European Union Network for the Implementation and Enforcement of Environmental Law

Safeguarding the Water Environment throughout Europe Project: Phase 3

Discharge Permitting and Manure Storage Workshop Reports

Date of report: 3 January 2018

Report number: 2017/12

Introduction to IMPEL

The European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL) is an international non-profit association of the environmental authorities of the EU Member States, acceding and candidate countries of the European Union and EEA countries. The association is registered in Belgium and its legal seat is in Brussels, Belgium.

IMPEL was set up in 1992 as an informal Network of European regulators and authorities concerned with the implementation and enforcement of environmental law. The Network's objective is to create the necessary impetus in the European Community to make progress on ensuring a more effective application of environmental legislation. The core of the IMPEL activities concerns awareness raising, capacity building and exchange of information and experiences on implementation, enforcement and international enforcement collaboration as well as promoting and supporting the practicability and enforceability of European environmental legislation.

During the previous years IMPEL has developed into a considerable, widely known organisation, being mentioned in a number of EU legislative and policy documents, e.g. the 7th Environment Action Programme and the Recommendation on Minimum Criteria for Environmental Inspections.

The expertise and experience of the participants within IMPEL make the network uniquely qualified to work on both technical and regulatory aspects of EU environmental legislation.

Information on the IMPEL Network is also available through its website at: www.impel.eu

Title of the report: Fill in title of report	**Number report:** 2017/12
Project Manager: Paul Hickey (UK) **Project Authors:** Barrie Howe (UK): Waste Water Discharge Anette Dodensig Pedersen (DK): Manure Storage Rob Hayes (UK)	**Report adopted at IMPEL General Assembly Meeting**: By Written Procedure, May 2018
	Total number of pages: 21 Report: 21 Annexes: N/A

Executive Summary

The IMPEL network has grown to apply its regulatory capability into the water environment arena, with a specific focus on the implementation of the Water Framework Directive (WFD); having previously focussed on Industrial emissions and associated processes under IPPC and IED directives.

Good management of the water environment requires Member States to be aware of emerging issues, be prepared to meet the challenges that these present, and improve current practices where needed.

The SWETE project team has been working over the past 3 years to support the development of a community of practice and build a common understanding of regulatory approaches by building a network of experts and developing shared resources to help enhance technical resilience.

Previous phases of the SWETE project produced a summary of current regulatory practice on water quality regulation; and supported the development of the 2016 Water Conference in Florence, Italy. And it was through this conference that the priority areas of focus for further discussion and technical collaboration were identified. These were on the issues of:

- Wastewater Discharge Permitting
- Manure Storage Capacity

It was agreed that in 2017, Phase 3 of the SWETE project would look at these two issues, which have been highlighted by IMPEL members as areas of concern, in more detail. Two workshops were arranged to discuss these topics, with the aim of collating best practice, identifying future areas of challenge, and nurturing a network of regulatory experts to help build technical resilience. The reports from these workshops are provided in this document.

Disclaimer

This report is the result of a project within the IMPEL network. The content does not necessarily represent the view of the national administrations or the Commission.

TABLE OF CONTENTS

1. Waste Water Discharge Permitting Report

1.1. Executive Summary

Over the 14th and 15th September 2017 the Environment Agency, England hosted a workshop as part of the third phase of the Safeguarding the Water Environment throughout Europe (SWETE) 3 project.

This followed the discharge permitting questionnaire and report produced in 2015 and the IMPEL Water and Land conference in October 2016, that identified discharge permitting as an issue that would benefit from greater collaboration and discussion. The SWETE Project team therefore agreed to consider this issue in more detail in 2017 and to host a workshop to exchange ideas and best practice with others in the IMPEL network.

Representatives of six IMPEL members states attended the workshop. On day one participants gave presentations on aspects of the permitting approach in their respective countries, each followed by questions and discussion. This session was followed by a discussion focusing on the form that an on-line resource should take, how to build a community of water management practitioners and the areas that SWETE should focus on.

Day 2 of the workshop was hosted by Wessex Water, one of the Water and Sewerage Undertakers in England. Wessex Water representatives gave an overview of the company and the regulatory and other frameworks that it operates within. This was followed by an explanation of some of the challenges that the company is facing and how they are developing innovative solutions to these, including working with regulators on new discharge permitting approaches.

This was followed by a site visit to a wastewater treatment works to see a trial of a new approach to phosphorus treatment using high rate algal ponds.

1.2. Background

The Project Team chose to focus on the topic of Waste Water Discharge permitting, following a review of responses to a questionnaire and report produced in 2015 under the first phase of the Safeguarding the Water Environment throughout Europe (SWETE) project. It was also clear from discussions at the IMPEL Water and Land conference in October 2016, that discharge permitting was an issue that would benefit from greater collaboration and discussion between member organisations.

The SWETE Project team therefore agreed to consider this issue in more detail in 2017 during phase 3 of the project; which would include a workshop where ideas and best practice could be exchanged with others in the IMPEL network.

The aim of the workshop was to discuss different approaches that have been adopted in IMPEL member countries across Europe, identify common challenges, exchange ideas on new and innovative techniques, and share examples of best practice.

The workshop would also be used as a platform for creating a web based resource, to hold practical information and examples of the different approaches taken by those organisations who are involved in these activities. It is agreed that a web based tool would help to create a community of practitioners who can build on and further develop the resource in future.

Eight people attended the workshop, from six IMPEL member countries. The workshop was held in Bath in the United Kingdom on 14 and 15 September 2017. A list of participants is included in Annex 1; and the Agenda is included in Annex 2.

1.3. Introduction to the Workshop and SWETE project

The project workshop was attend by eight practitioners from six IMPEL member countries. The workshop was held in Bath in the United Kingdom on 14 and 15 September 2017. A list of participants is included in Annex 1; and the Agenda is included in Annex 2.

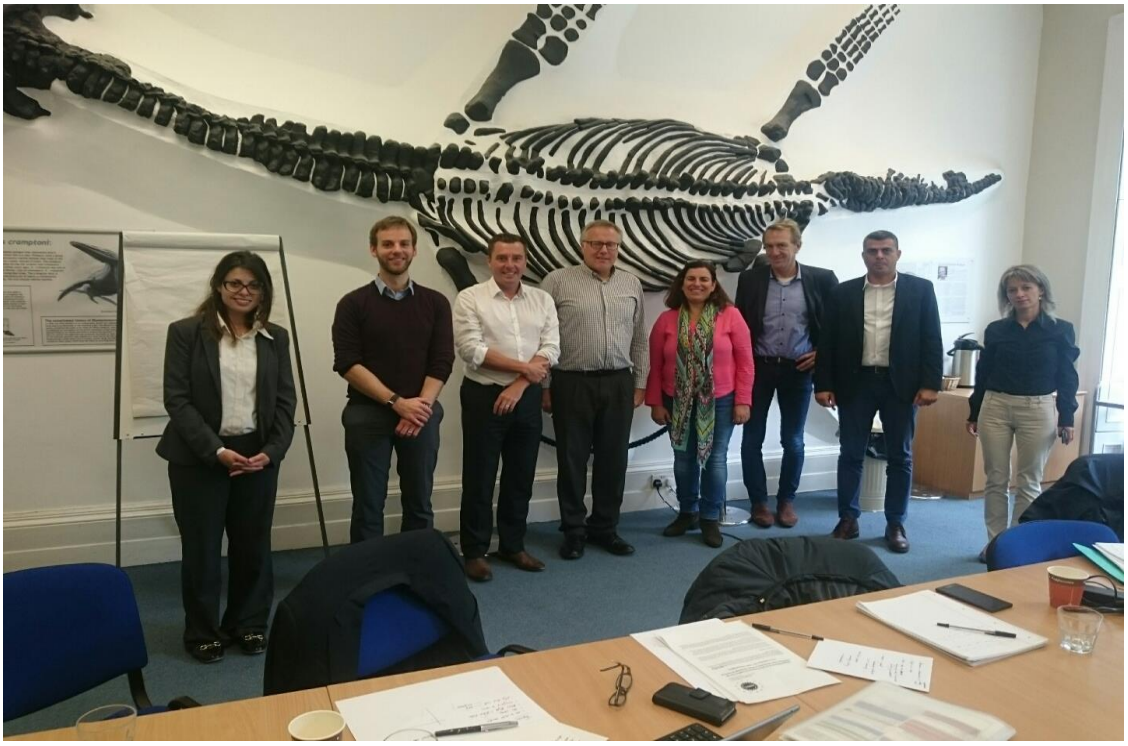


Fig.1. Photograph from Day 1 of Project Workshop in Bath, UK.

