

Project Reference: 191163

**Pencefn Drysgol
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Assessment of the design and construction of a concrete bund

for

Pencefn Feeds Limited

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1.0 Introduction

This report has been prepared by Barratt Associates, The Old Surgery, Oxford Street, Aberaeron, Ceredigion, SA46 0JB, acting on instructions from Bill Lloyd, director of Pencefn Feeds Limited (PFL).

Barratt Associates have worked for over 40 years in the construction industry with a considerable amount of experience in the forensic examination, structural appraisal and restoration of buildings, drainage systems and containment systems and is currently involved with similar projects throughout Wales.

The report has been made following a site visit and inspection on 5th November 2019 by D Barratt and S Pontin accompanied by Bill Lloyd. The weather was overcast with occasional showers. There had been heavy rainfall during the previous night and early morning.

Documents referred to;

CIRIA C736 Containment systems for the prevention of pollution
ACP (Concrete) Limited. Design calculations
Pencefn Feeds Limited. Photographs taken during construction

2.0 Scope of work

The visit was requested in order to assess the design and construction of a bund constructed as secondary containment for a recently constructed bio-digester tank.

Natural Resources Wales (NRW), have raised some concerns about the construction of the bund and the potential for leakage of pollutants into the surrounding area.

The site inspection focuses on the quality and suitability of the construction and contains the authors considered opinion as to the viability of the containment area.

3.0 Observations and assessments

There is a bio-digester tank constructed from pre-formed concrete sections enclosed within a walled area (2900 m²), the wall of which is also constructed from pre-formed concrete sections. Outside the secondary wall there is an embankment of shale mixed with clay (see Photographs in Appendix).

Due to heavy rainfall in the preceding twenty-four hours the area within the bund contained a substantial quantity of rainwater. The pumping system which had been installed in the site was in operation to remove the water. Because of this it was not possible to inspect the ground surface between the wall and the tank however, PFL were able to supply photographs of the area taken during construction of the wall. The ground is of loose shale and clay and photographs of the trenches during construction clearly show bedrock close to the surface.

The concrete retaining wall appears to have been constructed to a high standard. Photographs taken by PFL at various stages of the construction process show the methodology employed and these support the initial observations of the finished wall.

The panels for the bund wall are in pre-stressed concrete and are 180 mm thick. They are manufactured by ACP (Concrete) Limited and installed by Lloyds Brothers Construction Limited. The joints of the concrete slabs utilize a tongue and groove system with SikaSwell S-2 (red), swellable sealant applied to the central tongue and groove and Fosroc Supercast SW (grey), sealant applied to the flat outer edges of the joint.

Analysis of the design calculations have allowed an appraisal to be made of the structural adequacy of the wall

The concrete panel walls are three metres high, and with a freeboard allowance of 500 mm, the calculated volume of storage over the net area of 2,900 m² is 7,250 m³.

4.0 Conclusions and recommendation

As noted in Section 3 the wall has been built to a high standard with all joints being uniform and even. Close inspection of the joints shows that the sealant has been applied uniformly and evenly. The photographic archive of the various stages of construction, in addition to the visual inspection, show that the work has been carried out to a high standard in accordance with CIRIA C736 guidelines.

A check on the structural calculations produced by ACP suggested that the moment of resistance of the wall is 91.42 kN m and the applied moment for a depth of water of 3.4 m is 64.26 kN m. There is therefore a theoretical safety factor of 1.4% on failure which is considered satisfactory.

The ground within the enclosed area of the bund is presently of loose shale and photographic evidence shows bedrock close to the surface. The composition of the mudstone in this area is such that it is prone to fracturing and the likelihood of this occurring on a construction site with heavy machinery movements is high.

