation MR 42/98 (Manitoba)	
ASAE S441 Safety Signs	ASAE S441