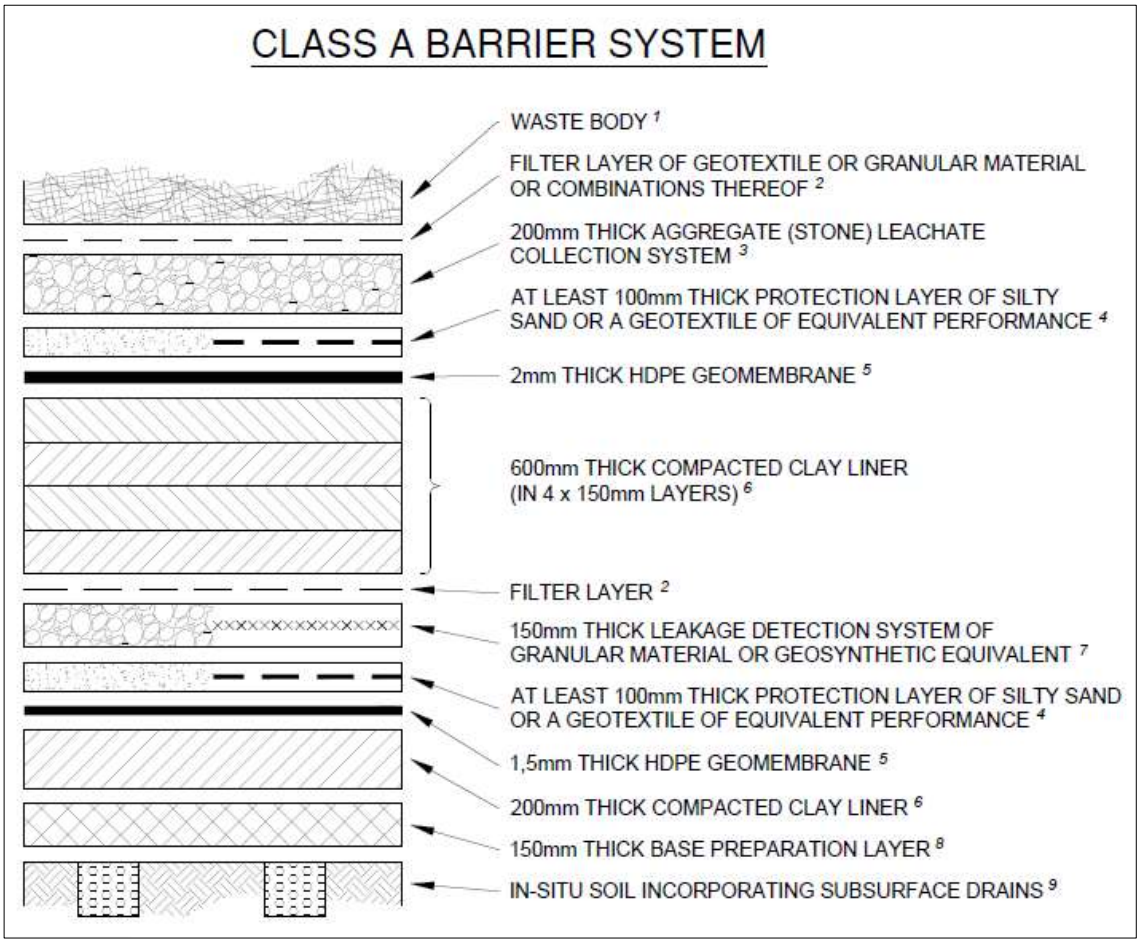
Regulation 3

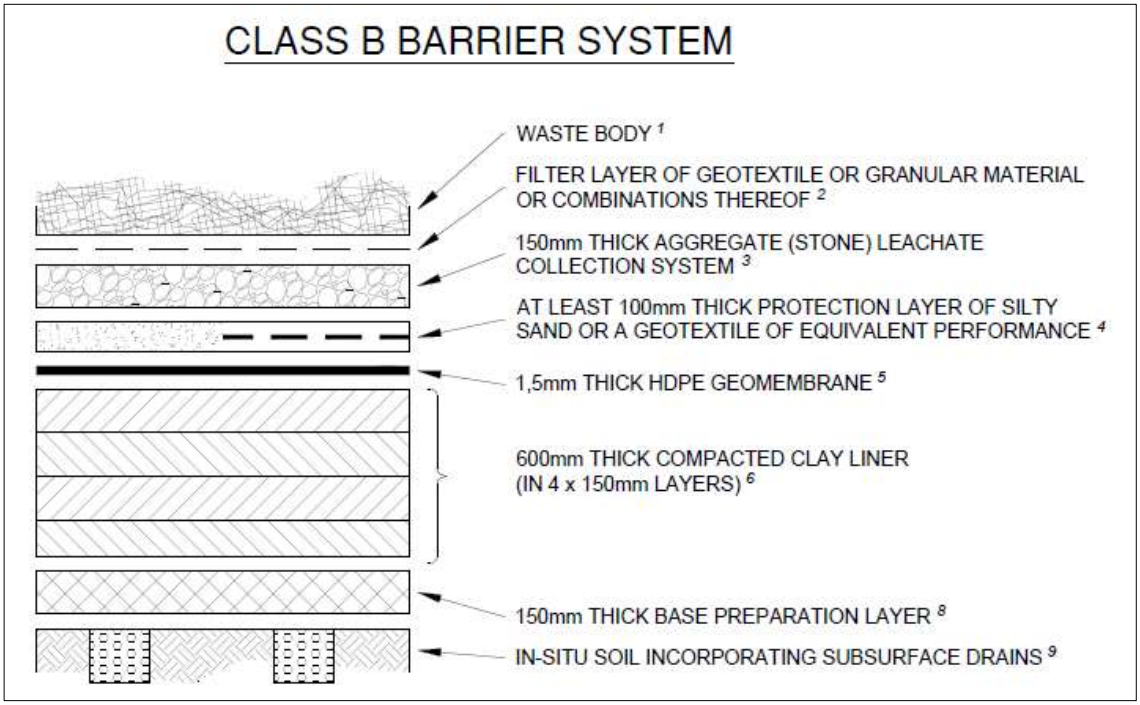
Waste Disposal Facility (WDF) Classification and Containment Barrier System Design

