

Manure Management Plan

A step by step guide for farmers

Name	Mason Farming
Farm Address	Cottam House Farm Cottam Driffield YO25 3BY
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Introduction

These guidelines have been designed to help you produce a plan for spreading livestock manures, slurries and organic wastes on your farm. This plan will help you to minimise the risk of causing water pollution. The background to the plan is described in the Code of Good Agricultural Practice for the Protection of Water (the Water Code, PB0587) which is available free of charge from Defra Publications, Admail 6000, London SW1A 2XX, or e-mail defra@iforcegroup.com or telephone 08459 556000. The Water Code also gives advice on the handling and storage of solid manures and slurries.

The guidelines have been divided into five easy steps.

The first four steps enable you to complete a **coloured map** of your farm showing where manures and organic wastes can safely be spread, particularly during the **winter**. Notes are provided to help you at other times of the year.

- **Step 1** helps you identify how much land you have for spreading manures and where manures should not be spread
- **Step 2** helps you identify any restrictions on manure spreading
- **Step 3** helps you work out the minimum area of land you need for spreading
- **Step 4** gives you guidance on applying sewage sludge (biosolids) and other organic wastes
- **Step 5** helps you work out whether you need extra storage for slurry and dirty water

**We have provided references to more detailed information and guidance at Annex 4.
This may not cover every circumstance or legal obligation on your farm.
Please discuss any problems with your adviser.**

You should obtain advice from the Environment Agency:

- if you have a pig or poultry unit affected by the Integrated Pollution Prevention and Control (IPPC) Directive, or
- if you wish to use this plan to support proposals for a structure affected by the Control of Pollution (Silage, Slurry, and Agricultural Fuel Oil) Regulations 1991 (amended).

Reducing the risk of pollution from land spreading

Complete the first four steps in the following pages to produce a plan. Carry out the recommendations and you will minimise the risk of causing water pollution from spreading livestock manures and organic wastes on your farm.

To complete this plan you will need to do some calculations. These are easier to do in metric units but we have provided conversion figures on page 20 to help you if your information is in imperial.

To draw up the plan you will need:

- 1 A map or maps of the land you farm that clearly shows:
 - every field and watercourse (including all ditches)
 - field areas in hectares (1 hectare = 2.5 acres)
 - any boreholes, springs or wells that supply water for farm dairies or human consumption, including any on neighbouring land near to your boundary

If these features are not marked on your map, please draw them in.

Note:

If you use a 1:2,500 scale map; 1 grid square = 1 hectare and 1 side of a square = 100 metres

If you use a 1:10,000 scale map; 1 grid square = 100 hectares and 1 side of a square = 1,000 metres

You will find these scales on the ruler inside the back cover

- 2 Stock details:

- the average number of each type of stock housed on the farm over the whole year (e.g. pigs, poultry) and/or over the winter period only (e.g. dairy cattle)
- the number of months cattle and sheep are housed

- 3 Coloured pens or pencils - red, orange, yellow, green. You can use blue for watercourses.

- 4 A calculator

In the following pages we give you the necessary steps to draw up a successful plan.

As you complete the steps you will notice letters beside some boxes. These letters are used to identify figures which recur throughout the document. They are a guide to help you when transferring figures from one box to another in certain calculations.

Colour coding of pollution risk areas

Your plan will contain some or all of the following coloured areas:

- **Red areas** should never be used for spreading and to do so may break a legal obligation (e.g. in Nitrate Vulnerable Zones).
- **White areas** are not normally used for operational reasons but may be brought into use in the future.
- **Orange areas** cannot be used when certain conditions apply, but they will usually be available at some times of the year. For example, fields which cannot be used when they are at field capacity in winter may be used in spring. However, they may also be at very high risk if the soil cracks over drains in summer.
- **Yellow areas** may be used for spreading at most times of the year but application rates must be no more than 50m³/hectare (4,500 gallons/acre) in a single application when certain conditions apply.
- **Green areas** may be used for spreading at most times of the year.

And additionally:

- **Cross-hatched areas** must not be used for spreading slurry, poultry manure or liquid digested sewage sludge during closed periods in **Nitrate Vulnerable Zones**. Such areas consist of sandy or shallow soils. The “no-spreading periods” are from 1 August to 1 November on arable land where no autumn crop will be sown; and from 1 September to 1 November on grassland, and also on arable land where an autumn crop will be sown.

Note:

To reduce the risk of nitrate leaching, whenever practicable, avoid applications of manures high in available nitrogen (i.e. slurries and poultry manures) during the autumn and early winter period. Delaying application until late winter or spring period will improve N utilisation by the crop.

Step 1

Calculating the area of crops and grass available for spreading livestock manures

Areas where livestock manures should never be spread

These areas are described below. Pick out those areas which occur on your farm and colour them on your map in **red**. Where an area is an unusual shape, for example circular areas around wells, mark off a square or 'practical' shaped area of the field.