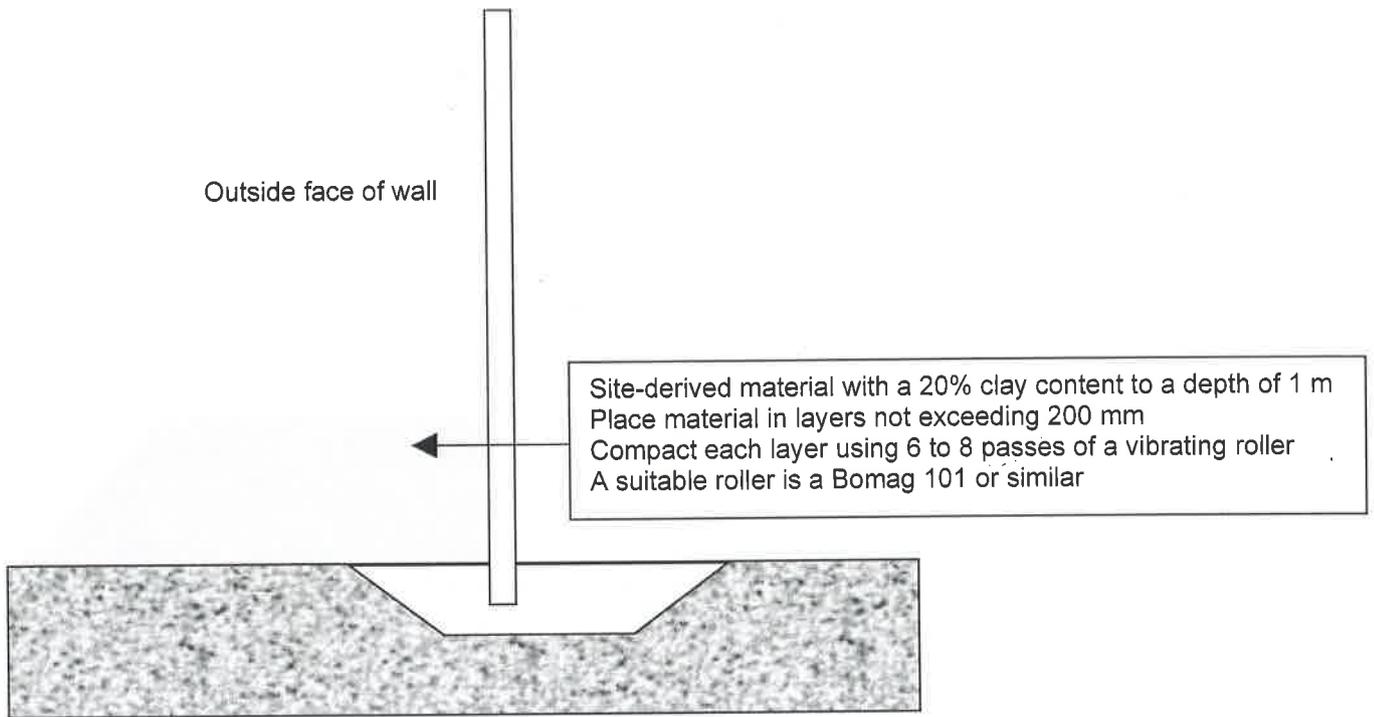
The ground condition in its present state is likely to be permeable and would therefore be ineffective as a containment medium. It is understood from PFL that there is a DPM membrane below the surface shale but conditions on the day of the site visit meant that it was not possible to confirm this. PFL have also advised that the ground between the tank and the wall will be concreted as part of Phase 2 of the project. Re-surfacing of the yard area with concrete close to the site has already commenced and it is understood that the entire yard including the bund will be concreted in due course.

