**Manure and Slurry Management Planning**

This annex provides guidance on the specific information that is required in a Manure and Slurry Management Plan (MSMP) submitted in support of an Agri-Environment Climate Scheme application for the Slurry Storage item.

It is not intended as a 'how to guide' but does make reference to relevant guidance material. The Rural Payments and Inspections Division (RPID) will regard a MSMP as being prepared to a professional standard provided that the plan is prepared accurately, in accordance with this guidance.

Farms where slurry is produced are subject to The Water Environment (Controlled Activities)(Scotland) Amendment Regulations 2021. These regulations set out the standards that need to be met in constructing new or substantially enlarged slurry store and that the Scottish Environment Protection Agency (SEPA) must be notified no later than 30 days prior to commencing the works. The notification must be accompanied by an engineering plan for the works to be carried out.

Hence, any proposals that involve substantial improvement or replacement of slurry storage facilities (including silage or midden effluent tanks) should be discussed with SEPA at the earliest opportunity. SEPA may also have additional requirements regarding the content or preparation of your MSMP.

Your plan must be prepared in accordance with this guidance to ensure that all of the relevant information is entered and considered. This will also make it easier for us to check that all of the required information is contained within the plan. A simple [slurry storage calculator](https://www.ruralpayments.org/media/resources/AECS-Slurry-Storage-Calculator-2023.xlsx) has also been provided, which will help with undertaking calculations and identifying areas where improvements to existing drainage areas may be possible. It is now a requirement of the scheme that any identified improvements to reduce contaminated rainfall drainage must be implemented and accounted for in the final storage capacity requirement. Failure to do may result in rejection of the application.

**1. Introduction**

The introductory section should identify the person who has drawn up the plan and include a brief description of the farm business, which covers:

* the individual units that make up the business
* the area of the individual units
* the typical stocking and cropping on each unit and the numbers and types of livestock currently housed on a slurry based system

The introduction should also identify the particular unit or units within your holding that are being included in your application. This should provide summary descriptions of:

* existing collection and storage systems, including an assessment of their age and condition
* any deficiencies that have been identified in the existing system, including deficiencies in clean and dirty water separation
* the proposed solutions, which must include addressing any issues identified relating to clean and dirty water separation
* the number of days storage that will be provided, if additional storage is required

**2. Calculating slurry storage requirements**

This section should provide a detailed description of the existing collection and storage systems. Information should be provided about:

* the age and condition of the system (and an assessment of its likely lifespan)
* the storage capacity of all elements of the system
* how the system is operated (including maintenance of 300mm 'freeboard' for slurry tanks or 750mm 'freeboard' for earth banked lagoons. See the [PEPFAA Code](http://www.scotland.gov.uk/Topics/farmingrural/Agriculture/Environment/PEPFAA/Overview))
* a diagram of the farmyard should be produced that clearly identifies the existing areas of effluent production and storage. This should show all of the yard areas that drain to the storage system with an indication of the area (square metres). Clean and foul drainage systems should be clearly identified

It should cover all slurries and manures produced by livestock on the units included in the application. PLANET software ([available for free download here](http://www.planet4farmers.co.uk/Content.aspx?name=PLANET)) may be used to calculate your slurry storage requirements or you can use the recently introduced [slurry storage calculator](https://www.ruralpayments.org/media/resources/AECS-Slurry-Storage-Calculator-2023.xlsx), which will assist with the various calculations, otherwise you can use the step by step process and tables below.

All calculations must be shown to demonstrate where the figures have come from. The following categories of material produced will typically have to be considered:

* farm yard manure
* slurry / poultry manure
* dirty water (from yards, dairy washings etc)
* silage effluent

Calculating your slurry storage requirements is a seven-step process (note that all of the steps may not be applicable to your farm):

**Step 1:** calculate the volume of excreta produced by animals kept on a slurry based system;

**Step 2 (optional):** adjust the volume to take account of where solids are removed with a slurry separator;

**Step 3:** calculate the volume of rainwater falling directly on the slurry store or draining to it from yards, buildings and silage pits;

**Step 4 (optional):** calculate the volume of wash-water collected in the slurry store;

**Step 5:** calculate the total volume of slurry to be stored;

**Step 6:** calculate your existing slurry storage capacity;

**Step 7:** compare your existing slurry storage capacity with your calculated storage requirement.

**Step 1: Complete Table A below for each class of livestock that is housed on slurry based system on your farm**

* enter the typical number of animals for each livestock type in column 1
* multiply column 1 by column 2 to calculate the total weekly contribution from each livestock category
* multiply the calculated value in column 2 by the appropriate number of weeks in column 3
* add up all of the calculated values in column 3 to calculate the total volume of excreta produced by all categories of livestock kept on a slurry based system