Areas on which solid manures and slurry should never be spread are:

Ditches and watercourses:

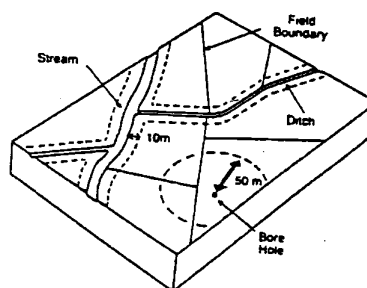
- Within at least 10 metres (11 yards) of either side of any watercourse including ditches and piped ditches. This will avoid direct spreading into the watercourse and also reduce the risk of run-off reaching the watercourse. Do not forget to include watercourses that form the boundary of your farm.

Other non-spreading (red) areas:

- Within at least 50 metres (55 yards) of any spring, well, borehole or reservoir that supplies water for human consumption or farm dairies.
- Very steep slopes where run-off is a high risk throughout the year.
- Any areas where you may not be allowed to spread for reasons such as a tenancy agreement, an abatement notice due to smell, set-aside land, Sites of Special Scientific Interest (SSSIs) or Environmentally Sensitive Areas (ESAs).
- The surface is rocky or uneven so that your equipment cannot be used effectively or safely.

After colouring in these areas on your map, use Table 1 (on page 5) to help you calculate the total number of hectares where you should never spread animal manures.

Areas on which solid manure and slurry should never be spread.



Other areas (fields or parts of fields) where you do not normally spread solid manure and slurry

We suggest that you leave these areas **white** on your map. Enter their areas into Table 1.

This may be because of:

- non-farmed areas - buildings, roads, tracks,
- particular land use such as orchards, woodlands, etc,
- location, e.g. they are too far from the farmstead.

Table 1 - Calculating the area not available for spreading

List in this table **only** your fields which have red or white areas. Remember ditches and watercourses have two sides.

Field name or number	Whole field area in hectares (ha)	Ditches and watercourses		Other red areas (ha)	White areas (ha)
		Total length in metres (m)	* metres ÷ 1,000 = ha		
4999 - Low Barn Dale	4.09			4.09	
2824 - Middle Dale	2.10			2.10	
2639 - Pit Pen	0.08			0.08	
2838 - Pit	0.24			0.24	
7289 - Ampitheatre	19.09			19.09	
2222 - 68 Dale	2.18			2.18	
8973 - Sunken Road	1.14			1.14	
8985 - Front Field	22.40			22.40	
4086 - Horses Paddock	1.18			1.18	

Total farm area: A 383.06 Ha

Areas not available for spreading: Totals x / y 52.5 Ha z /

**This calculation is derived from ditches x 10 m (red area) ÷ 10,000 to give hectares. If we do not multiply by the 10 m first, we only need to divide by 1,000.*

**Note: If you use a 1:2,500 scale map; 1 grid square = 1 hectare, 1 side of a square = 100 metres
If you use a 1:10,000 scale map; 1 grid square = 100 hectares, 1 side of a square = 1,000 metres**

Area available for spreading: A minus (x + y + z) = B 330.56 ha

Step 2

Identifying areas where livestock manures should not be spread under certain conditions or where rates should be restricted

Some areas of the farm will be unsuitable for spreading at certain times of the year, particularly in winter. These could vary from year to year. Other areas may receive manure at any time of the year but the rate and frequency of application needs to be carefully limited. The conditions which restrict the timing, rates and frequency of applications are listed in Table 2 below.

Table 2 - Identifying very high risk (orange) and high risk (yellow) areas
Any field which meets both orange and yellow conditions should be coloured orange

Key	Conditions leading to very high and high risk areas	Colour Map
1	Fields or part fields next to a watercourse, spring or borehole when the surface is severely compacted* or waterlogged.	Orange
2	Fields or part fields that are likely to flood sometime in most winters.	Orange
3	Field or part fields next to a watercourse, spring or borehole when the soil is at field capacity** (in winter) and there is: <ul style="list-style-type: none"> • a steep slope • a moderate slope and a slowly permeable soil (i.e. a clay soil or one through which water passes only slowly) • a moderate slope and a well-drained soil • a slight slope and a slowly permeable soil 	Orange Orange
	All fields*** or part fields with effective pipe or mole drains (but see extra limitations below)	Yellow
	Very shallow soils (less than 30 cm) over gravel or rock, e.g. limestone, chalk, slates and shales	Yellow

Notes

- * Severely compacted is when rain stays on the surface after rainfall.
- ** Field capacity is when the soil becomes fully wetted and more rain would cause water loss by drainage. This normally happens in autumn and lasts until the spring.
- *** Fields or part fields which in the last 12 months have been pipe drained, mole drained or subsoiled over drains should not be used for spreading.

Drained or mole drained fields should not be used in summer if they are cracked down to the drains or backfill.

Areas for spreading (subject to restrictions)

Identify areas which meet the conditions in **Table 2** and mark them on your map in **orange** (very high risk) or **yellow** (high risk) as indicated.

