Proposed Silage Clamp Design Philosophy Report
December 2025
Revision A

Job No. 28888

Merlin Renewables AD Plant
Redbourne Road
Hibaldstow
North Lincolnshire
DN20 9NN

Client: Future Biogas

January 2026

Civil • Structural • Environmental • Surveying

REPORT CONTROL SHEET

Client: Future Biogas **Job No.:** 28888

Project Name: Merlin Renewables AD Plant
Redbourne Road
Hibaldstow
North Lincolnshire
DN20 9NN

Issue		
Revision 0	December 2025	**Report Prepared by:** Jacob Bush BEng (Hons), EngTech MICE Engineer - Civil
		Report Reviewed & Authorised by: EUR ING Oliver Jones B. Sc (Hons), CEng MIET, EngTech MICE, GCInstCES, AMIMechE Director - Projects and Civils
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CONDITIONS OF INVESTIGATION & REPORTING

This report and its findings should be considered in relation to the terms of the brief and objectives agreed between PDC Engineering and the Client.

PDC Engineering has made every effort to provide an accurate assessment of the condition of the site's drainage.

The conclusions within this report are professional opinions based on the interpretation of a visual assessment which has been compiled using a standard methodology designed to provide reasonable consistency and robustness. PDC Engineering cannot be held responsible for any contamination subsequently identified during development of the land.

The details contained in this report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by PDC Engineering has not been independently verified by PDC Engineering, unless otherwise stated in the report.

This report was prepared and provided for the sole and specific use of the client. PDC Engineering shall not be responsible for any use of the report or its contents for any other purpose. Copies of the report to other parties for information should be copied in full but PDC Engineering shall extend no professional liability or warranty to other parties in this connection without written consent.

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DRAWINGS APPENDIX

PDC Engineering Drawing No. 28888 – 110 Rev 0 - Typical Silage Clamp Sections & Details

1.0 INTRODUCTION

PDC Engineering, a Plandescil Ltd company, has been commissioned by our client, Future Biogas, to prepare the design philosophy documentation for the proposed silage clamp construction at the Merlin Renewables Anaerobic Digestion (AD) Plant in Hibaldstow, North Lincolnshire.

2.0 PROPOSED SILAGE CLAMP DESIGN

2.1 Regulation Compliance

PDC Engineering has designed the additional silage clamp in accordance with CIRIA C759(f) and The Sludge, Silage, Slurry and Agricultural Fuel Oil (SSAFO) Regulations guidelines, and in line with Environment Agency recommendations. The design is consistent with the existing silage clamps on site, which were constructed in 2013.

Silage effluent is highly polluting and poorly constructed or maintained clamps present a significant risk of contamination to surface and groundwater. Compliance with SSAFO legislation and CIRIA C759 ensures that silage storage facilities are constructed and managed to appropriate standards, thereby mitigating environmental risks.

In accordance with SSAFO, the Environment Agency will be formally notified at least 14 days prior to the commencement of construction. The notification will include details of the structure type, design, and construction methodology. Following construction, and prior to first use, a completed WQE3 notification form will be submitted to the Environment Agency in line with SSAFO requirements.

Table 2.1.1 below provides a summary of relevant regulations against the proposals.

Legislation Item	Legislation	PDC Comments	Compliant
20-year lifespan with maintenance.	SSAFO	The proposed silage clamp surface and proposed holding tank are designed for a 20-year lifespan, provided they receive regular and adequate maintenance.	✓
Not within 50.00m of water supply source or 10.00m of inland or coastal waters.	SSAFO/C759	The proposed silage clamp will be situated outside the proximity of any water supply, as well as inland or coastal waters.	✓
All parts are to be resistant to attack.	SSAFO/C759	The flooring is designed to be resistant to wear and damage, comprising a 110mm thick Dense Bitumen Macadam (DBM) base course topped with a 40mm thick Hot Rolled Asphalt (HRA) wearing course.	✓
Impermeable base extending beyond clamp walls.	SSAFO	No clamp walls within proposal.	✓