1.3.1. Welcome and Introductions

Paul Hickey, Deputy Coordinator of the Water and Land Expert Team and SWETE Project Manager, opened proceedings by welcoming attendees to the workshop and the City of Bath. Paul added that the aims of the SWETE project are as follows:

- Create a network of water regulators to help achieve WFD objectives across Europe
- Develop an online water manual of best practice with an overall aim of improving capability to implement Water Framework Directive.

1.3.2. Introduction to the SWETE project

Barrie Howe explained in more detail what the project had achieved in Phase 1 and Phase 2, and provided some background on how the workshop topics had been selected. He also explained more about the aims for the two days and how the workshop outputs would be used.

Day 1 would focus on sharing information and experiences on the different permitting approaches adopted in each country, followed by a discussion to identify other challenges that would benefit from further collaboration. The discussions would also be used to discuss the format of the on-line resource and how SWETE could encourage more practitioners to support and be involved with this.

Day 2 would be an opportunity for attendees to participate in a site visit to a Waste Water Treatment Plant owned by Wessex Water. The aim of the site visit was to enable participants to learn about the water industry in England, the challenges that are faced; and some of the innovative techniques and approaches that are being developed to overcome these challenges by companies and regulators.

1.3.3. Day 1: Presentations

All of the presentations from the workshop are available on the IMPEL basecamp pages for the SWETE project; or alternatively on request from **Barrie Howe** or **Rob Hayes**

Water Quality Permitting in England

Barrie Howe, a Senior Advisor on Water Quality for the Environment Agency (England) delivered a presentation on some of the pressures that they have faced; such as acute and chronic pollution, and the large improvements in water quality that have been made over many decades. Barrie described how permit conditions and numeric limits are risk based and targeted to the discharge type to ensure that the objectives for the local receiving water are achieved.

Barrie then explained some of the modelling approaches that are commonly used in England to calculate permit limits and to drive action in improving water quality across catchments.

Finally Barrie discussed emerging issues, such as chemicals and antimicrobial resistance, and how these are starting to be investigated and addressed.

Waste Discharge Permit Legal Framework and procedures in Cyprus

Neoklis Antoniou, Environment Officer at the Department of the Environment, gave an interesting presentation on the permitting process in Cyprus. This looked at the legal framework covering the process and how the law was implemented.

This was followed by an explanation of the types of conditions on permits and the process for determining and issuing permits. Neoklis explained the role of technical committees selected from across society in examining draft permits and making recommendations to the minister for sign off or rejection of the permit.

The final part of the presentation looked at inspections and enforcement, including the use of 'spot fines' for lower level infringements. Neoklis explained that all wastewater treatment works in Cyprus include membrane technology and that applicants for a permit sign a declaration that they understand the terms and conditions of the permit.

Workshop on Water Discharge Permitting Examples from Portugal

Anabela Rebelo from the Portuguese Environment Agency gave an excellent overview of the legislation covering water discharge permits and the determination process in Portugal. Permits need to be determined in 45 days and there is a new IT system in place to help achieve this tight deadline.

Anabela then explained what permits in Portugal look like, the types of conditions that they include, how these are designed and targeted to protect the environment and how permit compliance is assessed.

Anabela finished her presentation with a very interesting look at a case study from the Algarve region of Portugal. This set out the investigations, modelling and control measures applied to discharges to protect sensitive shellfish beds, across different tidal states, from microbiological contamination in discharges.

Waste Water Management in Denmark and Danish experiences

Jóannes J. Gaard, a Special Consultant at the Danish Environmental Protection Agency, gave a thought provoking presentation on regulation, collaboration and innovation in water management in Denmark.

His presentation began with an overview of the size and organization of water management activity in Denmark including the large number of water companies. Jóannes explained that the possibility to take out profit from the industry was being considered and that Denmark was keen to understand approaches to this that had been taken in other countries.

This was followed by an explanation of how green taxes and legislation were an important part of water management. This included a look at the importance of technology providers to the water industry and to Denmark more widely, including the large number of water patents developed by Danish industry.

Partnerships have been created in Denmark to reduce the resources used by the water sector. This has been particularly successful in not only reducing, but also producing, energy. Jóannes added that several Waste Water Plants in Denmark now produce more energy than they consume.

Jóannes finished his presentation by discussing an innovative approach of turning wastewater treatment plants into bio-refineries. He also highlighted some emerging issues in Denmark, such as microplastics.

Water Discharge Permitting & Compliance in the Maltese Industrial Context

Gabriella Grima from the Maltese Environment Agency, set out the regulatory context for water management in Malta, followed by an explanation of the size and form of the of the WFD catchment.

Gabriella also explained the permitting process in Malta, saying that this plays a pivotal role in ensuring appropriate operational practices, mitigating pollution and ensuring environmental protection and water management across the catchment district and across the various economic sectors.

The current system follows a risk-based approach with high-risk sites being permitted through a site specific environmental permit and lower risk-sites being regulated by means of general binding rules.

There are three streams to permitting in Malta:

1. IPPC (Integrated Pollution Prevention and Control) permits as defined by the Industrial Emissions Directive.

2. Environmental Permits for those facilities that do not meet IED thresholds.

3. General Binding Rules which are standardised permits which involve registration by the applicant for basic activities that may impinge on the environment.

Gabriella then gave a very clear explanation of the permitting structures, aims and extent of permitting and operational aspects included in permits and the types of conditions used to protect the environment. She concluded her presentation with an explanation of the inspection system and some of the challenges that Malta is facing.

Discharge Permitting in Romania

Andreea Husu, from the National Environmental Guard in Romania delivered the final presentation, and explained how the National Environmental Guard is organised in Romania and how different types of inspections are carried out.

She then explained how permits are applied to different activities, how water is monitored and characterised, and about the impacts of different discharge types on the water environment. Andreea also explained how protected areas are identified and mapped, and the reasons for these protections being in place.

Andreea ended her presentation by discussing wastewater treatment in the Bistrița-Năsăud County in Romania; including how permits are set, the determinants that can be included in permits, how limits can be enforced, how exceedances of limits can be reported; and the penalties for non-compliance.

1.3.4. Group Discussions

Following the presentations by attendees, the group held a discussion which looked at various issues of interest to the SWETE project team; in anticipation of Phase 4 of the project. These discussions included the format of an online resource, how the group could better support the development of a community of water management practitioners; and finally possible topics that SWETE should focus on in future years of the project.

Online Resource

It was agreed that the basecamp service provided by IMPEL was a good starting point for an online resource but a bespoke system would be better. The group noted the practicalities and cost of this as being potential barriers that would need to be overcome.

Creating a Water Manager's Practitioner Community

The group agreed that this should be an aim of SWETE. It was accepted that this would need to be built up slowly. The focus should be on practical examples that helped practitioners. WEBEX and other technological solutions should be used to disseminate learning and good practice and that this should attract new participants into the project.

Future areas for collaboration

A number of potential areas for future collaboration were discussed, including:

- Water Quality modelling - sharing tools and practices (via webinar) then create an on-line library for wider use
- Permitting best practices – practical guidance for practitioners in an on-line resource.
- Emerging pollutants and sharing regulatory approach, including anti-microbial resistance and microplastics.

Links to IED

Sharing wider learning as part of an on line resource (these are items that aren't strictly in the remit of SWETE, but would be useful areas to develop).

Technology

Research such as Chemicals Investigation programme and new treatment technologies.

1.4. Day 2: Site visit to Wessex Water

On Day 2 of the workshop, the group travelled to Wessex Water's Office on the edge of Bath. Wessex Water is one of the eight water and sewerage undertakers in England, serving an area in the South West of the Country. The group was welcomed by Matt Wheeldon, Director of Asset Strategy and Compliance and Ruth Barden, Director of Environmental Strategy.