Number the orange areas on your map using the reasons and number key from Table 2. Number the map with all the conditions affecting it.

Colour the remaining areas of crops and grass **green** (lower risk). Green areas **do not** have effective pipe or mole drains. Remember you may need to leave some areas white (Step 1).

And additionally, identify any sandy or shallow soils in **Nitrate Vulnerable Zones (NVZs)** and mark the areas on your map by **cross-hatching**. These areas must not receive slurry or poultry manure during closed periods.

Note: In NVZs - A sandy soil has sand, loamy sand or sandy loam texture to 40 cm depth and sand or loamy sand to 80 cm; the topsoil will contain less than 8.5% organic matter (5% organic carbon). A shallow soil has 40 cm or less depth over rock which is commonly chalk, limestone or sandstone. See Annex 4: PB5505.

Slurry and solid manure should never be spread when:

- The ground is frozen hard or snow covered as a subsequent thaw or rainfall can cause a significant risk of run-off.
- The fields are so wet that tractor-drawn machinery will damage the soil. You may consider that areas you have marked yellow are not available during the winter for this reason.

Colour in the boxes and attach the keys below to your map to help you identify areas more easily.



Colour Key



Orange areas
Very high risk



Red areas
Land where manure and organic waste should never be spread



Yellow areas
High risk



Cross-hatched areas
Never apply slurry or poultry manure in NVZ closed periods



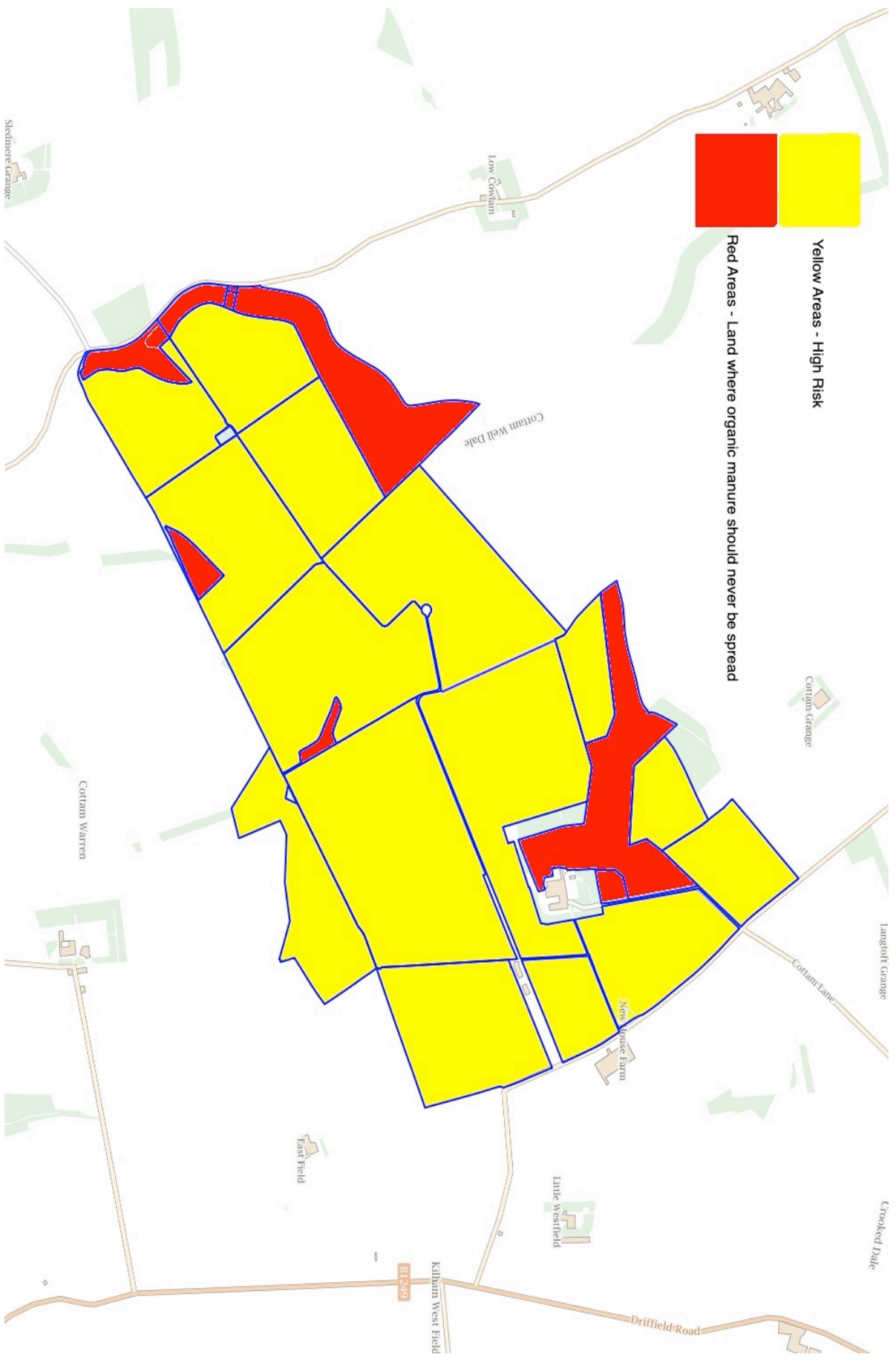
Green areas
Lower risk



White areas
Land not normally used for spreading

Orange Areas Number Key

- 1 Do not spread on these fields when the surface is compacted or waterlogged
- 2 Do not spread when there is a risk of flooding
- 3 Do not spread when the soil is at field capacity i.e. when the soil is fully wetted