Impermeable drainage collection channels around the exterior perimeter into an effluent tank.	SSAFO/C759	V-Max sump gullies are positioned around the exterior of the pad to collect runoff, which is then discharged into the 40,000l holding tank.	✓
Effluent tank is required to be impermeable for 20 years without maintenance.	SSAFO/C759	The 40,000l holding tank will be installed with its body encased in a minimum of 400 mm of reinforced concrete backfill, incorporating the required steel reinforcement to ensure structural integrity and long-term performance.	✓
Effluent tank should have capacity for 2 days peak flow storage.	SSAFO/C759	Tank sized accordingly, with continual pumping of liquid back into the AD system. This removes the extended requirement for leachate storage and has established precedent across the UK.	Not Required
Walls to be designed to withstand loading set in BS 5502-22:2003+A1:2013	SSAFO/C759	No walls within proposal.	Not Required
The base must comply with British Standard 8007:1987 and British Standard 8110-1:2997	SSAFO/C759	Both standards relate to concrete flooring, however, the proposed surfacing will comprise of a 110mm thick Dense Bitumen Macadam (DBM) base course overlain by a 40mm thick Hot Rolled Asphalt (HRA) wearing course. This asphalt build-up has been selected to provide adequate structural capacity for the anticipated vehicular loading and to ensure long-term performance under agricultural operating conditions. The use of asphalt surfacing provides a low-permeability barrier that significantly limits the ingress of leachate and other aggressive fluids whilst the bituminous binder within the DBM and HRA layers is inherently resistant to chemical attack from organic acids, silage effluent, and agricultural contaminants, thereby reducing the risk of deterioration of the surfacing structure and underlying sub-base. Additionally, asphalt surfacing allows for effective joint-free construction and facilitates straightforward inspection and maintenance, with localised repairs maintaining the integrity and impermeability of the surface over its service life.	-

Table 2.1.1: Proposed Silage Clamp Compliance Summary.

2.2 Proposed Silage Clamp Drainage

The drainage system associated with the proposed silage clamp has been specifically designed to convey dirty water only, including silage effluent and contaminated runoff generated during clamp operations. No separate surface water drainage system is proposed for this additional clamp. This approach ensures that all potentially contaminated flows are fully contained within the site's controlled drainage infrastructure, thereby eliminating the risk of uncontrolled discharge to ground or nearby watercourses. This will mitigate against the formation of source-pathway-receptor relationships by preventing pathways from developing.

All collected flows will discharge to a new dedicated cylindrical holding tank with a capacity of 40,000 litres, located adjacent to the proposed silage clamp. The tank provides secure interim storage and forms a key component of the site's pollution prevention strategy. From the leachate tank, effluent will be transferred via a sealed pumping main to the existing Anaerobic Digestion (AD) Plant, where it will be reused within the operational process. This strategy ensures compliance with Environment Agency guidance and SSAFO requirements, while also supporting sustainable resource management by maximising reuse of leachate within the AD process and minimising the need for off-site disposal.

The proposed silage clamp will incorporate a V-shaped drainage channel formed integrally within the asphalt surface, providing a 50mm fall to the channel centreline and appropriate crossfalls to promote efficient runoff. Collected flows will be directed into newly installed V-Max sumps, which will discharge via sealed pipework into a manhole located within the primary dirty water drainage run. The primary drainage run will be laid to a minimum gradient of 1:100, falling towards the front of the proposed silage clamp to ensure positive drainage and prevent ponding.

In accordance with design requirements, the tank body will be surrounded by a minimum of 400mm of reinforced concrete backfill, incorporating the necessary steel reinforcement to ensure structural integrity and long-term performance. Four leak-detection monitoring wells will be installed, one at each corner of the tank, to enable ongoing environmental monitoring. Each well will be fitted with a cover cap extending a minimum of 800mm above ground level to allow safe access and visibility.

The upper 1.00m of the tank below ground level will be coated with Fosroc Mulseal DP bitumen sealant to provide additional waterproofing and protection. This section will then be encased in 250mm thick concrete. The concrete pad will be constructed to achieve a finished surface level 50mm above the surrounding ground level, reducing the risk of surface water ingress.

Backfill around the drainage pipework will generally comprise a full shingle (gravel/aggregate) surround to provide uniform support, promote load distribution, and protect the pipework. Where the depth of shingle backfill is 600mm or less, a concrete cap will be provided in lieu of shingle, offering a more robust and durable solution for shallow installations and providing additional protection against trafficking and surface loading.

2.3 Proposed Silage Clamp Surfacing

The silage clamp floor construction comprises a well-compacted D.f.T Type 1 sub-base, overlaid with a 110mm thick Dense Bitumen Macadam (DBM) base course and a 40mm thick Hot Rolled Asphalt (HRA) wearing course. This pavement build-up has been selected to provide adequate structural

capacity for anticipated vehicular loading while maintaining long-term durability under agricultural operating conditions. All asphalt layers shall be formed using granite or other approved acid-resistant aggregates; the use of limestone filler is expressly prohibited due to its susceptibility to degradation when exposed to acidic silage effluent.