Fig 2. Photograph from Day 2 Site Visit to Wessex Water, Bath

Matt gave a presentation that explained how the UK Water Industry is set up and given its direction by UK government. This was followed by a description of Wessex Water and how it has achieved leading company status under the Environment Agency (of England) Environmental Performance Assessment. Matt then explained some of the challenges that the company is facing such as additional housing growth and how the company is addressing those challenges.

Ruth delivered an interesting presentation of some of the environmental and technical challenges that Wessex Water is facing and how research and innovation can being used to address these. This included the recent development of 'catchment permitting' and how the company wanted to extend the scope of this to include catchment management activities.

Following the presentations, a site visit was made to Beckington Wastewater Treatment works. The group was given a tour of the site, with a particular focus on the trials of high rate algal ponds, being run in collaboration with Bath University. This is one of the largest trials of this technology in Europe and is

achieving some impressive levels of phosphorus reduction. There was a discussion of how the technology could start to be used more widely and how permitting could be used to facilitate this.

Fig 3. Photograph of participants on site visit on Day 2 of Workshop

The group found the visit to Wessex Water extremely interesting and the project team would like to thank everyone from Wessex Water and Bath University that helped with this.

Workshop (1) - Annexes

Annex I. List of Workshop Participants

Anabela Rebelo - Senior Officer, Portuguese Environment Agency

Neoklis Antoniou - Environment Officer, Department of Environment, Cyprus

Andreea Husu - Commissary of Bistrita-Nasaud County Commissariat of National Environmental Guard Romania

Jóannes Gaard - Special Consultant, Danish Environmental Protection Agency

Gabriella Grima - Environment Protection Officer | Environment Permitting Environment & Resources Authority Malta

Paul Hickey – Deputy Director for Water Resources, Environment Agency, England / IMPEL Water and Land Deputy Coordinator

Rob Hayes – International Relations Advisor, Environment Agency, England /IMPEL UK National Coordinator

Barrie Howe – Water Quality Senior Advisor, Environment Agency, England

Annex II. Workshop Invitation and Agenda

European Union Network for the Implementation and Enforcement of Environmental Law

Safeguarding the Water Environment throughout Europe (SWETE) Project: Workshop on Water Discharge Permitting

14 & 15 September 2017 (Bath, United Kingdom)

Building on the success of the Water and Land conference last year, the IMPEL SWETE Project kindly invites you to participate in a two day workshop on the topic of 'Water Discharge Permitting'. The workshop will be held Bath (United Kingdom) on 14 and 15 September 2017.

Aim of the workshop

Discharge permitting was identified by participants at the IMPEL Water and Land conference in October 2016, as an issue that would benefit from greater collaboration and discussion. The SWETE Project team therefore agreed to consider this issue in more detail in 2017 and to host a workshop to exchange ideas and best practice with others in the IMPEL network.

On day one of the workshop, we will aim to provide practical examples of approaches to water discharge permitting in England. We will then look to discuss the different approaches that have been adopted in other IMPEL member countries across Europe, with a view to using this information to identify where common challenges exist. Finally, we will exchange ideas on new and innovative techniques, and share examples of best practice.

We hope to use the discussions at the workshop as a platform for creating a web based resource, which will hold practical information and examples of the different approaches taken by those organisations who are

involved in these activities. We also hope that this will help to create a community of practice that can build and develop this resource in future.

On day two of the workshop, we will visit a UK Water Industry wastewater treatment works in Bath, which is participating in a national programme of trials of new treatment technologies, and is also taking a new approach to permitting at a catchment scale.

Workshop agenda

The event will be hosted by the Environment Agency in England. The draft programme for the event is enclosed below:

Day 1
09:00 – 09:15 Arrival at Bath Royal Literary and Scientific Institution
09:15 – 09:30 Welcome and Introductions
09:30 – 09:45 Introduction to the SWETE project
09:45 – 12:30 Presentations by attendees on the permitting approach in their country, highlighting any areas of difficulty and innovation and good practice.
13:30-13:30 lunch
13:30 – 15:00 Further presentations and discussion
15:00 – 16:30 Facilitated group discussion on setting up the on-line resource and creating a community of practice to help future collaboration.
16:30 Finish

Evening – Dinner in Bath

Day 2
09:00 Travel to Wessex Water by coach

10:00 - 10:15 Arrival at Wessex Water site and welcome and Introductions

- Introduction WW- environmental performance and regulatory challenges
- Catchment approaches- innovative technologies, techniques and regulatory approaches
- Tour of the office and Control Room
- Lunch
- Travel to Beckington site tour and high rate algal ponds
- Next steps for the SWETE project and closing remarks

15:00 Coach will take attendees to Bristol airport and mainline stations for onward travel as required

Participants

Participants should be discharge permitting practitioners or policy makers involved in permitting discharges to meet Water Framework Directive (WFD) or other water quality objectives.

Each participant is expected to give a presentation on how discharge permitting is carried out in their own country or region; and the challenges they experience in doing this. Where possible, participants should also highlight any areas of innovation or good practice. The project team will contact participants for information on approaches before the workshop; and participants may also be contacted after the event to help the project team finalise the project report.

There is budget available for between 8 and 10 participants. In addition, a small number of attendees from the Environment Agency will also be present. Unfortunately, we are unable to support more than 10 participants due to restrictions on group sizes for the site visit.

Background for the workshop

Discharge permitting is a key element in achieving Water Framework Directive (WFD) objectives for water quality. We are aware that IMPEL members have developed different approaches to permitting to suit their local needs and circumstances.

As well as existing challenges, such as achieving WFD objectives for nutrients, there are many new and emerging issues that must be considered. For example, there is a need to achieve new and more stringent environmental quality standards for priority hazardous substances.

The SWETE Project Team are of the view that sharing information with others and working together to develop new approaches will help countries/regions to achieve their objectives for water quality. We believe that the IMPEL Water and Land group provides a platform for building a community of experts; and we look forward to working with the membership to address common implementation challenges in this area.

To register an interest in attending the workshop or for any further information; please contact:

Barrie Howe (Environment Agency England) at: barrie.howe@environment-agency.gov.uk

2. Manure Storage Capacity Workshop Report

2.1. Executive Summary

On 25 and 26 September, the second of two workshops under the IMPEL SWETE Project (Phase 3) was held in Aarhus, Denmark, on the topic of manure storage capacity. This was the second topic that was identified during phase 2 of the SWETE project; and through the 2016 Water and Land Conference as being an important area for collaboration between IMPEL practitioners.

The aim of the workshop was to provide practical examples of how manure storage capacity can be controlled as well as to highlight and discuss parameters that complicate an efficient control.

The desired final outcome of the workshop was a guidance tool with different examples of how manure storage capacity can be controlled under various circumstances. Inspection authorities that wish to improve their control of manure storage capacity should be able to find examples of methods suitable for them and get knowledge about the basic conditions for using those methods.

2.2. Background

The legislative drivers for this workshop are found in the Nitrates Directive annexes II and III:

Annex II-A.5. “The capacity and construction of storage vessels for livestock manures, including measures to prevent water pollution by run-off and seepage into the groundwater and surface water of liquids containing livestock manures and effluents from stored plant materials such as silage.”

Annex III-1.2. “The capacity of storage vessels for livestock manure; this capacity must exceed that required for storage throughout the longest period during which land application in the vulnerable zone is prohibited, except where it can be demonstrated to the competent authority that any quantity of manure in excess of the actual storage capacity will be disposed of in a manner which will not cause harm to the environment.”

Having sufficient capacity for storing manure is a simple way to limit the risk of manure being spread on fields at unfavorable times of the year when crops do not uptake much Nitrogen, thus resulting in Nitrate leaching. Although the Nitrogen in manure is an important source of fertiliser, the costs of establishing storage facilities can hold farmers back from actually ensuring that they have sufficient capacity.

Even though the requirement for sufficient storage capacity is simple, actual compliance can be difficult to control on the farms. At the IMPEL Water Conference in Florence (5-6 October 2016) and among participants in the nitrate diffuse pollution project (http://www.impel.eu/projects/good-practice-for-tackling-nitrate-pollution-from-farms-and-farmsteads/), a need for better control of storage capacity was expressed.