Yellow Areas - High Risk

Red Areas - Land where organic manure should never be spread

Step 3

Calculating the minimum area of land needed for spreading livestock manures

This calculation ensures that no more than 250 kg/ha (200 units/acre) of total nitrogen in livestock manure is applied in any one year. *(This is the upper limit advised in the Water Code and typically required of registered organic farmers, but which must be observed in Nitrate Vulnerable Zones).*

Follow these steps in **Table 3**.

- Fill in your stock numbers in column **A**
- Enter the number of months cattle and sheep are housed in column **B**
- Carry out the multiplication using the figures in columns **A**, **B** and **C** and record the result in column **D**
- Finally add up the column **D** to get the total area needed for the year.

Importing livestock manures

If you spread slurry/solid manure from other farms on your land, you can include these livestock numbers as well. Alternatively, you may find it easier to calculate spreading area needed from your knowledge of the number of spreader loads received during the year (go to Annex 1, page 17).

Sewage sludge and other organic wastes

If you spread sewage sludge or other organic wastes, see Step 4.

Table 3 - Calculating minimum area of land needed

Stock unit	A Number of stock units	B Months housed		C Hectares needed per stock unit	D Total area needed (ha)
1 dairy cow (650 kg)		X		X 0.039	=
1 dairy cow (550 kg)		X		X 0.032	=
1 dairy cow (450 kg)		X		X 0.025	=
1 dairy heifer replacement over 24 months (500 kg)		X		X 0.019	=
1 suckler cow	32	X	6	X 0.019	= 3.648
1 grower/fattener over 24 months (500 kg)	10	X	6	X 0.019	= 1.14
1 grower/fattener over 12 to 24 months (400 kg)	9	X	6	X 0.016	= 0.864
1 follower/young stock 6 to 12 months	18	X	6	X 0.008	=
1 bull beef cattle 6 to 14 months	25	X	6	X 0.012	= 1.8
1 calf (to 6 months)		X		X 0.005	=
1 bull for breeding (1,350 kg)	1	X	6	X 0.019	= 0.114
1 breeding sow place, including piglets				X 0.078	=
1 weaner place				X 0.012	=
1 grower pig place				X 0.024	=
1 light cutter pig place (35 to 85 kg)				X 0.038	=
1 bacon pig place (35 to 105 kg)	1950			X 0.042	= 83.58
1 maiden gilt place				X 0.052	=
1 boar place				X 0.064	=
1,000 laying hens				X 2.64	=
1,000 free range laying hens				X 2.32	=
1,000 broiler places				X 1.98	=
1,000 broiler breeders				X 3.90	=
1,000 replacement pullets				X 0.50	=
1000 male turkey places				X 5.56	=
1000 female turkey places				X 2.60	=
1000 fattening duck places				X 3.60	=
1 sheep	249	X	0	X 0.003	= 0
1 fattening lamb (to 6 months)		X		X 0.001	=
1 fattening lamb (6 to 12 months)		X		X 0.002	=
Imported livestock manures (if any)	Number from Box M (Annex 1, page 17) =				

Total = Minimum land needed

C

91.146 ha

Transfer C to next page

Enter C from previous page into box

Total = Minimum land needed C

91.146 ha

Area available for spreading manure B

330.56 ha

(Transfer B from page 5)

If C is bigger than B:

Extra area is needed to spread livestock manures (C minus B)

0 ha

- You may wish to consider if some of the white areas on your map which are used for cropping could be safely used for spreading to make good the difference.
- Alternatively you should make arrangements to spread the excess manure on another farm or dispose of it in other ways. You should always follow the advice in the Water Code.
- You should reconsider any decisions to import livestock manures.

If you have any land in a Nitrate Vulnerable Zone or are a registered organic farmer:

- You **must** check that you can comply with the farm-based limits for nitrogen from organic manure loadings.
- The farm-based limits may mean that you have to spread excess manure on another farm, even if **C is less than B**. And you may need more area than the ‘extra area’ calculated (C minus B). **Organic farmers must** use another organic farm.
- In NVZs, you **must not** apply more available nitrogen than the crop requires.

Step 4

Guidelines for spreading sewage sludge or other organic wastes

You only need to read this page if you spread sewage sludge or bring other organic wastes onto your farm.