A V-shaped asphalt drainage channel shall be formed around the full perimeter of the silage clamp and constructed to the same specification as the clamp floor. Integrating the drainage channel within the asphalt surfacing ensures continuity of material, eliminates joints, and reduces the risk of leakage or differential movement, thereby improving overall impermeability and durability. This also adheres to SSAFO regulations through the implementation of a perimeter drainage channel system.

Asphalt has been specified as the primary surfacing material due to its proven impermeability, chemical resistance, and suitability for silage clamp applications. When correctly laid and compacted, the asphalt forms a continuous, sealed surface that prevents silage effluent and contaminated runoff from infiltrating the underlying ground, thereby protecting soils and groundwater in accordance with environmental best practice. The use of acid-resistant aggregates further enhances resistance to the aggressive nature of silage effluent, minimising surface degradation, reducing maintenance requirements, and extending the operational life of the clamp. The smooth, joint-free finish also promotes controlled surface water and effluent flow toward the perimeter V-channel, ensuring efficient collection and removal.

A half-batter precast concrete kerb shall be installed along the perimeter of the roadway and along the western edge of the silage clamp V-channel. A minimum 100mm upstand between finished surface level and the top of kerb shall be maintained to positively direct surface flows toward the drainage system and prevent uncontrolled runoff. The kerb shall be bedded and haunched in concrete to provide adequate restraint and long-term stability under vehicular loading.

In addition, road markings will be provided to manage vehicle movements and loading areas, ensuring that trafficking and loading does not compromise the internal drainage falls of the silage clamp. This will help maintain optimal drainage performance and prevent localised ponding or surface damage over the operational life of the facility.

3.0 MAINTENANCE PLAN

To ensure the longevity and efficiency of the constructed silage clamp on site, PDC Engineering propose the following maintenance plan.

3.1 Asphalt Surfacing Maintenance

In areas where asphalt pitting, cracks, or potholes become present, it is recommended to saw-cut and square off the damaged section. The defect should be thoroughly cleared of debris before being patched with hot-rolled asphalt (HRA). A 40-50mm strip of bitumen sealant should then be applied along the joints between the existing asphalt and the new patch. This sealant will prevent further erosion beyond the asphalt layer, helping to reduce the likelihood of leaks forming in the clamp.

3.2 Silage Clamp Drainage Maintenance

Regular maintenance, including the clearing of silage from the V-max sumps every six months, is recommended to ensure that V-max gullies and manholes function properly and that the drainage system operates as designed. Additionally, jetting of all gullies, manholes, and V-max sumps should be carried out before and after harvest and during the loading of the clamps to prevent new feedstock from obstructing the drainage system. The shut-off valves must not be opened without first conducting water testing and verifying that the system meets the required standards.

Manholes should remain lined with a bituminous sealant to prevent leachate from corroding or eroding the concrete within. Regular inspections of the manholes are recommended to monitor the integrity of this lining. Additionally, reapplying the bituminous liner annually is advised to provide consistent protection to the concrete surfaces. This yearly maintenance helps ensure the durability of the manholes, reducing the risk of structural damage from leachate exposure and supporting long-term system integrity.

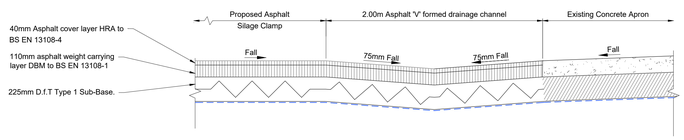
3.3 Compliance Reviews

PDC Engineering compliance checks and reviews are an established component of Future Biogas's ongoing maintenance regime and have been in place for over five years across all sites. These encompass routine inspections of digesters, silage clamps, and associated infrastructure. The proposed silage clamp will therefore be subject to the same robust compliance and review framework, ensuring continued adherence to CIRIA C759 and SSAFO requirements throughout it's operational life.