Countries vary considerably in national legislation, practices for storing manure, availability of data and natural conditions. Therefore a control method functioning well in some countries might not be equally effective in

other countries. A variety of practical examples from different countries is therefore desirable.

2.3. Workshop (Day 1): Presentations and Discussion

The workshop on Manure Storage Capture was attended by 6 participants from across Europe. The attendees were as follows:

Anabela Rebelo - Environment Agency, Portugal

Anette Dodensig Pedersen - Environmental Protection Agency, Denmark

David Lister - Agriculture and Rural Economy Directorate, Scotland

Karel Giesen - Regional Environmental Service Brabant Noord, the Netherlands

Marcelle Agius - Agriculture Directorate, Malta

Romana Šumak - Inspectorate for the Environment and Spatial Planning, Slovenia

Each participant gave a presentation of how manure storage capacity is controlled in their own country and the challenges that they experience in controlling the capacity. The individual presentations can be seen in **Annexes 1-6**.

The presentations and discussions were centered around the following questions:

- How are the Nitrates Directive's requirements for capacity of storage vessels implemented in national legislation? Does implementation and control differ within and outside Nitrate Vulnerable Zones?
- Which types of manure storage is commonly used? Which significance does storage type have for the control?
- How is the necessary minimum volume of storage assessed? Which parameters influence the needed volume?
- How is it ascertained that necessary storage is actually present?
- What are the challenges in controlling storage capacity? For example physical, technical, administrative and legal.
- What causes farmers to be in non-compliance with requirements for storage capacity?

Summary of presentations and discussions

The types of manure storage used in the six attendees' countries varied. However there are many similarities in the approach to controlling manure storage capacity.

As an example the typical assessment of supply to a manure storage facility for slurry would be adding the volumes of excreta produced by animals kept in a slurry based housing system, rainwater falling directly on the slurry storage or draining to it from yards and buildings, wash-water collected in the slurry storage and silage effluent led to the slurry storage. All calculations are done by using standard values.

The typical assessment of necessary volume of capacity would be adding the calculated volume of supply throughout closed periods (and perhaps taking other legislation into account) to an extra safety volume (in case of adverse weather, e.g. unusually heavy rainfalls, long period of frost after end of closed period etc.).

Some countries have a fixed minimum (e.g. at least 3 months' supply).

All countries have established standard values for manure volumes for different combinations of animals and manure handling system. Standard values for supply of manure depend on local agricultural practices and climate. The levels of detail in the established standard values vary among the countries.

Animal types are defined by species, breed, gender, age, weight and yield. Manure systems are variations of slurry systems, deep litter systems and systems with solid manure and cesspit.

It was a general experience among the attendees that the physical control of whether storage facilities are actually sufficient can be difficult and uncertain.

The most frequent on farm facilities are slurry tanks, lagoons, manure yards and cesspits, as well as storage within the stables as deep litter or slurry in manure cellars. The control can include construction drawings or direct measuring at inspection. Challenges are that with older storages often no construction drawings are present, and that it is difficult to estimate volume of storage in use, especially if partially buried.

Solutions could be requiring construction drawings for any new storage and possibly extra inspections in a transitional period if the risk of inadequate capacity is estimated high.

Other ways to comply with the requirements for storage capacity are storing deep litter as heaps in the field or transferring to another holding (or manure processing or incineration). With storage in heaps capacity is not the main problem, as it can simply be ascertained by inspection that the manure system is suitable for in field storage at inspection.

The main challenge to controlling transfer of manure is keeping track of where the manure ends up. This can be a major administrative and legal challenge, which was outside the scope of this workshop.

The main challenges to an effective control of manure storage capacity are lack of data and poor physical accessibility to measuring storages facilities.

Animal numbers are not always known or controlled and administrative and legal system often not set up to be able to get the data. Knowledge of the extent of the livestock production is crucial to be able to assess whether storage capacity is sufficient. Also solid evidence is necessary for enforcement.

Reasons for farmers' non-compliance with requirements for storage capacity could be financing the storage vessels, increased livestock numbers because of higher productivity in the same stables, draining new steading areas and unrealistic calculations (e.g. not taking into account worst case weather conditions).

Apart from the financing issue the underlying reason often seems to be lack of awareness among the farmers. Finding the incentives for farmers to be compliant (saving money, saving time, avoiding hassle) is an important part of the solution. Supporting farmers' incentive for compliance could be more effective than control.

The workshop's aim of providing practical examples of controlling manure storage capacity was met and the discussions were very rewarding. However providing a guidance tool as an immediate result of this workshop turned out to be too ambitious, but it will possibly be taken up via the Water and Land Expert Team at a later point.

Presentation at IMPEL Water and Land Conference 2017

The presentations and discussions from the workshop were summed up in a presentation given at the IMPEL Water and Land Conference on 4 to 5 October 2017 in Cagliari, Italy. This presentation can be seen in **Annex 7**.

2.4. Workshop (Day 2): Site Visits

On the second day of the workshop the group visited the central advisory service for Danish farmers, SEGES, and to one of the local advisory services for farmers, LMO.

The hosts at SEGES, who developed the tool used for documenting sufficient manure storage capacity in Denmark, gave a general introduction to the organisation and role of SEGES; and the tool was demonstrated for the attendees of the workshop. The tool has been created in an excel spreadsheet and contains standard values for volumes of manure from different types of animals and housing systems, as well as for water or silage effluent led to the storage. The calculations can be adjusted to actual practices on the farm regarding washing routines, system for drinking water supply to the animals, misting systems etc.

The tool is owned by SEGES and available for subscribers to their services. A pdf document of part of the tool translated into English is seen in **Annex 8**.

The tool is widely used by Danish farmers and their advisers and accepted as documentation by the controlling authorities.

https://www.seges.dk/en

The hosts at LMO gave a presentation about its organization and functions in advising farmers. LMO is one of the larger local advisory services in Denmark.

LMO is, like the majority of Danish agricultural advisory services, an independent consulting company owned by farmers associations covering all areas of primary agricultural activities (e.g. economics, plant cultivation, livestock production, legal affairs, building and construction). Dialogue with the environmental authorities (e.g. when applying for a permit) is typically taken care of by the advisory service on behalf of the farmer.

LMO has more than 4000 active members, 400 employees, and approximately 7000 customers within agriculture and 1500 in other businesses. It is possible to be a customer without being a member. The advisory service has several offices throughout the mid-eastern part of Jutland.

The visit was to the section of LMO that deals with environmental issues and therefore the presentation mainly focused on this part of the service, especially how the application for a permit for establishing or expanding a livestock production is handled.

https://www.lmo.dk/Quicklinks/In-English

Workshop (2) – Annexes

The Annexes for the workshop on Manure Storage Capacity include the presentations from the meeting; and an example of the SEGES tool. These are enclosed separately to this report.

Ministry of Environm
and Food of Denmark
Environmental
Protection Agency

Regulation of manure storage capacity in Denmark

Anette Dodensig Pedersen, September 2017

Implementation of Nitrate Directive's requirements

- **Denmark has chosen not to identify specific Nitrate Vulnerable Zones, cf. Nitrate Directives article 3, paragraph 5**
- **Instead the Action Programme, cf. article 5, covers the whole country**
- **The requirements are implemented as general binding rules (GBRs) in the "Livestock manure order"**
- **Local authorities (municipalities) are responsible for controlling these rules**
- **Cross compliance control is carried out separately by the Agricultural Agency**

Commonly used storage types

- **Around 2/3 of the manure is slurry**
- **Slurry tanks are the most common storage type**
- **The remaining 1/3 is mostly deep litter, stored in:**
  - **Manure yards**
  - **In livestock housing until field application**
  - **Compost heaps in field**

What is sufficient storage capacity?

