

AD027 - HSC

Bund Volume Calculations

Calculations detailing the volume of the banded area and relevant calculations considering the consequences of a spillage.



Version 1

DATE



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1 Abstract

This document details the calculations made to assess the volume of the bunded area of the digester plant designed for Haworth Scouring Company.

The total bunded volume of the site is calculated to be 232.8m³.

All seven tanks are identical and each contain 128m³ of liquid, giving a total volume of 896m³ of liquid.

110% of the largest tank contents is 140.8m³.

25% of the total volume is 224m³.

These numbers show that the bund meets the requirements for the system's containment.

2 Tank Details

The internal volume of each tank is 135m^3 , however, 8m^3 of this volume is taken up by components, structure and retained media, this leaves a maximum liquid volume of 128m^3 .

The first 6 tanks will maintain this level continuously and the 7th tank will vary to meet the demand from HSC's decanter system, that will operate using the treated liquid from the digester.

The maximum liquid that can be contained in the 7 digester tanks, is therefore 896m^3 .

The tanks rest on skirts that are 3.5m diameter and 50mm thick, liquid is able to fill the void under the tanks, the total area that the 7 tank skirts cover is 1.9m^2 .

110% of 128m^3 is 140.8m^3 .

25% of 896m^3 is 224m^3 .

Given that 25% of the total volume of the site is larger than 110% of the largest tank, this is the volume that the bund must contain.

3 Bund Details

Please reference drawing FRE-AD027-002-001.

The bunded area consists of two levels, a lower spill catchment area and a higher area which is bunded but which will not be exposed to effluent or digestate under normal operation.

There is a grit sump within the spill catchment area with a total volume of 7.5m^3 . Under normal operation this will be empty, however, it has not been included in the volume of the bunded area and will contribute excess volume to the stated total bunded volume.

There is a rainwater sump within the main bunded area, the volume of this sump has not been included in the volume of the bunded area.

The spill catchment area is 200mm below the higher area and the higher area is bunded by an additional 200mm concrete wall. Where this bund wall surrounds the spill catchment area, the height difference between the spill catchment area floor and the top of the bund wall is 400mm.

There is a gas holder that is within the main bunded area that encompasses 5.65m^3 of volume, in the lowest 200mm of its shape.

The spill catchment area is 29.6m long and 14.75m wide, with a total area of 435.125m^2 , deducting the tank base area gives 433.3m^2 . This provides a usable volume of 86.6m^3 .

The main bunded area is 40.2m long and 18.925m wide, with a total area of 760.785m^2 , deducting the tank base area gives 758.9m^2 . Deducting the volume encompassed by the gas holder, this gives a usable volume of 146.1m^3 .

Combining the volume of the spill catchment area and the volume of the main bunded area gives a total usable bunded volume of 232.8m^3 .

4 Drainage

All liquid in the spill catchment area drains into the grit sump, this liquid is then pumped back into the digester tanks.

Under normal operation, any rain that falls into the raised portion of the main bunded area will drain to a rainwater sump.

Under normal operation the rainwater sump will discharge rainwater to the HSC rainwater drain.

If a serious leak occurs in the site, it will first fill the spill catchment area, beginning with the grit sump. The grit sump contains a float switch that triggers when the grit sump is full of liquid and a pressure level sensor. If the float switch is triggered, the power to the rainwater sump pump will be cut. If the pressure level sensor indicates that the grit sump is full, the power to the rainwater sump pump will be cut.

This means that, if a serious leak occurs and the spill catchment area is filled, the rainwater sump pump will not remove any spilled liquid from the bunded area.

5 Conclusion

Given that the total bunded volume is 232.8m^3 and the required volume to be contained is 224m^3 , we deem the bunded area to be sufficient.