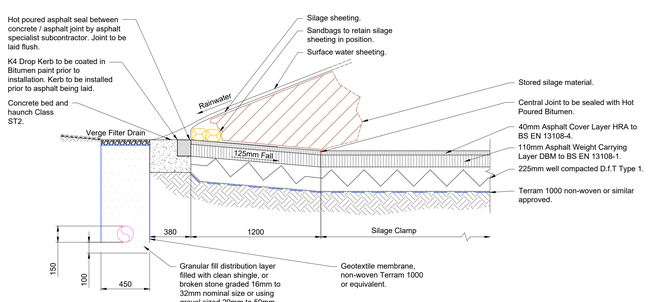
DRAWINGS APPENDIX

CONTENTS

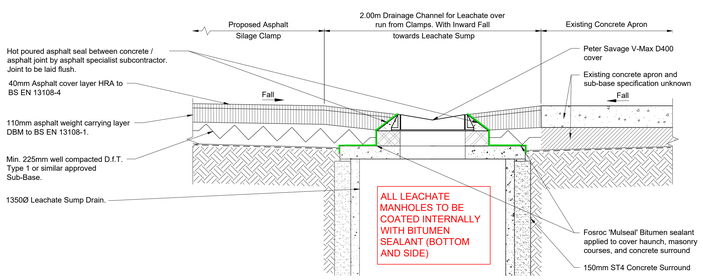
SILAGE CLAMP SECTION LOCATION PLAN
Scale 1:500



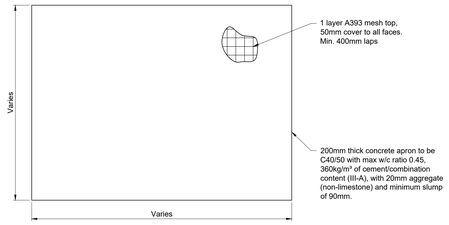
TYPICAL CROSS SECTION OF SILAGE CLAMP V-CHANNEL - SECTION B-B
Scale 1:20



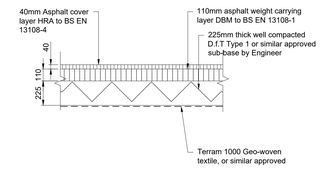
TYPICAL EDGE OF CLAMP WITH VERGE FILTER DRAIN SECTION C-C
Scale 1:20



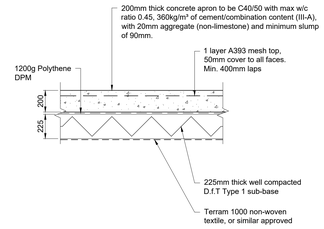
TYPICAL CROSS SECTION OF SILAGE CLAMP SUMP DRAIN - SECTION A-A
Scale 1:20



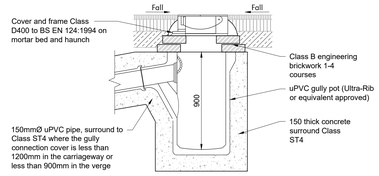
TYPICAL CONCRETE APRON SLAB PLAN (BAY SIZE VARIES)
Scale 1:50



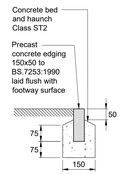
TYPICAL ASPHALT SURFACE CONSTRUCTION
(EXCLUDING SILAGE CLAMP FLOORS)
Scale 1:20



TYPICAL CONCRETE APRON SLAB CONSTRUCTION DETAIL
Scale 1:20



TYPICAL LEACHATE GULLY DETAIL
Scale 1:20



CHANNEL EDGING (EF)
Scale 1:10

NOTES:

1. All dimensions noted are in millimetres unless stated otherwise.
2. All levels to be above Ordnance Survey Datum defined levels (A.O.Dm) unless noted otherwise.
3. Do not scale from this drawing, if dimensions are not clear ask.
4. This document has been created in accordance with PDC Engineering Terms & Conditions along with the scope of works provided by the Client to PDC Engineering. Any use of this document other than for its original purpose is prohibited. PDC Engineering accept no liability for any third party uses of this document.
5. PDC Engineering to be immediately notified of any suspected omissions or discrepancies.
6. This drawing is to be read in conjunction with all other relevant PDC Engineering drawing, documents & schedules relating to the project.
   - 28888/001 - Topographical Survey (Sheet 1 of 3)
   - 28888/002 - Topographical Survey (Sheet 2 of 3)
   - 28888/003 - Topographical Survey (Sheet 3 of 3)
   - 28888/010 - Proposed Site Remedial Layout Option 1
   - 28888/011 - Proposed Site Remedial Layout Option 2
7. This drawing is to be read in conjunction with all other relevant received drawings, documents & schedules relating to the project.