According to the GBRs:

- **Necessary volume should correspond to at least 6 months supply**
- **Storage capacity must be sufficient to ensure that**
  - **Land application within closed periods or on water-saturated, flooded, frozen or snow covered ground can be avoided**
  - **Utilization of the nutrient content of the manure fulfils requirements of legislation about the use of fertiliser and plant cover (fx Nitrogen norms for various crops)**

Assessment of necessary minimum volume of storage

- **Supply is calculated as:**
  - **Quantity of livestock manure produced in stables, plus**
  - **Otherwise supplied to the storage facility (fx water and silage effluent**
- **In practice a calculation model by SEGES is used.**
- **SEGES will give a detailed presentation of this model Tuesday**

How is it ascertained that necessary storage is actually present?

- **An updated calculation of manure volume and capacity for storage is required prior to changes (fx more animals, change of animal housing system)**

- **Copies of agreements about delivering manure to other farms are cross-checked with the fertilizer accounts**

- **Calculations and copies of agreements shall be submitted to the municipality**

- **On site inspection by the municpality at least every 3rd**
- **or 6th year (frequency based on risk analysis)**

- **Observing whether storage facilities are actually present**

- **Cross Compliance control by the Agricultural Agency: A minimum of 1 % of farms each year**

Reasons for non-compliance

- **Cost of storage facilities**
- **Unrealistic calculations of necessary capacity, fx not taking into account worst case weather conditions**
- **Perhaps broken agreements of delivering manure to other farms?**

Conclusions

- **Non-sufficient storage capacity can only be actually controlled if directly observing overflow**
- **Sufficient storage capacity is ensured by requiring capacity for at least a minimum length of supply (indirect regulation)**
- **Ensuring sufficient storage capacity relies on an extensive system of:**
  - **Regular inspections of all farms (controlling actual presence of storage facilities)**
  - **Standard values for manure volumes (enabling assessment of supply)**
  - **Fertilizer accounting (ensuring control with delivery of manure to other farms)**

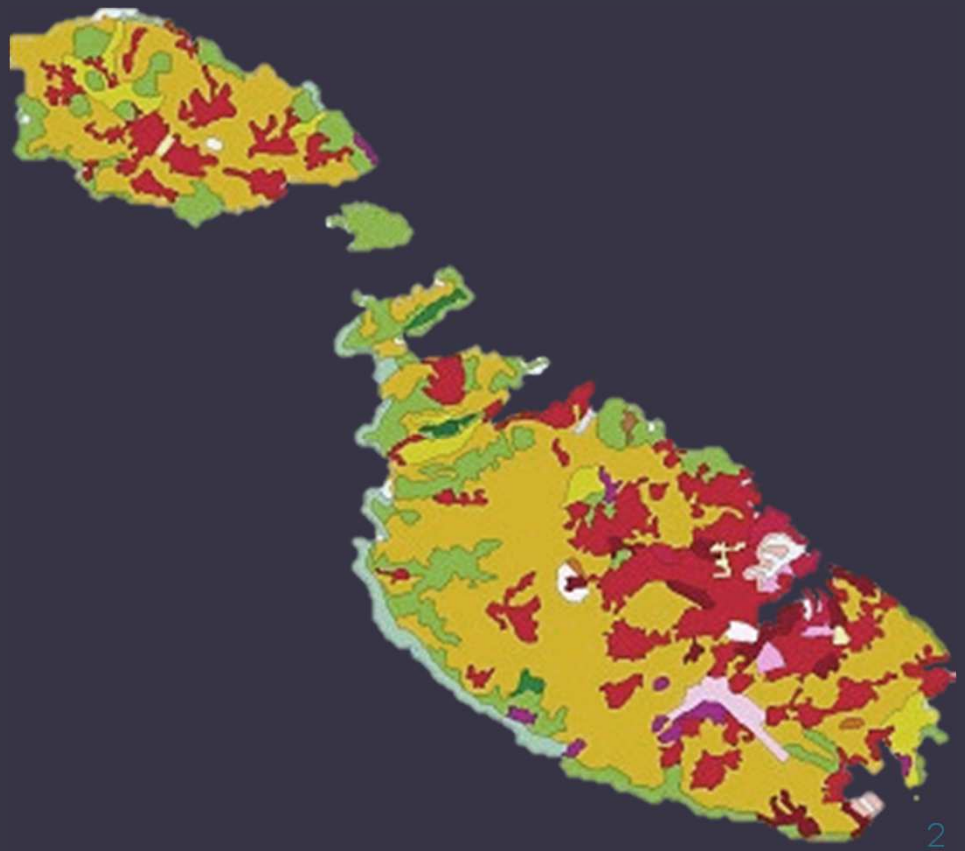
Manure Storage Capacity in Malta

IMPEL: Aarhus 25 – 26 September 2017

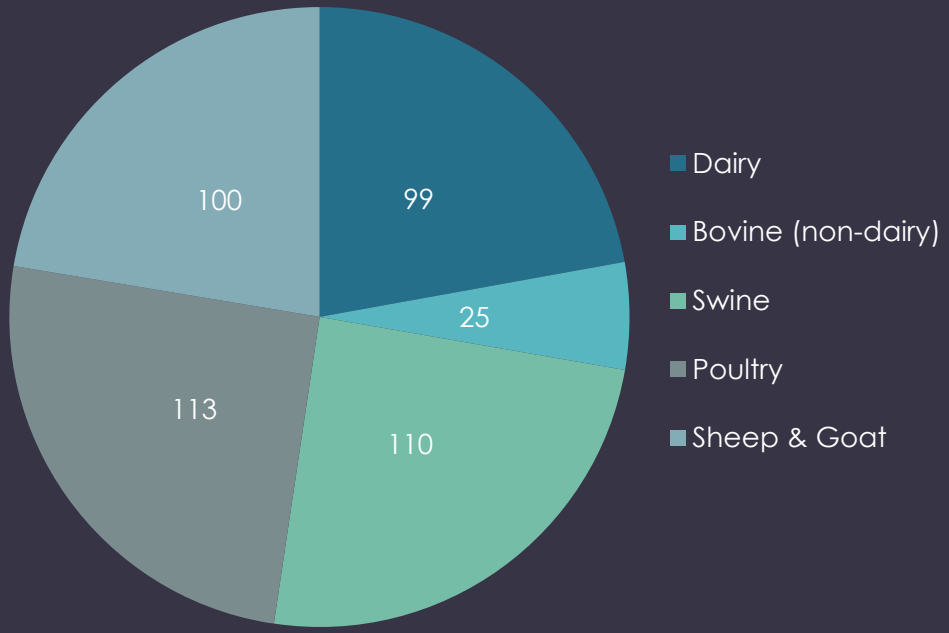
Marcelle Agius
Agricultural Directorate
Ministry for the Environment, Sustainable Development and Climate Change

Malta: Facts & Figures

Area:	316 km^2
Population:	400,000
Mean Temperature:	10 °C – 34 °C
Mean Precipitation:	500 mm
Agriculture share of GDP:	1.4%



Commercial Farms



Nitrates Action Programme (1)

- Current NAP effective since 2011 (S.L. 549.66)
- All Malta designated as a Nitrate Vulnerable Zone (S.L. 549.25)
- Organic fertiliser closed period: 15 October – 15 March
- Manure application: 170 kg N/ha with a dry matter content of at least 30%
- Prohibition: - slope ≥ 7%
  - proximity to surface / ground water bodies
  - slurry application (all year)

Nitrates Action Programme (2)

- All animal holdings / passageways shall be covered at all times.
- Livestock grazing is prohibited.
- Farm management records (incl. manure production; storage capacity).
- Manure storage in certified leak-proof clamp connected to a covered cesspit.
- Sufficient storage capacity for manure produced during the closed period.
- Deep litter system - only for sheep/goats (*subject to approval*)

Minimum Storage Capacity

Cesspit	15 days
Manure Clamp	153 days

Volume calculated based on:

- Number, type and age of animals;
- Additional off-site storage available for holding.

Manure clamps

Manure storage on land

- May be stored in the field where land application will take place:
  - Subject to a maximum limit of 120 days between 16 March and 14 October if the dry matter content is at least 30%;
  - Not in the same location of the field during consecutive years;
  - Stored in a compact heap which shall not be placed within:
    - 20m of water courses; 30m of a borehole, spring or well; 100m of a borehole used for a public water supply; or 100m of the coast.