The Manure Management Plan you have drawn up should also be used to guide you when spreading sewage sludge or other organic wastes. The risk of causing pollution is very similar to the risk that occurs when spreading livestock manures.

The recommended annual limit of 250 kg/ha N in organic manures applies to the total organic nitrogen applied during the year from all sources (*for NVZs and organic farms see below*). Therefore you should only spread sewage sludge and other organic waste if you have more land suitable for spreading than you need for livestock manures.

Before deciding whether you wish to spread these materials check that there will be some land available for spreading after you have spread all your livestock manures. The amount of land remaining will be given by:

Area available for spreading

Area needed to spread livestock manures

Amount of land remaining for spreading sewage sludge or other organic wastes

$$\boxed{} \text{ ha} \text{ minus } \boxed{} \text{ ha} = \boxed{} \text{ ha}$$

(Box B, page 5) (Box C, page 9)

If you have any land in a Nitrate Vulnerable Zone or are a registered organic farmer:

- You **must** check that you can comply with the farm-based limits for nitrogen from livestock manure loadings and from imported organic wastes.
- In NVZs, you **must not** apply more available nitrogen than the crop requires.
- You **must not** import sewage sludge or other organic wastes if it would breach these nitrogen limits. For operational reasons you should allow a safety margin.
- **Organic farmers must not** use sewage sludge; and other organic wastes may be restricted or prohibited. If in doubt – consult your Certifying Body.
- **Do not** spread liquid digested sewage sludge to sandy and shallow soils in NVZs (cross-hatched areas on your map) during closed periods.

The simplest way to avoid applying excess nitrogen (to each field) is to avoid spreading sewage sludge or organic wastes on fields where you plan to spread livestock manures. A single application of sludge commonly contains at least 250 kg/ha N. To help you avoid applying more than 250kg/ha N, the rate of application should not be more than that given in Annex 2. However, sludge from a particular source may contain more or less nitrogen than the average analyses on which these figures are based. The supplier should provide you with an analysis and interpretation. All other organic wastes should be spread at rates which take account of their nitrogen content and polluting potential.

Using this plan

These pages help you use your plan to avoid pollution

Red areas

These should never be used for spreading livestock manure or organic wastes as it may cause water pollution, damage natural habitats or break a legal obligation (e.g. in NVZs).

White areas

You have judged these unsuitable for various reasons. It may be possible to spread livestock manure or organic waste safely at some time in the future. You should use the guidance in Table 2 and the notes on page 6 to make this decision.

Maximum annual applications to all spreading areas

- The amount of livestock manure or organic waste applied to a given area in a 12 month period should not contain more than 250 kg/ha total N (200 units/acre). Annex 2 shows typical annual application rates for livestock manures and sewage sludge that supply this amount of total N. You may not be able to use these rates if you have any land in NVZs or if you are a registered organic farmer (see Annex 4: PB5505 and Booklet 4).
- All applications of livestock manure and organic wastes should follow the plan, take account of soil and weather conditions, and be subject to frequent checks to ensure pollution does not occur.

For all risk areas (orange, yellow and green) - remember :

- **Slurry, solid manure and organic wastes should never be spread on any areas which are frozen hard, snow covered, waterlogged or flooded**
- **Risks can be reduced by applying at lower rates than those recommended above**
- **Do not spread when the soil is so wet that tractor-drawn machinery will damage the soil**
- **The maximum annual application also applies to land used for growing maize**
- **In Nitrate Vulnerable Zones - do not apply slurry, poultry manure or liquid digested sewage sludge to sandy or shallow soils during closed periods, or to steeply sloping fields**

Using orange areas

Do not apply to these areas in the winter or when severely compacted or in summer if cracked over drains.

Using yellow areas

Provided your machinery does not damage the soil these areas can be used for spreading at most times of the year. When the soil is at field capacity you should follow the guidelines below:

- Do not** apply more than 50 m³/ha (4,500 gallons/acre) of slurry or other effluent at any one time
- Do not** apply more than 50 m³/ha by travelling irrigators at any one time
- Do not** apply more than 5 mm/hour (¹/₅"/hr) dirty water with sprinklers
- Do** move sprinklers regularly to suit conditions. On drained soils take particular care that polluting material does not pass into a watercourse
- Do** leave an interval of at least 3 weeks between applications.

These rules also apply to drained and very shallow soils throughout the year.

- **Risks can be reduced further by applying at lower rates than those recommended above**
- **Remember that some drained fields which are high risk (yellow) in winter may crack in summer. They should not be used for spreading when in this condition.**

Using green areas

Provided your machinery does not damage the soil, these areas can always be used for spreading, with a lower risk of causing pollution. Low dry matter slurries or other dilute effluents may be applied at more than 50 m³/ha at any one time, but always taking care that run-off does not occur.

Drained soils

In orange and yellow areas, drained soils may be used provided the limiting rates given above for yellow areas are observed - but check drain outfalls to ensure no pollution occurs.

You should not use any drained fields when they are cracked in summer, or within 12 months of installation of drains or of moling or of subsoiling.

