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FARMING connect
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Technical Report on Infrastructure Improvements

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Category:	**Technical Grassland & Crop Management**
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Ariennir gan
Lywodraeth Cymru
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1. Introduction

1.1 Objectives of this Report

The purpose of this report is to ensure the farm improves existing infrastructure to ensure compliance with the **Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021**:

- **Install silage clamp boundary effluent channel and link to existing tanks.**
- **Improve clean/dirty yard boundaries around scrape yard areas.**
- **Construct new slurry store.**

1.2 Disclaimer

This report is prepared from physical and financial information supplied by the farming client. The report is prepared in good faith and every effort has been made to ensure accuracy, however AgriPlan Cymru Ltd cannot accept liability for errors and omissions. Responsibility for actions taken lies with the client. Professional advice and statutory advice should be taken as appropriate.

1.3 Farming Connect

AgriPlan Cymru Ltd has been approved to deliver the Advisory Service on behalf of Farming Connect. This Technical Report should be part-funded through Farming Connect.

2. Summary

2.1 Background and opportunities

The business is run as a dairy unit and is looking to assess improvement works required to ensure compliance with CoAPR21.

The business is looking for economic solutions to address any potential issues and ensure the holding infrastructure can comply with the **Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021.**

If the farm does not implement the recommended improvements there will be a risk of prosecution by NRW relating to lack of control of effluent runoff and failure to provide 5 months winters slurry storage capacity based on the existing farm infrastructure and layout. Please remember that this applies to the current infrastructure set-up. The recommendations section will provide alternative mitigation to ensure the farm meets compliance by the August 2024 CoAPR21 deadline.

The farm will need to provide 5 months storage capacity for all slurry/dirty water produced by August 2024. The farm must provide slurry storage capacity for all slurry/dirty water produced between 1st October 2024 to 1st March 2025 and for every following year. This will be tied into a non-spreading period for slurry/dirty water running from 15th October to 15th January each winter. The construction of a new slurry store will be essential if the farm is to provide 5 months winters slurry storage capacity.

The recommendations below will address the issues raised and provide mitigation to ensure compliance with CoAPR21.

2.2 Agreed route forward.

The business will assess the advice in the report and implement the recommended improvement works. Any required works should be carried out as soon as possible to keep any potential pollution risk to a minimum and ensure CoAPR21 compliance.

3. Business Profile

3.1 The Farm

The farm runs a dairy herd, milking 220 cows all housed on cubicles and fed under cover. The dairy herd produce an average approx. 7000 litres annual milk yield.

The holding covered a total of 650 acres. The land is split between 400 acres of owned land with an additional 250 acres of rented land. The majority of the land is suitable for slurry disposal if land and weather conditions are suitable.

At Borras Head Farm 415 mm of rain will fall over the 5-month winter period as stated on the Welsh Government data map https://datamap.gov.wales/maps/974.

This equates to a monthly average rainfall of 83 mm per winter month.

Current practice is to spread any slurry produced to the land on a daily basis. The cubicles use a high level of straw as bedding resulting in a relatively dry material. The passages and open link yard areas are all scraped to a central ramped elevated push in point. The slurry produced is pushed directly into the farms spreader where it is taken to the land and disposed of on a daily basis.

The FYM produced by the straw bedded loose housed stock is either spread directly to the land if conditions are suitable or stored in temporary field heaps. FYM stored in temporary field heaps should not be sited in the same place each year as they tend to form hotspots of leachate into the soil profile.

The regulations specify that solid FYM field heaps should not be located:

- Within 10m of a surface water or land drain
- Within 50m of a spring or borehole
- On land that is likely to become waterlogged
- On land likely to flood
- On any single position for more than 12 successive months

There should be a two-year gap before returning to the same site. FYM should be able to be stacked in a freestanding heap without slumping.

The material collected included any runoff from the open scrape yard areas and the open yard linking the cubicles to the milking parlour, will be classed as slurry. From October 2024 the farm must provide 5 months slurry storage capacity in order to comply with CoAPR21. This will be tied into the non-spreading period running between 15th Oct to 15th Jan each winter. The farm has accepted new slurry storage is required and is looking at the option of installing an above ground circular tank linked to a slurry separator. The capacity required to comply with CoAPR21 will be discussed in the recommendations section below.

All parlour washings and roofed silage clamp runoff are piped to a separate collection tank. The tanks are linked and operate as a settlement system with the liquid flowing from one to the other. The lowest tank is then emptied when required.