Challenges

- Slurry prohibition:
  - Costly waste separation and transport;
  - Lower nutrient content in dry manure;
  - Difficult to detect and follow-up illegal slurry application.
- No land for expansion, or proximity to urban areas are a limiting factor.
- Costly infrastructural investments.
- Cases of non-compliance take long to be resolved.
  - Farm upgrades.
  - Lengthy Court proceedings.

Thank you for your attention!

Agricultural Directorate
Rural Development Department
Ministry for the Environment, Sustainable Development and Climate Change

agri-inspect.mesdc@gov.mt

CONTROLLING MANURE STORAGE CAPACITY

How it is done in the Netherlands

How are the Nitrates Directive requirements for capacity of storage vessels implemented in national legislation?

Wet milieubeheer (Environmental management law)

Wet algemene bepalingen omgevingsrecht
(Law regarding general rules for environmental legislation)

Permits for manure storage

Vergunningen (Permits)

For installations with a big environmental impact

Activiteitenbesluit (Activities decree)

General rules for the smaller installations

How does the Nitrates directive 'fly in'?

- Nitrates directive is implemented in Meststoffenwet (Manure law).
- Manure law is Lex Specialis of the Environmental management law.
  - Nederlandse richtlijn bodembescherming (Dutch directive on soil protection)
  - Bodemrisicochecklist (Soil Risk Check List)
  - Besluit Regeling Bodemkwaliteit (Decree on the Regulation of Soil Quality)

These are the legislative instruments for implementing the Nitrates directive.

Does implementation and control differ within and outside vulnerable zones?

- No, only ammount of nitrates to be applied on land differ.

Which types of manure storage is commonly used?

Manure cellar (beneath stables)

Manure cellar (beneath stables)

Manure basin or lagoon

Manure basin or lagoon

Manure silo

Manure silo

Manure bag

Manure bag

Dung (heap) in trench silo

Dung (heap) in trench silo

Which significance does storage have for the control?

None.

- Only warranty or reference periods differ for different storage types.
- Quality standards laid down in BRL's (Beoordelingsrichtlijnen: Assessment directives)

Fermentation silo's

How is the necessary minimum volume of storage assessed?

Manure law

- Storage capacity needed for period 1 August -1 March

Which parameters for volume?

- Guide numbers for production of manure for all domesticated animals. For instance 0,75 m3/animal for fattening pigs.

How is ascertained that necessary storage is actually present?

Storage only in licensed facilities.

- No ascertained storage capacity requested in advance
- All manure should be stored
  - Enforcement by local authorities for the sites/localities on the place of production (the farmers)
  - Enforcement by the Nederlandse Voedsel- en Warenautoriteit (Dutch Food and Drugs Authority) for transporters and dealers

What are the challenges in controlling storage capacity?

Controlling the management of surplus manure is the real challenge in the Netherlands!

- Way to much manure production
- Surplus manure must be incinerated or disposed off
- Challenges are mainly administrative and legal:
  * "Homeopathic challenge" …dilute, dilute, dilute.
  * "Panama papers challenge" …transfer, transfer, transfer.
- Enforcement authority: Dutch Food and Drugs Authority

What causes farmers to be in non-compliance with requirements for storage capacity?

- Financing the storage vessels
- But in the Netherlands the main hurdle is the (pre)treatment and disposal of the surplus manure.
- Dutch Food and Drug Authority monitors this.

AGÊNCIA PORTUGUESA DO AMBIENTE

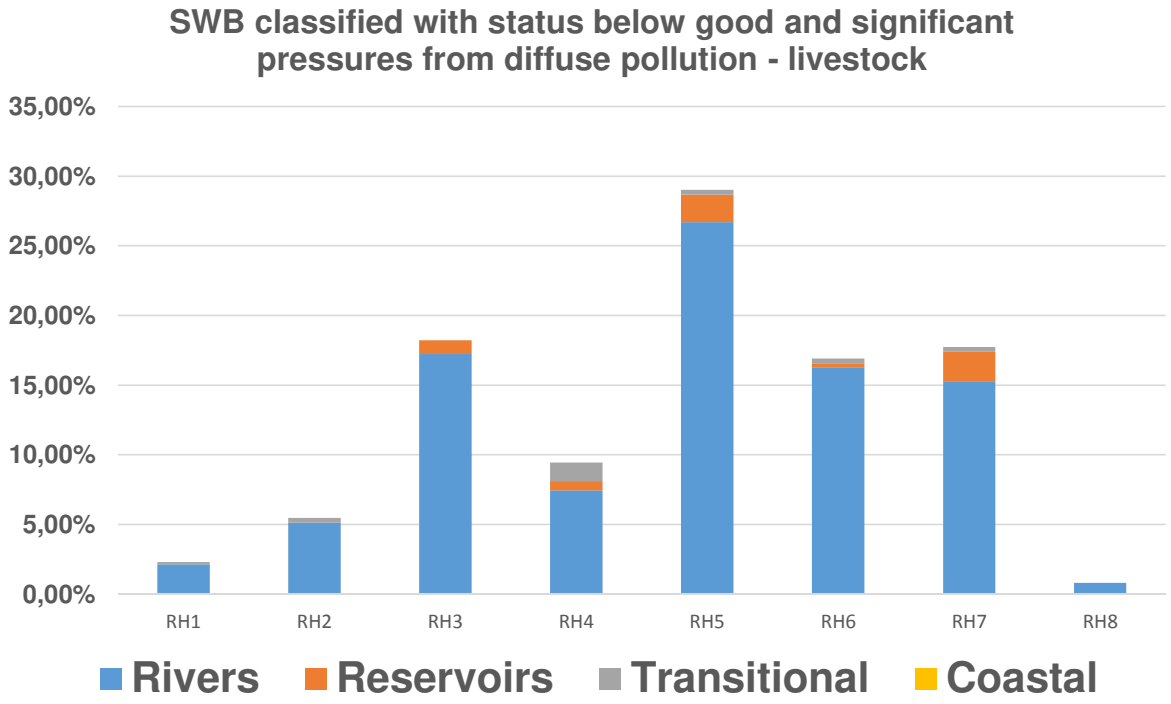
IMPEL SWETE Project
Workshop on manure storage capacity
Examples from Portugal