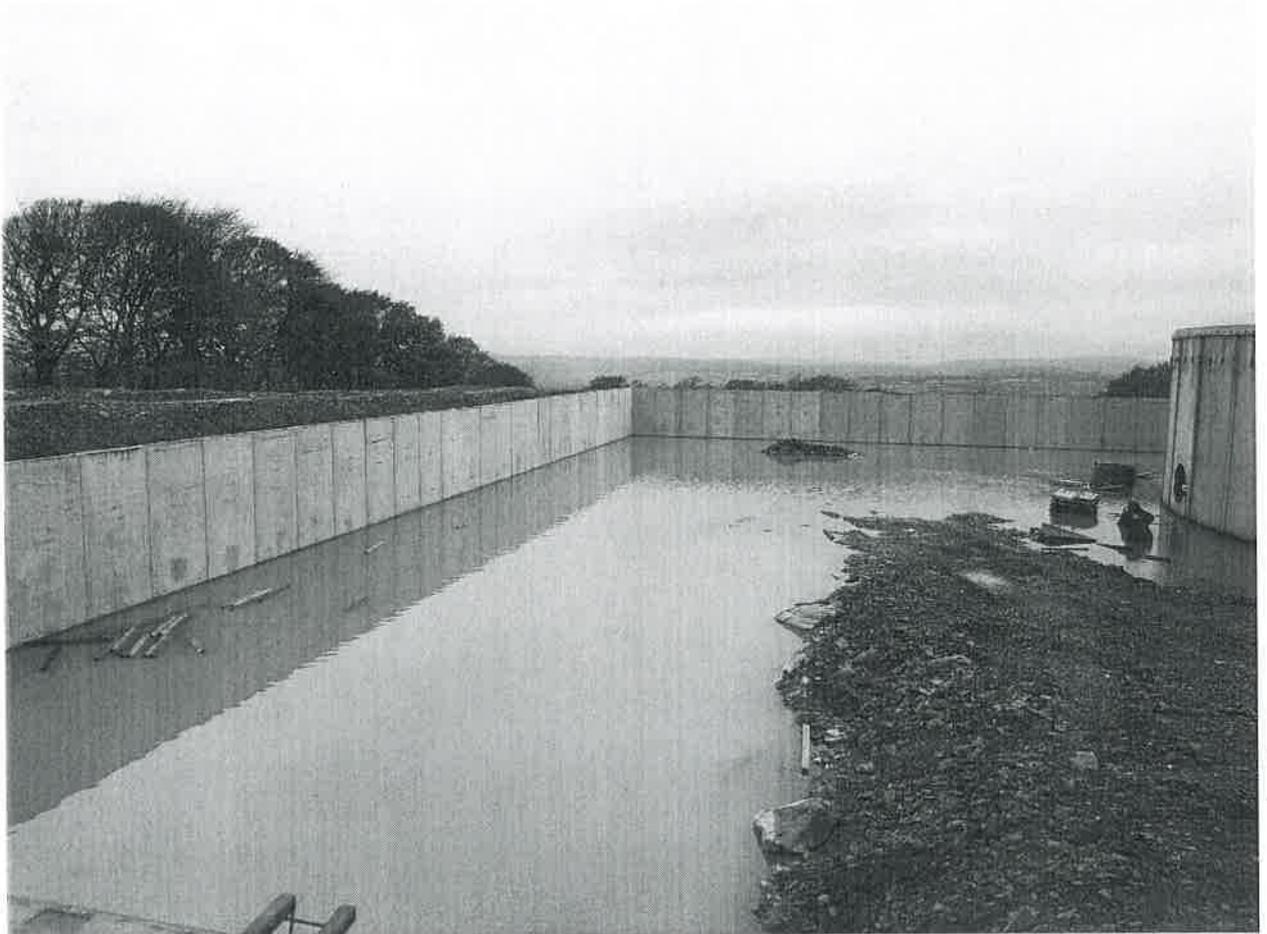
When the ground between the tank and the wall has been sealed with an adequate depth of concrete, the bund wall can then be regarded to be fully effective. Until such time, the loose surface area cannot be considered an effective leak-proof barrier and it was recommended to PFL that an impermeable plug of soil be created along the outer face of the wall to a depth of 1m. A schematic drawing with a specification of the requirements passed to PFL has been included at the end of this section. This backfill will also increase the stability of the wall by counterbalancing the overturning effect should any leakage occur.