**Table A – weekly volumes of excreta collected as slurry**

|  |  |  |  |
| --- | --- | --- | --- |
| **Livestock Type** | **Number of animals on slurry based system** **1** | **Volume of excreta per livestock type per week (m³)** **2** | **Total volume of excreta to be stored as slurry during the required storage period** **3** |
| 1 Dairy cow, over 2 years (over 9000 litre milk yield) | **x** | 0.45 = | x 26 = |
| 1 Dairy cow, over 2 years (6000 to 9000 litre milk yield) | **x** | 0.37 = | x 26 = |
| 1 Dairy cow, over 2 years (up to 6000 litre milk yield) | **x** | 0.29 = | x 26 = |
| 1 Dairy heifer replacement, 13 to first calf | **x** | 0.28 = | x 26 = |
| 1 Dairy heifer replacement, 3 to 13 months | **x** | 0.14 = | x 26 = |
| 1 Beef suckler cow (over 500 kg) | **x** | 0.32 = | x 26 = |
| 1 Beef suckler cow (up to 500 kg) | **x** | 0.22 = | x 26 = |
| 1 Steer/Heifer for slaughter | **x** | 0.22 = | x 26 = |
| 1 Steer/Heifer, over 25 months | **x** | 0.22 = | x 26 = |
| 1 Steer/Heifer, 13 to 25 months | **x** | 0.18 = | x 26 = |
| 1 Steer/Heifer, 3 to 13 months | **x** | 0.14 = | x 26 = |
| 1 Bull beef, 3 months and over | **x** | 0.18 = | x 26 = |
| 1 Bull for breeding, over 25 months | **x** | 0.18 = | x 26 = |
| 1 Bull for breeding, 3 to 25 months | **x** | 0.18 = | x 26 = |
| 1 Calf, up to 3 months | **x** | 0.05 = | x 26 = |
| 1 Sow place (including litter up to 7 kg) fed on a diet supplemented with synthetic amino acids | **x** | 0.08 = | x 26 = |
| 1 Sow place (including litter up to 7 kg) fed on a diet without synthetic amino acids | **x** | 0.08 = | x 26 = |
| 1 Maiden gilt place | **x** | 0.04 = | x 26 = |
| 1 Breeding boar 66 kg to 150 kg | **x** | 0.04 = | x 26 = |
| 1 Breeding boar over 150 kg | **x** | 0.06 = | x 26 = |
| 1 Weaner place (7 to 13 kg) | **x** | 0.01 = | x 26 = |
| 1 Weaner place (13 to 31 kg) | **x** | 0.01 = | x 26 = |
| 1 Grower place, 31 to 66 kg (dry fed) | **x** | 0.03 = | x 26 = |
| 1 Grower place, 31 to 66 kg (liquid fed) | **x** | 0.05 = | x 26 = |
| 1 Finisher place, 66 kg to slaughter (dry fed) | **x** | 0.04 = | x 26 = |
| 1 Finisher place, 66 kg to slaughter (liquid fed) | **x** | 0.07 = | x 26 = |
| **Total column 3 = Total Volume of Slurry to store (m³)** | **m³** |

**Step 2: (Optional) Adjust the volume where solids are removed with a slurry separator**

*If this is not applicable to your farm, proceed to Step 3.*

You can make this adjustment if you **always** use a mechanical separator to remove solids from the slurry. In the calculation you may reduce the volume of cattle slurry by 15 to 20 per cent, and reduce the volume of pig slurry by 5 to 10 per cent.

Please provide a calculation showing the amount and justification for reducing the figure calculated at Step 1.

**Step 3: Calculate the volume of rainwater falling directly on the slurry store or draining to it from yards buildings and silage pits**

Rain falling directly onto stores, or draining to them from yards, roofs, middens and silage pits etc. can have a massive impact on the volume of slurry that you have to contend with. It is therefore of great importance to calculate accurately the rainwater collection area that contributes to store.

To calculate this you need to know:

* the surface area (square metres) of any unroofed/uncovered existing stores
* the area of open yards, silage clamps, middens, roofs etc. that drain into the slurry store (in square metres)
* Unless you record your own rainfall data you must use the 10 year average monthly rainfall for the months when storage is required, based on the SEPA rainfall station that is located closest to the unit where the proposed work is being undertaken. The SEPA data is available at the following link [Scottish Rainfall Data - provided by Scottish Environment Protection Agency (SEPA)](https://www2.sepa.org.uk/rainfall/)
* A [csv file can be downloaded](https://www.ruralpayments.org/media/resources/Slurry-storage-calculator-user-guide.docx), which can then be pasted into the slurry calculator to determine the 10 year average for the months October to March inclusive or you can enter the relevant data manually into your plan.