Silage effluent

The amount of effluent produced will vary from year to year according to the moisture content of the grass when it is ensiled. **Silage effluent is highly polluting and should be diluted with the same amount of water before application to land. Do not apply more than 50 m³/ha of diluted effluent.** Apply according to the criteria for different areas above.

Avoid drained land wherever possible to reduce the risk further. Take account of its nitrogen content in your fertiliser policy.

Using manures

Use your map together with your cropping plan and grazing schedule to decide when to apply to a particular field. The fertiliser value of livestock manures and organic wastes should be maximised by applying according to crop need and making adjustments to your inorganic fertiliser applications. For further guidance - see the publications at Annex 4.

Step 5

Assessing whether extra storage is needed for slurry and dirty water

You may wish to use this step to help you assess your storage need. It does not apply to farms where only solid manures are produced.

You should identify how to keep clean roof water and yard water out of slurry and dirty water stores to reduce the need for storage; this will reduce your field spreading costs.

Using the assessment of spreading risks made in steps 1 to 4, together with your experience of spreading over winter, step 5 will enable you to estimate whether extra storage of slurry and dirty water will be needed to minimise the risk of causing pollution.

It is assumed that solid manures will remain in buildings or be stored at a suitable outside location if you do not have enough land available for winter spreading.

Complete the boxes below with your best estimate of existing slurry and dirty water storage capacity.

Storage capacity available - slurry

D₁ mths

Storage capacity available - dirty water

D₂ mths

OR

Storage capacity available - slurry and dirty water together

D₃ mths

From your coloured map, add the total green and yellow areas and enter the figure in box E.

E ha

And, add any cross-hatched (green and yellow) areas and enter the figure in box E1.

E1 ha

Complete Table 4 (and Table 5 where necessary) overleaf using the above information. Pay particular attention to the notes below each table before completion.

Slurry Storage

Table 4 - Assessing whether extra slurry storage is needed (see notes below)

	<u>A</u> Do you apply slurry during these months? YES or NO	<u>B</u> If the answer in column A is Yes, do you have enough suitable land available on your plan for spreading in these months? YES or NO	<u>C</u> If the answer in column B is No, do you need more storage in these months? YES or NO
August September October	Yes	Yes	/
November December	No	/	/
January February	No	/	/
March April	Yes	Yes	/
May June July	Yes	Yes	/

Column **A**

- The answers in column **A** should reflect typical current practice. If you sometimes use these months, answer YES.

Column **B**

- Consider whether the map you have prepared shows adequate land available for each 2 or 3 month period for which you answered YES in column **A**. **Remember that you should not exceed the safe application rate on each field.**
- Use your knowledge of cropping and grazing together with the information in Box **D₁** (or **D₃**) and Box **E**. You will also need to consider whether soil conditions will allow field machinery to operate.
- You will need to consider the effect of any land (Box **E1**), that is subject to NVZ closed periods (during August and during September & October) when you must not spread slurry, poultry manure and liquid digested sewage sludge. For guidance see Annex 4: PB5504 and PB5505.
- You may wish to refer to Annex 3 to estimate the minimum **monthly** area needed for spreading slurry (Box **F**) when all livestock are housed (maximum slurry production). The area for spreading may be reduced at other times.

Column **C**

- If you answered **NO**, it means that you can overcome the shortage of land for spreading in these months by other means, e.g. spreading on a neighbouring farm.
- If you answered **YES**, the size of additional slurry storage will need to be calculated. You may need to take professional advice or consult other guidance – see Annex 4.

Dirty Water Storage

Table 5 - Assessing whether extra dirty water storage is needed (see notes below)

	<u>A</u> Do you apply dirty water during these months? YES or NO	<u>B</u> If the answer in column A is Yes, do you have enough suitable land available on your plan for spreading in these months? YES or NO	<u>C</u> If the answer in column B is No, do you need more storage in these months? YES or NO
August September October			
November December			
January February			
March April			
May June July			

Column **A**

- The answers in column **A** should reflect typical current practice. If you sometimes use these months, answer YES.

Column **B**

- Consider whether the map you have prepared shows adequate land available for each 2 or 3 month period for which you answered YES in column **A**. **Remember that you should not exceed the safe application rate on each field.**
- Use your knowledge of cropping and grazing together with the information in Box **D₂** and Box **E**. You will also need to consider whether soil conditions will allow field machinery to operate.
- You will need to consider the effect of any land (Box **E1**), that is subject to NVZ closed periods (during August and during September & October) when you must not spread some types of “dirty water”. NVZ rules apply to dirty water that includes liquids from weeping-wall stores, strainer boxes, slurry separators and silage effluent which are rich in N and regarded as slurry. For guidance see Annex 4: PB5504 and PB5505.
- You may wish to refer to Annex 3 to estimate the minimum **six monthly** area needed for spreading dirty water (Box **K** or **L**).