It should be noted that at the time of the second visit to the site on Sunday the 10th of November 2019, the external backfilling had been satisfactorily completed and the bund adequately sealed.

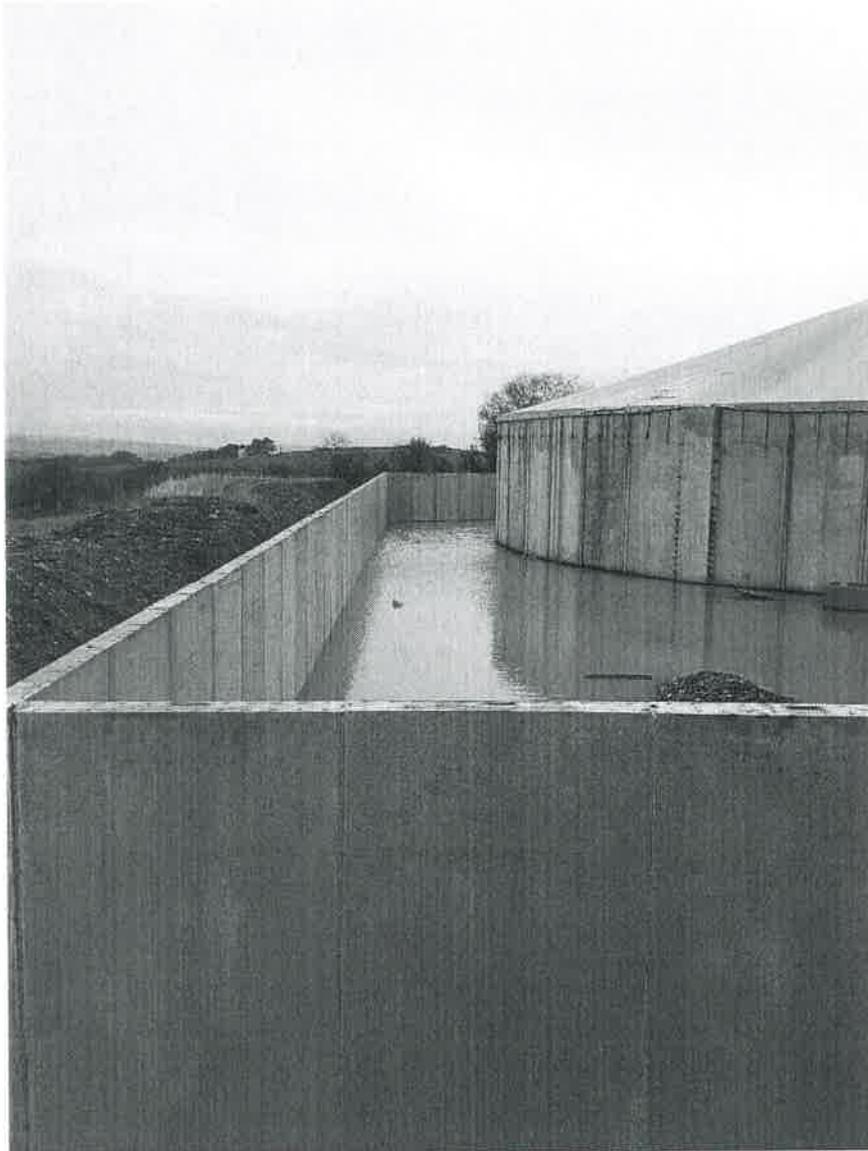
It is recommended that a further inspection be made of the site when the Internal base of the bund has been concreted.