The material collected is not contaminated by high volumes of slurry so can be classed as “lightly fouled contaminated runoff”. It is permissible to spread this liquid to the land throughout the winter period as long as land and weather conditions are suitable. The settlement tanks provide **approx. 43m³.**



Lightly fouled runoff collection tank.

The 2 roofed clamps that drain to the tanks are pre 91 structures and classed as exempt from CoPAR21 as long as they do not pose a pollution risk. However, the farm is also using an open clamp area to store maize. Under CoAPR21 this also qualifies as a silage clamp and needs to meet regulatory requirements. This clamp is a post 91 structure and needs to comply fully with CoAPR21. Mitigation to address the works required to the clamp will be discussed in the recommendations section below.

Below are the slurry/dirty water production figures at Borras Head.

Slurry Production per month	Volume of slurry per month (m^3)
220 dairy cows producing 53 litres of slurry/cow/day for 30 days.	**350 m^3**
Parlour washings intercepted and diverted to separation tank.	**0 m^3**
Remaining youngstock loose housed on straw and producing FYM only.	**0 m^3**
Open yard linking cubicle/feed buildings to parlour @ 240m^2 collecting 83mm surface rainfall each month.	**20 m^3**
Open scrape yards linked to ramped push in point @ 152m^2 collecting 83mm surface rainfall each month.	**13 m^3**
Pre 91 silage clamps linked to separation tank and stored in isolation as lightly fouled contaminated runoff.	**0 m^3**
Post 91 silage clamp to be connected to separation tank and stored in isolation as lightly fouled contaminated runoff.	**0 m^3**
Total current monthly production of slurry/dirty water currently entering the slurry store.	**383 m^3**

Over the 5-month winter period this equates to **1,915m^3.** The farm currently has no slurry storage and is looking to install a new slurry tank to cope with the capacity required. The new slurry tank will need to be in place by August 2024 in time for the October 2024 storage period under the Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021.

The farm is also keen to install a slurry separator to help remove the straw from the slurry prior to entering the new slurry tank. This will reduce overall slurry production volumes by **approx. 15%.**

4. FARM ADVICE AND RECOMMENDATIONS.

- **Install silage clamp boundary effluent channel and link to existing tank.**

The pre 91 clamps are linked to the effluent collection tank and classed as exempt from the CoAPR21 regulations. However, the farm has built a maize clamp on the upper yard area. Whilst this clamp has a concrete floor, it is not linked to any effluent collection tank and the construction does not comply with the requirements of CoAPR21. Whilst I understand that there is limited effluent produced any clamp built after 1991, must comply with the CoAPR21 regulations.



Non-compliant clamp in need of refurbishment.

If improvement works are not carried out to the clamp then the farm risks prosecution and the facility being condemned.

When the clamps are next empty install a boundary kerb or channel along the outside edge of the concrete pad running along the rear and side elevations. This will prevent any overflow of effluent onto the surrounding ground and help direct all runoff to the natural low point at the front. The existing stone wall will need to remain within the centre of the clamp as this is a listed structure and cannot be removed.

The elevations running alongside the 2 existing buildings will also require a boundary channel linked to the proposed kerb/channel running around the pad.



Effluent channel required between building and clamp. This can be created by installing a new wall separating the clamp from the building.

Freestanding concrete panels can be installed to create boundary walls along the 2 building elevations, or the existing concrete panel wall can be extended as discussed on site.



Concrete panel wall could be extended to create effluent channel between building and wall.

The freestanding panel walls can sit directly on the concrete pad and do not require base fixings. The panels interlock and need to sit inside the proposed boundary kerb. The kerb/channel will then create the boundary channel required under the Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021.



Example of free-standing concrete silage panels sitting on concrete base.

A new front channels need to be installed across the lower front elevation which is used for entry and exit.



Example of effluent collection drain running across open front elevation.

These will provide a clear boundary between the clean yard area in front and the clamp behind. This needs to be linked to the boundary channel discussed previously. The new open front channel must then be connected via a sealed pipe to the existing effluent tank currently used by the parlour washings/pre 91 clamps.

If the clamp is not connected to the existing tank then a new effluent tank will be required. To comply with the **Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021** a compliant effluent tank for the specific silage clamp volume will be required. This volume is based on an effluent tank with a minimum storage capacity able to hold at least 20 litres of effluent for each cubic metre of silo space if the silo holds less than 1,500 cubic metres. Silos with a capacity of more than 1,500 cubic metres should have an effluent tank of not less than 30 cubic metres plus 6.7 litres for each cubic metre of silo capacity in excess of 1,500 cubic metres.