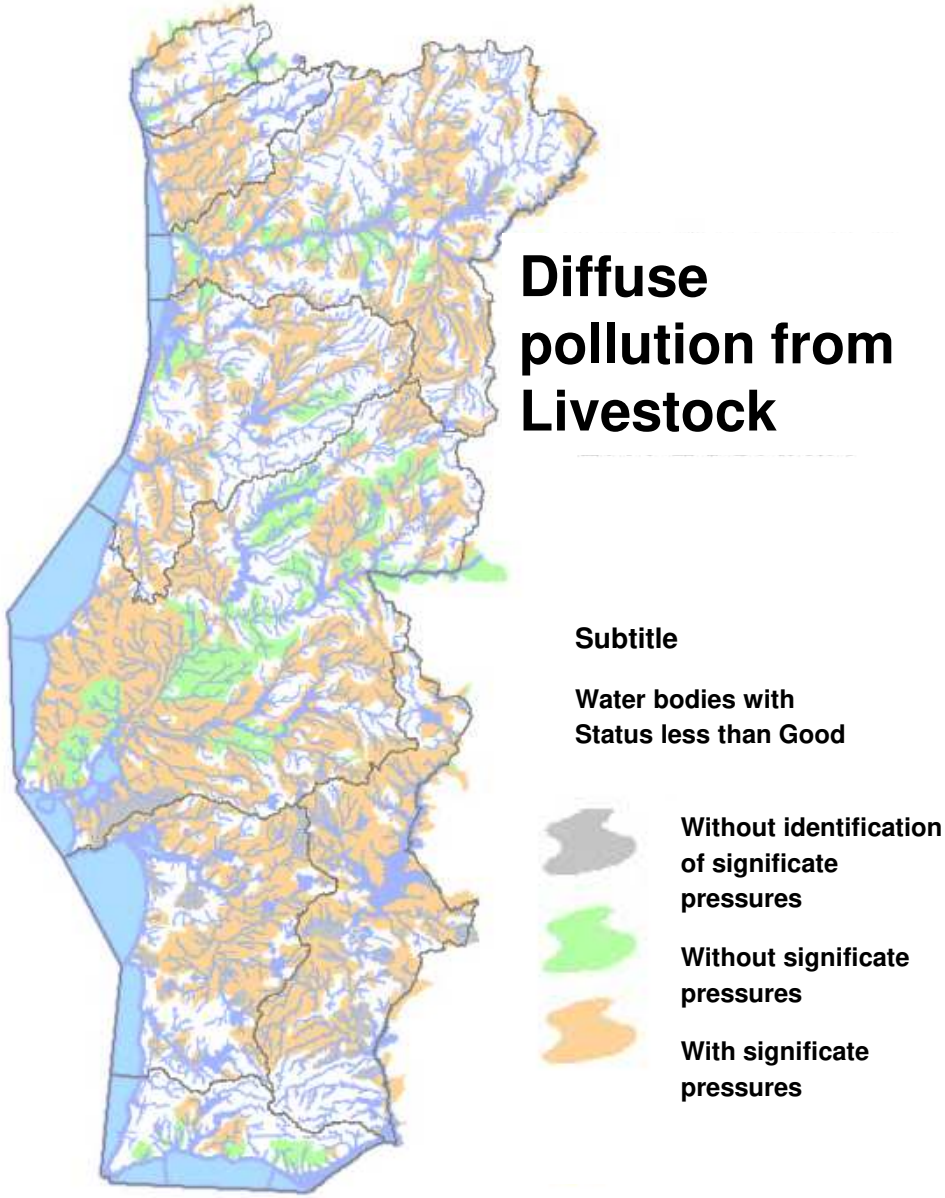
Aarhus
25 & 26 September 2017

Anabela Rebelo, PhD
Portuguese Environment Agency
anabela.rebelo@apambiente.pt

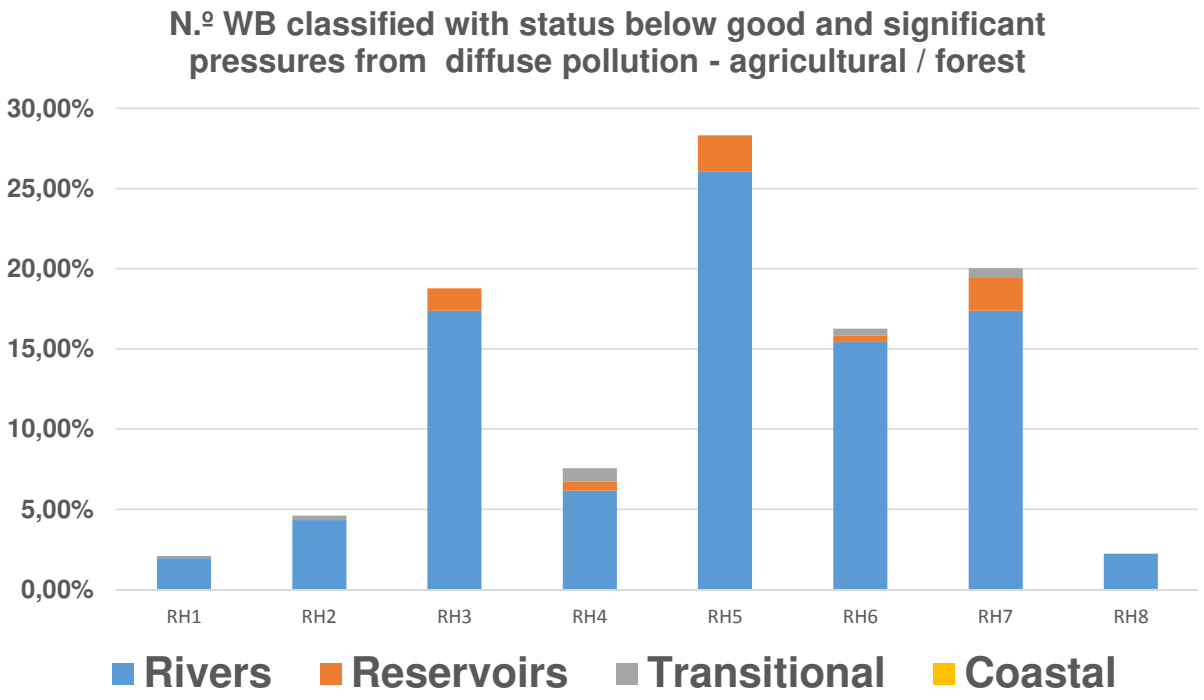
REPÚBLICA PORTUGUESA
AMBIENTE

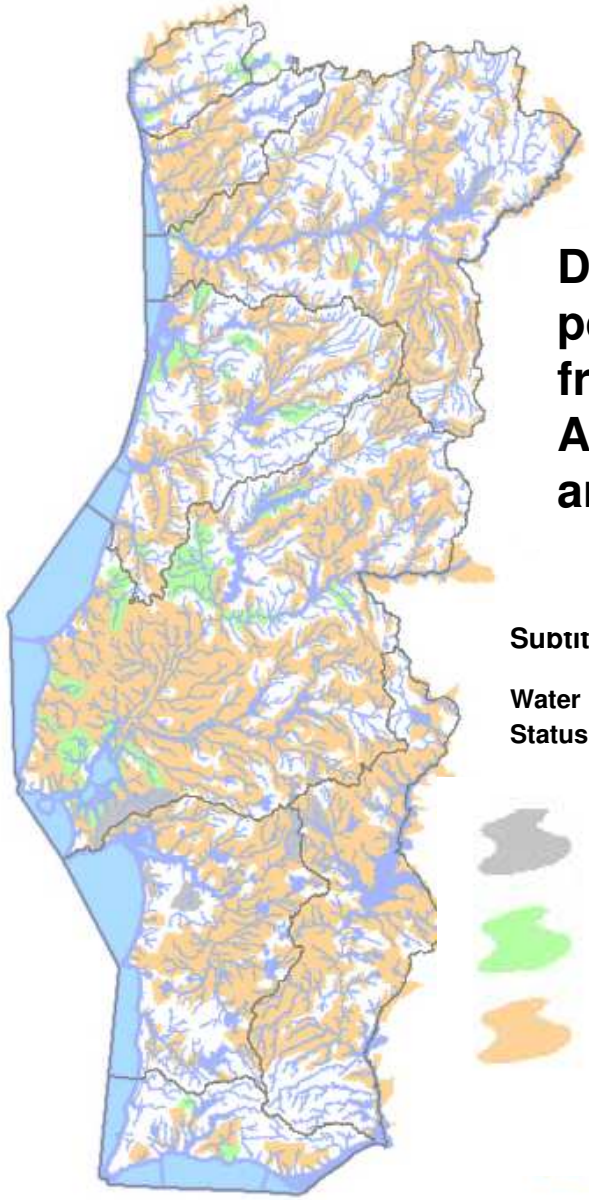
AGRICULTURAL PRESSURES





AGRICULTURAL PRESSURES





Diffuse pollution from Agriculture and Forestry

Subtitle

Water bodies with Status less than Good

Without identification of significate pressures

Without significate pressures

With significate pressures

AGRICULTURAL PRESSURES

Livestock

Agriculture/Forestry

Water bodies

856 SWB with state less than Good

AGÊNCIA PORTUGUESA DO AMBIENTE

LIVESTOCK FARMING IN PORTUGAL

Class	Animal farming	Cattle	Sheep/Goats	Horses	Pigs	Fowl	Rabbits
1	Intensive	> 260 NH					
2	Intensive	15 < NH ≤ 260					
	Extensive	> 15 NH					
3	Intensive Extensive	≤ 15 NH					
Home farms (n.º animals)		2	6	2	4	100	80

NH – Normal Head

1 NH = 1 Bull or suckling cow (>500 kg) or a dairy cow (<7000 kg/milk per year)

Examples.