Secondary leak prevention around outside of wall

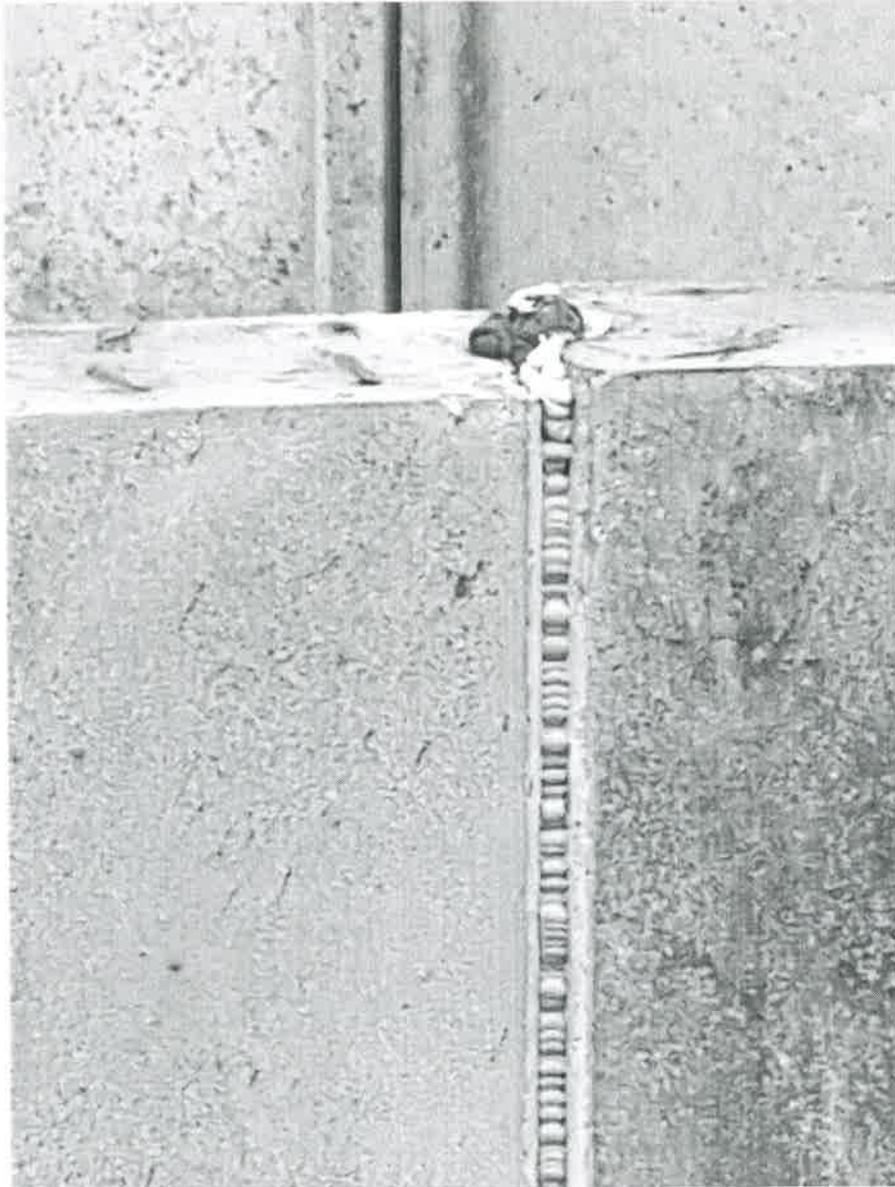




Photograph 1. The bund with tank on right. View looking west.



Photograph 2. View along west wall looking north. The embankment can be seen on the left of photograph.



Photograph 3. Section of joint showing two types of swellable sealant



Photograph 4. The bund during construction showing ground surface. Photo courtesy of Bill Lloyd, PFL.

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Any queries should be addressed to the author at Barratt Associates on 01545 571777.

A handwritten signature in black ink, appearing to read 'D A Barratt'. The signature is written in a cursive style with a large initial 'D' and 'A'.

D A Barratt
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10th November 2019