3(1) The containment barrier systems of waste disposal facilities for the disposal of waste in terms of section 4 of these Norms and Standards must comply with the following minimum engineering design requirements –

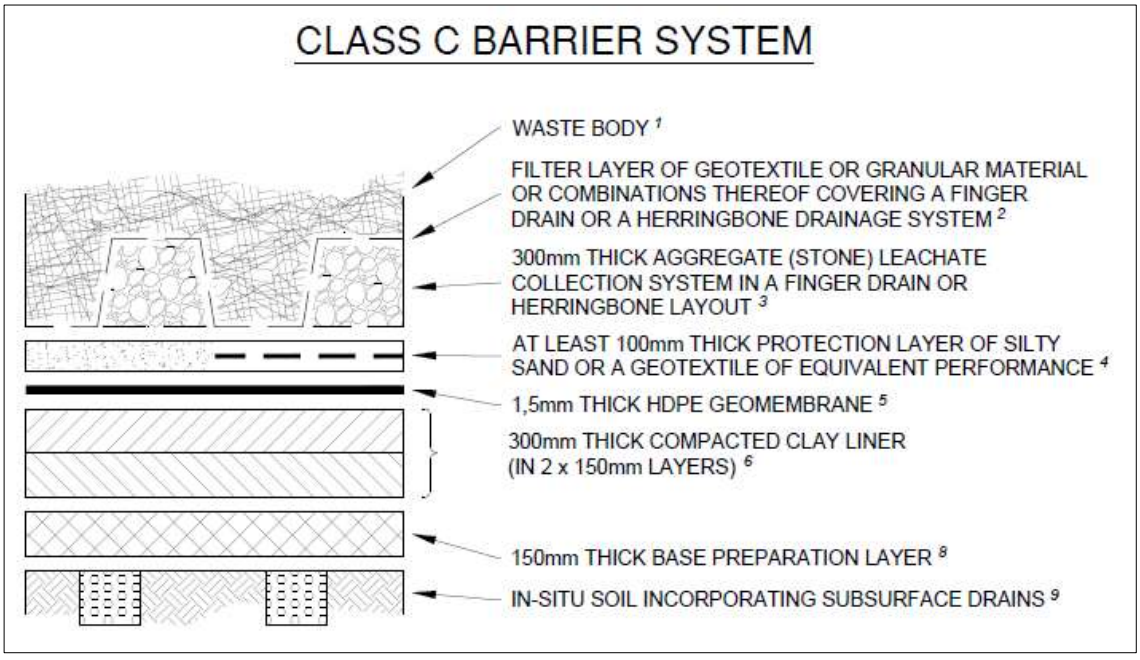
(a) Class A Barrier System



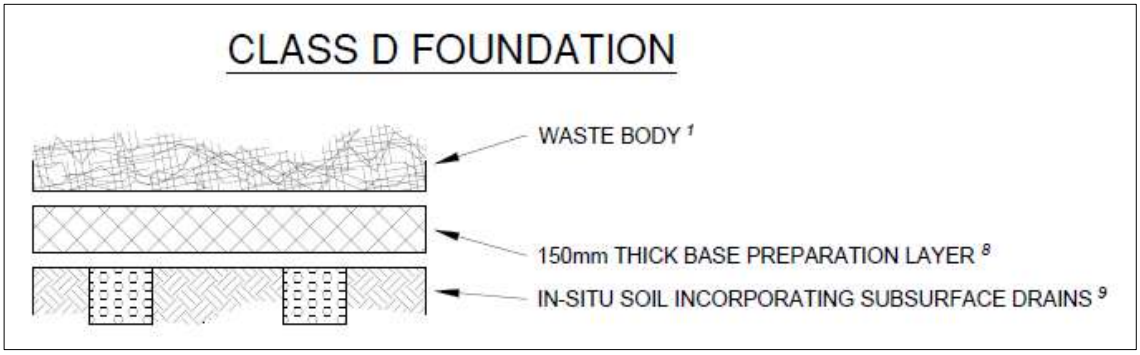
(b) Class B Barrier System



(c) Class C Barrier System



(d) Class D Foundation



Notes:

1. The waste body – represents the Type of waste to be disposed of including a selected layer or pioneering layer, and is above the filter layer. It is good practice to provide a selected soil or waste pioneering layer of the order of 300mm thickness or more above the filter layer to protect it and underlying layers from damage post construction and prior to covering with waste.
2. The filter layer – is usually a geotextile filter selected to retain the site specific waste material while allowing the leachate to pass through it, and is to be able to withstand damage from the underlying aggregate of the leachate collection system and overlying waste placement for the site specific loads to be accommodated. In some designs the filter layer may be a granular material which is compatible with adjacent materials and permeant.
3. The stone or aggregate layer – represents the leachate collection system which typically includes drainage pipes to facilitate maintaining the leachate pressure above the geomembrane to a maximum value used in total solute seepage determination. The aggregate nominal size for municipal solid waste (MSW) is typically 53mm to 38mm well rounded stone to provide for adequate pore spaces to accommodate biological clogging and chemical precipitate while simultaneously providing adequate drainage capacity in the layer thickness for the particular floor slope.
4. The protection layer - is to provide a cushion between the aggregate of the Leachate Collection System or Leakage Detection System and the HDPE geomembrane to:
   (a) limit contributions to the total tensile strain in the geomembrane,
   (b) provide protection against physical and similar damage, or ultraviolet (UV) degradation of the geomembrane in exposed conditions, and
   (c) contribute to the confining stress required for direct contact between the geomembrane and compacted clay liner or GCL, of a composite liner system.

   The nature and thickness of the protection layer required is a function of the short and long term stress conditions such as vehicular traffic during construction and operation, as well as the foundation material properties.
5. The geomembrane - shall be of High Density Polyethylene (HDPE) in accordance with the most recent revision of the SANS1526 standard specification.
6. The compacted clay liner (CCL) - shall be selected material from the geotechnical investigation identification of a suitable borrow pit(s) and shall have a low permeability, plasticity, linear shrinkage and a particle size distribution which is incorporated in the performance assessment of the design and associated construction quality assurance plan. The CCL shall be compacted to a minimum of 98% Standard Proctor Maximum Dry Density (MDD) at optimum moisture content to +2% OMC unless otherwise justified. In some cases the CCL may be partially or totally replaced by a geosynthetic clay liner (GCL) provided equivalent performance to the CCL for the specific waste stream and barrier system is demonstrated, taking into consideration inter alia chemical compatibility with adjacent materials and permeants, short and long term stability, and moisture absorption and retention characteristics.

7. The leakage detection system (LDS) - is typically a granular material sized to accommodate permeant flow without inducing excess pressure head, including due to precipitate. In the event of a geosynthetic drainage layer being used as an alternative of equivalent performance the design shall demonstrate that the alternative has adequate drainage capacity in the short and long term, adequate compressive strength including compressive creep collapse resistance, adequate service life of the constituent materials, and not induce barrier performance detractors due to undesirable slip planes through internal or interface shear, nor excessive tensile strain in adjacent materials.
8. The base preparation layer - is the in-situ reworked material devoid of vegetative material such as plants and roots, and similar abnormalities which may affect the containment and drainage performance of the barrier system.
9. The in-situ soil foundation - shall incorporate a subsurface drainage system to avoid uplift pressures by groundwater vacillation and maintain a 2m unsaturated zone between the base of the liner system and the wet season high groundwater level. The foundation material properties shall be included in the design assessment of stability.

3 (2) The following containment barrier requirements must be included in an application for waste management license approval of a waste disposal facility site or cell –

(a) design reports and drawings that must be certified by a registered professional civil engineer prior to submission to the competent authority;
(b) service life consideration that must be quantified taking into account physical and chemical effects including temperature on containment barrier systems;
(c) total solute transport (inorganic and organic) that must be calculated in determining acceptable leakage rates and action leakage rates (the transport mechanism through geomembranes includes seepage through discontinuities and diffusion through intact areas, the latter not being significant when the volatile organic compound (VOC) content of the leachate is less than 0,03M/l).
(d) alternative elements of proven equivalent performance which have been considered, such as replacement of –
    (i) granular filters or drains with geosynthetic filters or drains
    (ii) protective layers with geotextiles; or
    (iii) clay components with geomembranes or geosynthetic clay liners

(e) All drainage layers must contain drainage pipes of adequate size, strength and spacing to ensure atmospheric pressure within the drainage application for the service life of the waste disposal facility;

(f) Alternative design layouts for slopes exceeding 1:4 (vertical: horizontal) may be considered provided equivalent performance is demonstrated;

(g) Construction Quality Assurance (CQA) for implementation during construction

(h) Geosynthetic materials must comply with relevant South African National Standard Specifications, or any prescribed management practice or standards which ensure equivalent performance; and

(i) Consideration of the compatibility of liner materials with the waste stream, in particular noting the compatibility of natural and modified clay soils exposed to waste containing salts or cations