The **Steading Drainage Assessment Plan** (refer to Annex 1) will help you to identify areas where rain falls directly onto slurry stores, or where contaminated areas drain to them. A scale plan will also make it easier for you to calculate the areas involved; otherwise you will have to take the measurements using a tape or wheel. Alternatively the map viewer function on your Rural Payments and Services account has tools to assist with creating steading plans. With aerial photography and OS map detail you are able to identify and measure the areas where dirty water is produced and collected to store with the measure tool.

**3.1 Enter the measurements of each area which collects rainwater and drains to the store into Table B below**

**Table B**

|  |
| --- |
| **Calculation of areas contributing to slurry storage** |
| **Yards/ buildings/lagoons etc. description** | Length (a) | Width (b) | **Area in m²** **(a x b = m²)** |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 4 |  |  |  |  |
| 5 |  |  |  |  |
| **Unroofed circular stores description** | Circumference | Radius (r) = (circumference ÷ (3.142) ÷ (2) | **Area in m² =****(r x r) X (3.142)** |
| 6 |  |  |  |  |
| 7 |  |  |  |  |
| 8 |  |  |  |  |
| **Total contributing area** | **(box a)****m²** |

**3.2 Use the average rainfall figure for your locality and enter the monthly rainfall figures into Table C below**

The total figure (contributing area) from Table B should be entered on Table C (box b).

**Table C**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Month** | **Jan** | **Feb** | **Mar** | **Oct** | **Nov** | **Dec** |
| **Monthly rainfall figure (mm)** | **mm** | **mm** | **mm** | **mm** | **mm** | **mm** |
| **Total contributing area from Table B (box a)** | **(box b)** **m²** | Multiply the total contributing value from box b by the average rainfall value for your locality. Then divide by 1000 to convert to cubic metres (m³). Record the cubic metre value in the boxes below. |
| **Monthly dirty water production from rainfall (m³)** | **m³** | **m³** | **m³** | **m³** | **m³** | **m³** |

The values for each month shown above will have to be taken into consideration in later total calculations for cumulative amounts contributing to store.

**Step 4: Calculate the volume of wash-water that is collected in the slurry store. If you do not produce wash-water or collect it separately from slurry, proceed to Step 5**

**4.1 Dairy Farms (only complete this calculation if the washings are contributing to store)**

* enter the number of dairy cows that will be milked during the minimum storage period into Table D below
* multiply by the appropriate volume for the cleansing equipment used on your farm i.e. high pressure hose or high volume hose (you can use actual figures for your farm if known)
* multiply by the number of days in the month. This will give you an estimated volume of cleaning water going into the store – add the figure to the last column in Table D (dairy) (you may use actual figures for your farm if known)

**Table D**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Month** | **Number of dairy cows** | **Multiply by the washing volume 0.018m³ (without power hose) or 0.035m³ (power hose)** | **Multiply by days in month** | **Estimation of cleaning water used (per month) (m³)** |
| **October** |  | X | X 31 | = |
| **November** |  | X | X 30 | = |
| **December** |  | X | X 30 | = |
| **January** |  | X | X 31 | = |
| **February** |  | X | X28 | = |
| **March** |  | X | X31 | = |
|  |  | **Total dairy washings** | = |

|  |  |
| --- | --- |
| **No washing water is collected to slurry store (confirm by check box to right)** |  |

**4.2 Pig Farms**

Using Table E below add in the number of pigs against the standard figures shown for cleansing equipment and the number of washes per day. Then multiply together the number of pigs, the washing volume, and the number of days in the month. This will give you an estimated volume of cleaning water going into the store – add the figure to the last column in Table E (Pigs) (you may use actual figures for your farm if known).

**Table E**

|  |
| --- |
| **Estimation of water used in cleansing operations (adapted from PEPFAA Code)** |
| **Month** | **Cleaning out pens after each batch (10 pigs per pen)** | **Multiply by the washing volume 0.018m³ (high pres. hose)** | **Multiply by days in month cleaning carried out** | **Estimation of cleaning water used (per month) (m³)** |
| **October** |  | X | X 31 | = |
| **November** |  | X | X 30 | = |
| **December** |  | X | X 30 | = |
| **January** |  | X | X 31 | = |
| **February** |  | X | X28 | = |
| **March** |  | X | X31 | = |
|  |  | **Total pig washings** | = |

|  |  |
| --- | --- |
| **No washing water is collected to slurry store (confirm by check box to right)** |  |

You have now gathered all the information required to estimate the amount of water that is contributing to your store.