The clamp has an approx total storage capacity of **approx. 1,440m²** and would require an effluent tank with a minimum stroage capacity of **29m³ (6,380 gallons).**



Example of effluent tank prior to installation.

The farms effluent tanks provide enough capacity for the washings and pre 91 clamp runoff based on information given to comply with the storage requirements on CoAPR21

During the winter period, or part of the winter, the lightly fouled contaminated runoff collected in the effluent tanks can be spread to the land using the farms slurry tanker or by linking to a Briggs type irrigator. The runoff should only be spread to the land if land and weather conditions are suitable for application. Outside of the winter period, the lagoons contents can be pumped back into the slurry storage system if required.

NRW should be informed of the silage clamp refurbishment works 14 days before commencement of works on site and the works should be signed off once completed. The works should be signed off by the contractor or structural engineer to clarify it has

been built to satisfy CoAPR21 and BS5502. The link below should be used for this purpose.

Preconstruction notification of new slurry store and silage store

Any significant refurbishment works to pre 91 clamps will also require the whole facility to be brought up to regulatory standards. The business is already looking at options to bring the facilities up to CoAPR21 compliance after the NRW inspection and I would recommend the following works are carried out.

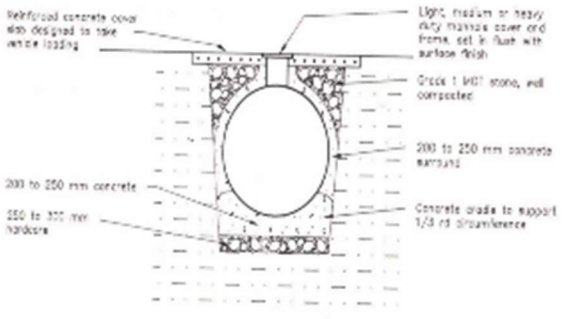
Below are the regulatory requirements for new silage clamps if the facility is classed as substantially improved.

Site Suitability

- Consult the NRW and Local Planning Authority when selecting a site.
- Avoid sites in a flood plain or sites with a high-water table.
- Size, site location & suitability – carry out survey & investigation (See References 1, 2, 9).
- Site more than 10 metres from a watercourse with no land drains beneath silo or within 10 metres.
- Suitable sites will be on firm and level non-organic sub strata.

Specification

- Obtain a professional design, e.g., from chartered civil or structural engineers, that conforms to the Control of Pollution Regulations, the Water Code and BS 5502 (See References 1, 2, 3).
- Impermeable base e.g., Concrete to BS 8007 with water bars to joints, or Hot Rolled Asphalt if site is suitable.
- Floor must extend beyond any walls and have an external perimeter effluent collection channel.
- Effluent collection channels and tanks must conform to the Control of Pollution Regulations (See Reference 1 & 2).
- Walls and their foundations must be designed to withstand the loading described in BS 5502, Part 22 (See Reference 3).
- The walls could become overloaded if an effluent drain is not installed at floor level within 500 mm of the inside face of the wall.
- Proprietary wall panels and timber railway sleepers may be used. However professional advice must be obtained on their use and on the support system and foundations appropriate for the site conditions.
- All silos must be provided with an effluent tank with a capacity equivalent to m3 for each 150 ^{m3} of silo capacity up to 1500 ^{m3} and an additional m3 capacity for each 150 ^{m3} of silo capacity in excess of 1500 $^{m3.}$



GRP effluent tank with load bearing

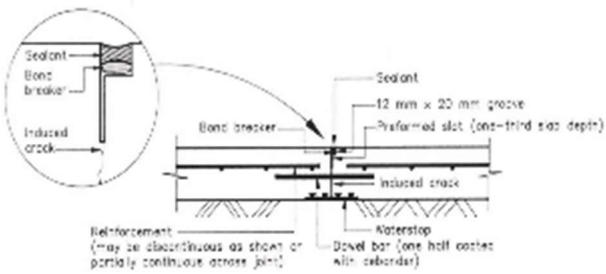
- Effluent tanks constructed on site using in-situ reinforced concrete, masonry or other structural materials must be impermeable. Take professional advice on an appropriate design.
- Proprietary silage effluent tanks are common. Tanks and any associated drainage should be installed strictly in accordance with the manufacturer's specification.
- Tanks must have a 20-year durability life without maintenance and require certification to Environment Agency requirements.
- Cover slab Construction:

Site preparation

- Remove all vegetation and organic topsoil from site.
- Excavate and trim to formation levels. Protect from weather.
- Remove soft ground and fill with Department of Transport specification type 1 hardcore to formation level.
- Compact formation with vibrating roller to achieve a permissible bearing pressure of more than 200 kN/m2.
- Spread in uniform layers and compact as above at least 150 mm thickness of Department of Transport type 1 hardcore. Avoid limestone susceptible to acid attack (See Reference 9).
- Alternatively, a minimum of 75 mm of C20 concrete to BS 8007 or GEN 2 mix concrete to BS 5328, may be used instead of hardcore (See References 6 & 7).
- Lay 1000-gauge polythene on formation and lap the joints.

Construction: - Concrete floor slabs

- Set rigid formwork to edges of slab and joints.
- For 150 mm deep RC 45 concrete slab and maximum joint spacing at 5mg for a 5pm wide bay, use A252 fabric reinforcement in top with at least 40 mm cover. See BS 8007 for alternative bay size and specification (See Reference 6).
- Use water bars and sealants to BS 6213. Set and joint water bars before concreting work (See Reference 5, 9).
- Lay reinforcement lapped one mesh, on spacers.
- Use ready mixed RC45 concrete; max W/C ratio 0.50, minimum cement content 350 kg/m^3 (See References 6 &7). Only use approved additives.



Section through concrete floor slab & joint detail

- Transport concrete in approved manner.
- Vibrate concrete using approved mechanical vibrator.
- Pour slab bay in one continuous operation.
  Provide uniform and regularly tamped finish to falls.
- Protect and cure concrete on completion - all to BS 8110 (See Reference 8).
- Apply joint sealant – resistant to effluent attack.
- Apply protective coating against effluent attack.

- Do not fully load concrete until it achieves design strength (equivalent to 28-day strength).
- Concrete specification: see BS5328, BS 8007 and BS8110 (See References 6, 7, 8).
- Internal and external perimeter effluent drainage channels set into the floor slab require special construction methods. Plastic perforated land drains, laid on the floor near the inside face of the wall, may be used for effluent collection within the clamp. (See Reference 9).

Construction: - Hot Rolled Asphalt (HRA) floor slabs

- Not all sites are suitable for HRA use.
- Specifying and laying HRA is a specialised job requiring special equipment (See Reference 9).
- Special measures will be necessary to ensure water tightness around stanchions and silo wall foundations.
- Concrete foundations are necessary for walls and other structures.
- Gas produced from any escaped effluent lying beneath HRA can cause uplift and failure of the HRA.

Example of HRA specification – paviour machine application only

- Top wearing course at least 40 mm thick of HRA to BS 594 Part Table 3 or 5 (non-limestone aggregate), on.
- Base course at least 110 mm thickness of 28 mm nominal size dense bitumen Macadam to BS4987 clause 2.2.5, on.
- Mechanically compacted Department of Transport type 1 non-limestone hardcore, compaction specification and depth to suit ground conditions.

Repair and Maintenance

- Obtain all information for operation and maintenance from designer or installer.
- Major structural defects including steel corrosion and concrete decay – refer to expert for advice.
- HRA can be used to re-surface some forms of defective concrete – refer to specialist (See Reference 9)
- Minor shallow concrete defects where reinforcement is not affected must be properly cut out prepared and filled with compatible mortar. Epoxy resin mortars and bonding agents are especially suitable.
- Exposed and corroded reinforcement can cause structural failure – refer to expert for advice.
- Floor and wall joints must be inspected every year. If defective, properly prepare and repair with effluent resistant sealant.
- Joints with defective concrete may require special attention.
- Observe precautionary notices; do not use heavier tractors than wall design, failure can occur. Repair impact damage.
- Do not surcharge or overload walls more than design load criteria?
- Check and rectify damage and blockages to drains and effluent tank. Be aware of danger and take precautions against toxic gases during inspections.

- Refer to CIRIA Report 126 for specialist techniques and repair practice (See Reference 9).

- **Improve clean/dirty yard boundaries around scrape yard areas.**

  As described above the pre 91 silage clamp runoff is diverted to the collection tanks. It is important to ensure there is no risk of the clamp runoff becoming contaminated by slurry. This would affect its classification as “lightly fouled contaminated runoff” so it is important all slurry is kept away from contaminating the clamp runoff.