Column **C**

- If you answered **NO**, it means that you can overcome the shortage of land for spreading in these months by some other means.
- If you answered **YES**, the size of additional dirty water storage will need to be calculated. You may need to take professional advice or consult other guidance – see Annex 4.

Annex 1

Estimating minimum areas needed for spreading imported livestock manure

Minimum area needed for spreading imported solid manure and slurry

This calculation allows you to estimate the minimum spreading area using your knowledge of the number of spreader loads received during the year.

Follow these steps in **Table 6**.

- For each type of solid manure/slurry, fill in a typical spreader capacity in column **A**.
- Enter the number of loads per year in column **B**.
- Carry out the multiplication using the figures in columns **A**, **B** and **C** and record the result in column **D**.
- Finally add up the column **D** to get the total minimum area needed.

Table 6 Calculating the minimum areas needed for spreading imported solid manure and slurry

Type of solid manure or slurry	A Typical spreader capacity (m ³ or tonnes)	B Number of loads per year	C Factor to limit nitrogen loading	D Minimum area needed (ha)
Solid manure				
Cattle (25% dry matter)		X	X 0.024	=
Pig (25% dry matter)		X	X 0.028	=
Laying hen (30% dry matter)		X	X 0.064	=
Broiler (60% dry matter)		X	X 0.120	=
Slurry				
Cattle (6% dry matter)		X	X 0.012	=
Pig (4% dry matter)		X	X 0.016	=

Total = minimum land needed

ha

M

Typical spreader capacities

4.5 m³ spreader (1,000 gallons)

6.8 m³ spreader (1,500 gallons)

9.1 m³ spreader (2,000 gallons)

Annex 2

Typical maximum annual livestock manure and sewage sludge application rates

Table 7: Typical maximum annual application rates to supply 250 kg/ha (200 units/acre) of total nitrogen

Manure or sludge type	Metric	Imperial	Total N kg/m ³ or kg/t
Cattle farmyard manure	42 tonnes/ha	17 tons/acre	6.0
Pig farmyard manure	36 tonnes/ha	14.5 tons/acre	7.0
Sheep farmyard manure	42 tonnes/ha	17 tons/acre	6.0
Duck manure	38 tonnes/ha	15 tons/acre	6.5
Poultry layer manure	16 tonnes/ha	6.5 tons/acre	16
Poultry broiler litter	8 tonnes/ha	3.2 tons/acre	30
Turkey litter	8 tonnes/ha	3.2 tons/acre	30
Dairy cattle slurry, 2% dry matter	167 m ³ / ha	14,900 gallons/acre	1.5
Dairy cattle slurry, 6% dry matter	83 m ³ / ha	7,400 gallons/acre	3.0
Dairy cattle slurry, 10% dry matter	63 m ³ / ha	5,600 gallons/acre	4.0
Beef cattle slurry, 2% dry matter	250 m ³ / ha	22,300 gallons/acre	1.0
Beef cattle slurry, 6% dry matter	109 m ³ / ha	9,700 gallons/acre	2.3
Beef cattle slurry, 10% dry matter	71 m ³ / ha	6,400 gallons/acre	3.5
Pig slurry, 2% dry matter	83 m ³ / ha	7,400 gallons/acre	3.0
Pig slurry, 4% dry matter	63 m ³ / ha	5,600 gallons/acre	4.0
Pig slurry, 6% dry matter	50 m ³ / ha	4,500 gallons/acre	5.0
Dirty water, less than 1% dry matter	833 m ³ / ha	74,400 gallons/acre	0.3
Strainer box cattle slurry	167 m ³ / ha	14,900 gallons/acre	1.5
Weeping-wall cattle slurry	125 m ³ / ha	11,200 gallons/acre	2.0
Mechanically separated cattle slurry	83 m ³ / ha	7,400 gallons/acre	3.0
Sewage sludge: digested liquid	125 m ³ / ha	11,200 gallons/acre	2.0
Sewage sludge: digested cake	33 tonnes/ha	13 tons/acre	7.5
Sewage sludge: thermally dried	7 tonnes/ha	3 tons/acre	35
Sewage sludge: lime stabilised	42 tonnes/ha	17 tons/acre	6.0

Annex 3

Estimating minimum areas needed for spreading slurry and dirty water

Minimum area needed each month for spreading slurry when all livestock are housed

Transfer from **Table 3** (page 9) any **cattle stock units** that produce slurry and the corresponding figures at Column **C**, and place them in **Table 8** below.

Transfer from **Table 3** (page 9) any **pig stock units** that produce slurry but divide the hectares needed in Column **C** of Table 3 by **12** and enter the result in Column **C** below.

Complete Column **A** and Column **B** below, and then calculate the area in Column **D**.