*Note: there may be opportunities to remove some rainfall contribution to the slurry store. You can assess this later (see under Step 7 “review rainfall contribution to store”).*

**Step 5: Calculate the total volume of slurry to be stored**

Enter the volumes calculated at Steps 1 to 4 above into Table F below

**Table F**

|  |  |
| --- | --- |
| **Total volume of livestock excreta to be stored as slurry (Steps 1 and 2)** |  |
| **Total volume of rainwater collected to slurry store (Step 3)** |  |
| **Total volume of wash-water collected to store (Step 4)** |  |
| **Total volume of slurry to be stored** | **m³** |

**Step 6: Calculate your existing storage capacity**

**6.1 Storage capacity of a rectangular store or lagoon**

Measure the length (metres) and the width (metres) and average depth (metres) from the top of the bank to the base of the store. Make sure you reduce the measured depth by 0.75 metres to allow for freeboard (this give you the effective working depth). You will also have to reduce the length and width measured from the inside of the bank top to allow for the sloping sides. Enter the relevant data into Table G below to calculate the storage capacity (cubic metres). **Safety note: Do not attempt to measure the depth of such a store while it contains any liquid.**

**Table G**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Store** | **Description** | **Length** | **Width** | **Depth\*** | **Volume a x b x c =volume m³** |
| **1** |  |  |  |  |  |
| **2** |  |  |  |  |  |
| **3** |  |  |  |  |  |
| **4** |  |  |  |  |  |
| **Total capacity stores and lagoons** | **m³** |

**\*Depth minus freeboard**

**\***Freeboardis the term given to the unfilled depth (safety margin) at the top of a slurry or effluent tank or compound. Freeboard allowances are: 750mm for earth bank lagoons and 300mm for all other structures. Freeboard is not a legal requirement for structures which are exempt under the SSAFO Regulations (structures completed before 1991). It is, however, considered best management practice to adhere to freeboard requirements in all structures.

**6.2 Storage capacity of a circular store**

You will already have calculated the area of circular stores at Table B in this booklet. Enter the relevant areas into Table H below. Multiply the floor area (m2) by the depth (m) (reduce the depth by 0.3 m to allow for freeboard) to give the capacity of the slurry store (m3).

**Table H**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Store** | **Description** | **Area from Table B** | **Depth\*** | **Volume** |
| **1** |  |  |  |  |
| **2** |  |  |  |  |
| **3** |  |  |  |  |
| **4** |  |  |  |  |
| **Total capacity circular stores** | **m³** |

**\*Depth minus freeboard**

**\***Freeboardis the term given to the unfilled depth (safety margin) at the top of a slurry or effluent tank or compound. Freeboard allowances are: 750mm for earth bank lagoons and 300mm for all other structures. Freeboard is not a legal requirement for structures which are exempt under the SSAFO Regulations (structures completed before 1991). It is, however, considered best management practice to adhere to freeboard requirements in all structures.

**6.3 If you have both circular stores and rectangular stores or lagoons:**

Calculate the existing slurry storage capacity for your farm by adding up Table G and Table H totals in Table I below.

**Table I**

|  |  |
| --- | --- |
| Total slurry store capacity = | m³ |

**Step 7: Comparing slurry production with available storage capacity**

This section will enable you to compare current slurry storage capacity with slurry production on your farm over 6 months. Enter the following information into Table J below:

 1. Enter the relevant totals from Tables H, G or I into box X.

 2. Enter the total volume from Table F into box Y.

**Table J**

|  |  |
| --- | --- |
| **Total Storage Capacity (slurry)** | **Total Production (all contributors)** |
| **X)** | **Y)** |

1. If **X** is greater than **Y**, you have more than the **MINIMUM storage** required.

2. If **Y** is greater than **X**, you do not have sufficient storage capacity and will need to consider the actions that you can take to resolve this. You will need to consider the following options:

* whether there are opportunities to reduce the volume of rainwater going into the existing store, e.g. covering slurry stores, diverting clean water away from the store
* reducing contaminated areas by reviewing the way in which livestock move around the steading
* whether there are opportunities to export the excess slurry to another farm or an appropriate processing facility
* changes to the housing system for some of the livestock kept on your farm, e.g. move some stock onto a bedded housing system or consider off wintering some stock
* provide additional storage