  The main area of concern is the open scrape yard located below the buildings complex. This yard is used to scrape slurry from the cubicle/feed building to the push in point. However the clamp runoff also flows in a channel parallel to the scrape yard risking contamination. I would recommend a kerb is installed along the edge of the scrape yard to ensure there is no risk of effluent flowing into the effluent channel.



Protect effluent channel with new kerb.

This will protect the clamp runoff from any significant slurry contamination.

I would also recommend a kerb is installed along the opposite edge of the yard. This will ensure no slurry flows onto the adjoining land causing pollution.



Install kerb along outside edge of scrape yard.

The kerbs will ensure all slurry is retained within the concrete scrape yard and no point source pollution or clamp runoff contamination occurs.

- **Construct new slurry store.**

  The business is aware that is has to invest in new slurry storage. The farm has considered the various storage options and has decided an above ground circular tank is the best suited option. This will be linked to a slurry separator which will take out dry matter prior to the slurry being pumped into the slurry tank.



Example of circular slurry tank under construction.

I would recommend that the separator and slurry reception pit are located at the location of the current ramped push in point. All slurry is already scraped to this point so it would be logical location for the reception pit/separator.

The calculations indicate that the farm will produce **1,915m³** of slurry/dirty water over the 5 month winter period. The reception pit will need a minimum of 2 days storage capacity in order to comply with CoAPR21. This equates to a minimum storage capacity of **26m³** plus 300mm freeboard plus 415mm surface rainfall if the tank is open.

The slurry separator will take out approx. 15% dry matter from the total slurry production. This will leave a slurry storage requirement of approx. 1,628m³ in order to provide 5 months winters capacity when combined with a slurry separator. The reception pit can provide an element of buffer capacity.

Based on a 3 ring Permastore tank at 4.26m high, the tank would need to have a minimum diameter of **24.76m (model 8115).** This will provide enough storage capacity after deducting the 300mm freeboard and 415mm surface rainfall when linked to a slurry separator.

Prior to constructing the new tank, planning permission **MUST** be approved.

The tank will need to be designed by someone suitably qualified and the structure built to satisfy BS5502.

As part of the planning process for the slurry tank a Design and Access Statement will be required clarifying capacities and slurry/dirty water production for NRW. A SCAIL

(ammonia) assessment may also be required depending on the screening of the proposal by NRW.

NRW need to be informed of the facility 14 days prior to commencement of works on site, via the pre notification form found on the NRW website and the link below.

Preconstruction notification of new slurry store and silage store

Grant aid may be available from July 2024 to help with the cost of construction of the facility.

I would recommend that the concrete base of the tank is designed to accept an additional ring. This will allow for future expansion should the dairy herd ever increase.

5. Action Plan

Objective	Action required	Responsible Person	Time Frame	Outcome
Ensure compliance with CoAPR21	Refurbish silage clamp and bring up to CoAPR21 standards.	Mr Jones	Asap	Ensures clamp meets CoAPR21 and all effluent is directed to effluent tank as lightly fouled contaminated runoff.
Prevent seepage of slurry/dirty water causing contamination.	Install kerb along edge of scrape yard to prevent overflow and contamination.	As above	ASAP	Protects silage clamp runoff classification and prevents point source pollution.
Ensure compliance with CoAPR21	Construct new slurry store.	As above	Aug 24	Ensures adequate slurry storage capacity is available, enabling farm to meet CoAPR21 compliance.

6. Further Guidance

Natural Resources Wales Guidance

Guidance for Farming

General guidance for the Farming sector

Notification of the improvement works can be submitted to NRW via the following link.

Preconstruction notification of new slurry store and silage store

Farming Connect Guidance

Farming Connect home page.
Farming Connect home page

Control of agricultural pollution slurry storage fact sheet

Slurry storage Fact sheet

Control of agricultural pollution storage of silage

Silage storage Fact sheet

Farm Nutrient workbook guidance

Farm nutrient workbook guidance

Risk map guidance.

Producing a risk map guidance

Construction Guidance for Livestock manure and silage storage

Ciria: Livestock Manure and Silage storage infrastructure for agriculture – this guidance is available in 2 parts – part 1 is a selection guidance and part 2 is design and construction**. The documents are free to download.**

Construction guidance for manure and silage store

Statutory Guidance

The Water Resources (Control of Agricultural Pollution Regulations) (Wales) (2021)

Control of Agricultural Pollution Regulations