Table 8 - Calculating the areas needed to spread slurry each month

Stock Unit on slurry based system	A No. on slurry or part slurry-based system	B Proportion collected as slurry e.g. <i>half = 0.5</i> <i>all = 1.0</i>	C Hectares needed per stock unit per month	D Area needed for month (ha)
<i>e.g. 1 dairy cow (650 kg)</i>	X		X 0.039	=
	X		X	=
	X		X	=
	X		X	=
<i>e.g. 1 bacon pig place (35-105 kg)</i>	1950	X 1	X 0.00035	= 6.825
	X		X	=
	X		X	=
	X		X	=

Total minimum area needed per month = F **6.825 ha**

Calculating dirty water production (six months winter period)

To estimate likely production of dirty water you will need:

- 1 A rough plan of the open yards and silage clamps with dimensions to enable calculation of the total dirty yard area from which run-off is collected.
- 2 The average annual rainfall for your farm.
- 3 A calculator.

You should identify how to keep clean roof and yard water out of slurry and dirty water stores to reduce the need for storage; this will reduce your field spreading costs. Use your plan of open yards to work out the total dirty area in square metres. Then **exclude** covered areas if rain falling on these roofs is collected and discharged to a clean drain. Where rainfall onto roofs or clean concrete does unavoidably mix with dirty water, then **include** this roof or yard area. Also **include** the area of uncovered silage clamps and dungsteads and weeping wall stores if the liquid drains to the dirty water store.

In the calculations below, parlour washings are based on a standard figure of 18 litres (4¹/₂ gallons) per cow per day. If you know the total amount of parlour washings (litres) on a daily basis multiply by 0.18* and enter directly into box **H**.

For **pig units**, make use of box **G** and box **I** only.

	Total yard area in m ²	Typical winter rainfall (annual rainfall x 0.6)			
Run-off:	<input type="text" value="1731"/> m ²	<input type="text" value="450.66"/>	X	<input type="text" value="1,000"/>	** = G <input type="text" value="780"/> m ³

		Number of cows			
Parlour washings:		<input type="text"/>	X	3.24***	= H <input type="text"/> m ³

Estimate any other foul run-off in the winter 6 months, eg use of hosepipe or pressure washer					I <input type="text" value="15"/> m ³
--	--	--	--	--	--

Total winter volume of dirty water		= G + H + I =			J <input type="text" value="795"/> m ³
---	--	----------------------	--	--	---

1 square yard = 0.84 m²; 1 inch = 25.4 mm; 220 gallons = 1 m³

* multiplying by 0.18 converts litres per day into cubic metres per 6 months

** dividing by 1,000 converts rainfall from millimetres into metres

*** multiplying by 3.24 gives the volume of parlour washings over 6 months

Minimum area needed for spreading dirty water in winter

Six month (winter) volume of dirty water (transfer J from above)		Minimum area needed for spreading dirty water in winter
J <input type="text" value="795"/> m ³	divided by 833* =	K <input type="text" value="0.95"/> ha

* divided by 833 because up to 833 m³ of dirty water may be applied to a hectare without applying more than 250 kg/ha N. Dirty water contains 0.3 kg N/m³ (on average), 250 ÷ 0.3 = 833.

The nitrogen concentration of dirty water is increased if you add to it the liquid that drains from weeping-wall stores or strainer boxes. If this is the case you will need to increase the area for spreading. To do this multiply the figure in box **K** by 4 and enter into box **L**.

The minimum area is related to nitrogen content and spreading on **green** areas. The area will need to be increased when spreading on **yellow and orange** areas to take account of hydraulic loading limits.

Annex 4

Further information and guidance

- Fertiliser Recommendations for Agricultural and Horticultural Crops (Defra, RB 209)

Comprehensive reference booklet on use of manures and inorganic fertilisers. Available in hard copy from the Stationery Office (price £15) ISBN 0-11243058-9.

The following publications are available free of charge:

From ADAS Gleadthorpe Research Centre (Tel: 01623 844331)

- Managing Livestock Manures: Booklet 1 – Making better use of livestock manures on arable land (*ADAS, IGER, SRI*)
- Managing Livestock Manures: Booklet 2 – Making better use of livestock manures on grassland (*IGER, ADAS, SRI*)
- Managing Livestock Manures: Booklet 3 – Spreading systems for slurries and solid manures (*SRI, ADAS, IGER*)
- Managing Livestock Manures: Booklet 4 – Managing manure on organic farms (*ADAS, Elm Farm research Centre*)
- MANNER (ADAS MANure Nitrogen Evaluation Routine) is a simple, personal computer based decision-support system, supplied on CD-ROM or disk, with full instructions and a User Guide. It predicts the nitrogen content of organic manures.
- Your Farm and NVZs – *do you comply?* This software can be used to calculate monthly slurry and dirty water production and storage needs.

From Defra Publications (Tel: 08459 556000)

- The Water Code, PB 0587
- Guidelines for Farmers in NVZs - England, PB 5505
- Manure Planning in NVZs - England, PB 5504
- Farm Waste Grant Scheme, PB 2529

All of the publications (except MANNER) are available on the internet at www.defra.gov.uk

Note: A list of local consultants who can provide professional advice on manure management planning is available from the National Farm Waste Management Register, Telephone 01398 361566 or 01884 234852.