**Review rainfall contribution to store (only if the previous step shows insufficient storage)**

Using Table K below, enter the total rainfall collection area that could be excluded (identified using the Steading Drainage Assessment Plan), and the average rainfall total over six months from October to March (Total monthly rainfall figures from Table C) in the table below to calculate the potential volume reduction (**PV**):

**Table K**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Total rainfall collection area that could be excluded (m²)** |  | **Rainfall over 6 months (Total rainfall from Table C)** |  |  | **Potential volume excluded from slurry store** |
| **m²** | **X** | **mm** | **÷ 1000** | **=** | **PV** | **m³** |

**3. Proposed solutions**

This section should consider and compare all of the possible solutions to any problems that have been identified. Slurry reception pits that receive drainage water must be able to cope with storm rainfall events (normally based max 48 hour rainfall figures averaged over 5 years for your area).

Note that for the purposes of this scheme a reception pit is a below ground tank for emptying, periodic cleaning of settled solids from storage tank and recirculation mixing and the size is restricted to 36m³.

Tanks that are effectively intermediate storage tanks will count towards the 2000m³ storage limit and will be paid at the lower rate.

It is important to consider simple solutions such as diverting clean water away from the slurry storage system. Refer to Annex 1 for further information and examples.

A revised plan of the farmyard should be produced that shows the intended site of the proposed works and any changes to the existing drainage system. This may also require you to recalculate the rainfall that is being collected by the new store if there is an increase in the surface area.

4. Additional Storage

Table L Provide details of the additional storage facility proposed – stores and lagoons

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Store** | **Description** | **a****Length** | **b****Width** | **c****Depth\*** | **Volume a x b x c =volume m³** |
| **1** |  |  |  |  |  |
| **2** |  |  |  |  |  |
| **Total capacity new stores and lagoons (u)** | **m³** |

Table M Provide details of the additional storage facility proposed – circular stores

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Unroofed circular stores description | Circumference | Radius (r) = (circumference ÷ (3.142) ÷ (2) | (d) Area in m2 = (r x r) x (3.142) | (e) Depth\* | Volume (d) x (e) = Vol m3 |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Total Capacity new circular stores (v) | m3 |

\*Freeboard is the term given to the unfilled depth (safety margin) at the top of a slurry or effluent tank or compound. Freeboard allowances are: 750mm for earth bank lagoons and 300mm for all other structures. Freeboard is not a legal requirement for structures which are exempt under the SSAFO Regulations (structures completed before 1991). It is, however, considered best management practice to adhere to freeboard requirements in all structures.

The new store if uncovered will also gather water from rainfall. To calculate the additional production value to store from rainfall you will need to take the surface area of the structure (stores and lagoons a Length x b Width from the table above, circular stores use “d” calculated area in m2 from the table above. Using the same method as previously at step 3 calculate the additional contribution to store from store surface area against average rainfall figures

Table N

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Month** | **Jan** | **Feb** | **Mar** | **Oct** | **Nov** | **Dec** |
| **Monthly rainfall figure (mm)** | **mm** | **mm** | **mm** | **mm** | **mm** | **mm** |
| **Total contributing area from new slurry storage facility** | **(box b)** **m²** | Multiply the total contributing value from box b by the average rainfall value for your locality. Then divide by 1000 to convert to cubic metres (m³). Record the cubic metre value in the boxes below. |
| **Monthly dirty water production from rainfall (m³)** | **m³** | **m³** | **m³** | **m³** | **m³** | **m³** |
| **Total additional rainfall to store (w)** | **m³** |

Revised **slurry production with available storage capacity**

**Table O Transfer the original totals (X & Y) from Table J into the table below**

|  |  |
| --- | --- |
| **Total Storage Capacity (slurry) combined m3** | **Total Production (all contributors) combined m3** |
| **X)** | **Y)** |
| **U&V)** | **W)** |
| **Total X+U+V** | **Total Y+W** |

**Total X+U+V must be greater than Total Y+W to demonstrate that the new store will provide sufficient storage for the required 6 months period required by the scheme.**

**4. Contingency plan**

This section must consider the steps that would be undertaken in the following circumstances:

* extended periods of very wet weather
* land is frozen hard for extended periods
* power / mechanical failure of any part of the system
* a potentially polluting incident arising during slurry spreading operations (e.g. contact SEPA via its Hotline number, 0800 807 060)

**5. Conclusions**

This section should provide a summary of the existing storage system and any deficiencies that have been identified. It should also detail the solutions that are to be implemented and the number of days storage that will be available following their implementation.

**Finally, a MSMP is a working document, which needs to be regularly updated to take account of changing circumstances. It is not something to be shelved and forgotten.**