SILAGE CLAMP CONSTRUCTION:

8. All D.f.T Type 1 must NOT contain Limestone.
9. Clay Core to be imported from a source certified as not contaminated.
10. All leachate water pipes to be uPVC (orange foul water pipe specification), NOT Concrete or Twin Wall.
11. All surface water pipes to be uPVC Twin Wall, NOT concrete.
12. All asphalt to be made with Granite or other acid resistant aggregate (no limestone filler allowed)
13. All joints and exposed edges in clamp floor to be sealed with hot poured bitumen emulsion.
14. All levels and dimensions should be checked on site by contractors and relevant sub-contractors.
15. All Leachate manholes to be coated internally with bitumen sealant (bottom and sides).
16. Silage clamps & drainage design to comply with latest SSAFO and CIRIA C759 guidance.

MATERIAL NOTES:

17. All D.f.T Type 1 must NOT contain limestone.
18. All Asphalt to be made with Granite or other acid resistant aggregate (No limestone filler allowed).

FOUNDATION NOTES:

19. Assumed GPB value of 100kN/m² taken in lieu of site investigation, Contractor to confirm on site and advise Engineer, prior to construction of foundations.
20. Any soft spots or deleterious materail is to be removed & taken down to virgin ground level & replaced with compact D.f.T Type 1 or suitable hogging material.
21. Overdig to be made up in compacted D.f.T Type 1 or lean mix concrete.

LEGEND:

- Proposed Site Boundary
- Lease/Ownership Boundary
- Proposed Asphalt Clamp Surfacing
- Proposed Asphalt Access Track
- Proposed Leachate Drainage
- Fall — Surface Drainage Fall Arrow
- Proposed VMAX Gully
- Proposed Gully
- Proposed Drainage Channel
- Proposed Screening (Feathered Trees, Whips & Wild Flowers)
- Scrub (2,400m²/0.24ha)

ALL PROPRIETARY MATERIALS TO BE FIXED STRICTLY IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS USING MATERIALS APPROVED BY THE MANUFACTURER.

NOT TO BE USED FOR CONSTRUCTION

APPROVAL & COMMENT

Rev	Date	Rev By	Chkd	Description
0	15-01-26	-	OAJ	First Issue

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Client
Merlin Renewables Ltd.

Project
Proposed Silage Clamp
Land off Redbourne Road,
Hibaldstow, DN20 9NN

Drawing Title
Typical Silage Clamp
Sections & Details

Scale	U.N.O.	Date	Drawn By
As Noted (A0)		January 2026	LJS

Drawing No.	Rev
28888/110	0

Civil engineering and building

- Industrial, Commercial, Agricultural and Domestic building design
- Foundation Design and ground improvements
- Highway Engineering including Civil 3D
- Retaining walls
- Sheet Piling
- Infrastructure planning and design
- Design of sustainable drainage system (SUDS)
- Soakaway design
- Architectural design of industrial buildings
- Planning and building regulation applications
- 3D conceptual models
- Renewable Energy Civil Engineering design and project management
- Anaerobic Digestion and Waste to Energy Project design and detail

Environmental engineering

- Contaminated Land reports
- Environmental impact assessments (EIA)
- Flood Risk Assessments
- Water supply, treatment, storage and distribution
- Foul and surface water & effluent/leachate drainage design
- Drainage network modelling
- 1D & 2D flood modelling
- Hydraulic river modelling
- Flood Alleviation
- Breach & overtopping analysis
- Reservoir flood inundation modelling
- Consent to discharge applications
- Environmental Permits
- Nutrient Neutrality

Structural engineering

- Structural calculations for Commercial, Agricultural and Domestic building design
- Structural design using steel, stainless & carbon steel, concrete, timber and masonry
- Maritime and Hydraulic structures
- Structural surveys and structural suitability surveys
- Structural failure studies
- Subsidence claims
- 3D Finite Element Analysis
- Structural monitoring
- Structural enhancement/ remedial work
- Historic building advice
- 3D Revit & Level 2 BIM structural design & modelling

Surveying land and buildings

- Geomatic / topographical site surveys
- Building, Road, and Earthworks Setting out
- Engineering Setting out
- Establish precise site survey control
- 3D digital terrain modelling
- Volumetric analysis
- Site area computations
- Flood risk surveys using GPS active network
- Measured building floor plans and elevation surveys
- Land transfer plans to Land Registry requirements
- Drainage network surveys
- Assistance/Expert witness in land boundary disputes
- Deterioration monitoring
- Preparation of asset plans
- As built record surveys

PLANNING
DESIGN
CIVIL

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