- **1 Sow pig = 0,35 NH**
- **1 Adult horse (> 24 moths or > 600 kg = 1 NH)**
- **1 Quail = 0,002 NH**

AGÊNCIA PORTUGUESA DO AMBIENTE

MANURE STORAGE OBLIGATIONS

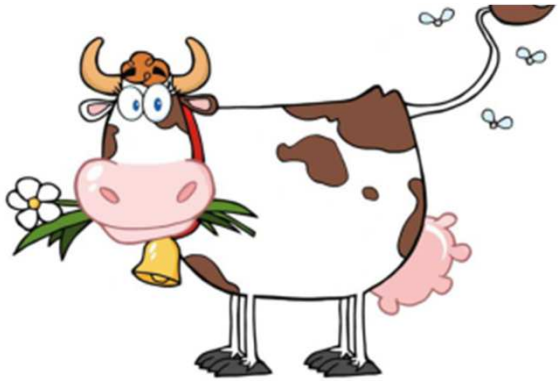
Intensive livestock farming (Class 1 & 2), with manure production above 200 m^3 or 200 ton/y

Farms (crop production) that use an annual manure volume above 200 m^3 or 200 ton/y

Any farms that use products from the processing of animal by-products

Farming sewage: Technical units, composting units, biogas production or thermal treatment units

Manure Plan Management



AGÊNCIA PORTUGUESA DO AMBIENTE

MANURE MANAGEMENT PLANS

- **The Portuguese Environment Agency is responsible for delivering technical opinions on the protected areas under WFD**

AGÊNCIA PORTUGUESA DO AMBIENTE

MANURE MANAGEMENT PLANS

- Efficient water use: Consumption reduction and promote reuse
- Split systems for farming sewage and rainfall
- Cleaning waters, dry stack and silos runoff must be drained for the manure storage system
- Storage capacity needs to be adjusted with the manure production and its use

AGÊNCIA PORTUGUESA DO AMBIENTE

MANURE PRODUCTION

- **Manure production: Use of specific coefficients given by the "Code of for Good Practices for Agriculture"**
- **Examples:**
  - **Cattle in permanent stables*:**

With bar screen	**Slurry**	**20 m^3 / year**
With slurry drainage or platform for manure	**Manure in piles Slurry**	**8 t / year 10 m^3 / year**

*** Production per unit of cattle = 1 dairy cow with 600 kg and 5 t/milk production per year**

AGÊNCIA PORTUGUESA DO AMBIENTE

STORAGE CAPACITY

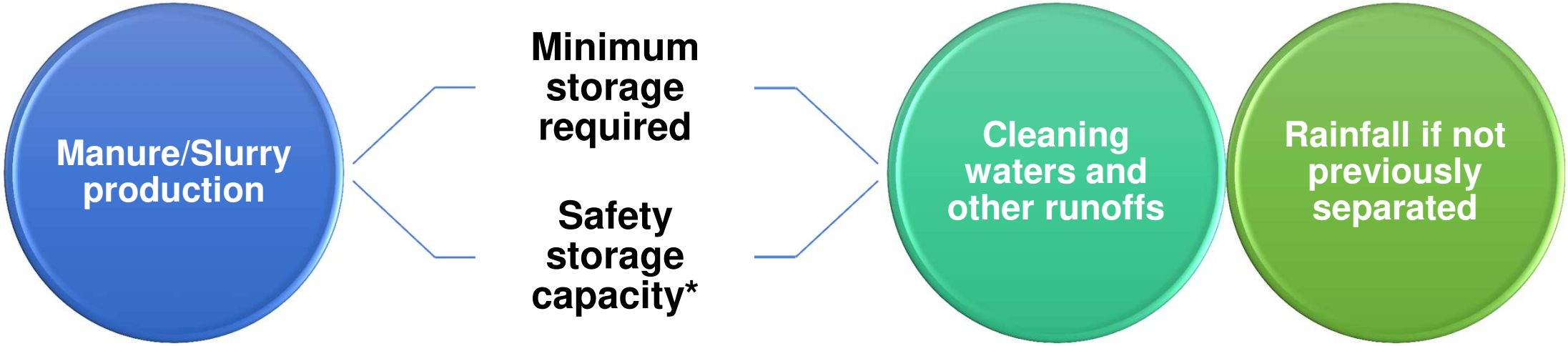
Minimum	Maximum	Specific situations
• 3 Months	• 12 Months	• 24 Months

STORAGE CAPACITY

The minimum storage period can be reduced if the farmers' demonstrates that they have a contract for elimination or transference of the manure/slurry to other management operators that ensures an adequate final destination

AGÊNCIA PORTUGUESA DO AMBIENTE

STORAGE CAPACITY



* ¼ Annual precipitation according animal area without separate systems for rainfall and food and bed wastes

AGÊNCIA PORTUGUESA DO AMBIENTE

TYPES OF STORAGE SYSTEMS USED

Cattle farms

- Dry stacks manure storage
- Manure piles

Pig farms

- Pond storage with previous solids screening
- Silos

AGÊNCIA PORTUGUESA DO AMBIENTE

AGRICULTURE DISPOSAL

Slurry

- Disposal by direct injection or by low pressure system to minimize its dispersion
- Incorporation in soils immediately after disposal, until a maximum of 4h period

Manure

- Incorporation in soils until a maximum of 24h after disposal

AGÊNCIA PORTUGUESA DO AMBIENTE

PIG FARM UNDER IED

Installations

Slurry storage

Slurry treatment

Agriculture disposal

BAT

BREF Compliance

LAND USE RESTRICTIONS

Storage and treatment units cannot be implanted in:

- 10 m from river banks
- 25 m from boreholes
- Protection perimeters for public water supply (specific distances described at the respective regulations)
- 100 m from public water reservoirs

AGÊNCIA PORTUGUESA DO AMBIENTE

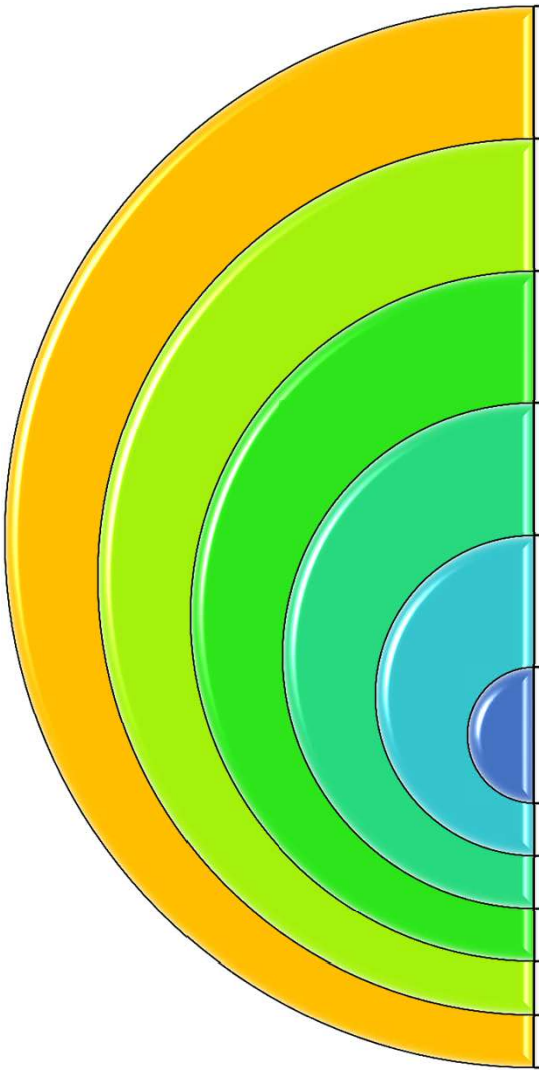
LAND USE RESTRICTIONS

Manure storage in piles

- Temporary disposal for maximum 30 days before soil incorporation
- >15m of river banks
- > 25 m boreholes
- Compliance with protection perimeter conditions for water public supply

AGÊNCIA PORTUGUESA DO AMBIENTE

LAND USE RESTRICTIONS



Period of the year	• **Not allowed from November to January**
Adverse climatic conditions	• **During or when is previewed precipitation** • **Windy days** • **High temperatures**
Flooding areas	
< 100 m of public waters reservoirs or lakes	
High declive fields	• **To prevent slide**
Fields	• **Where there is no crop production and is neither previewed**

MANAGEMENT CONTROL: FIELD DAIRY

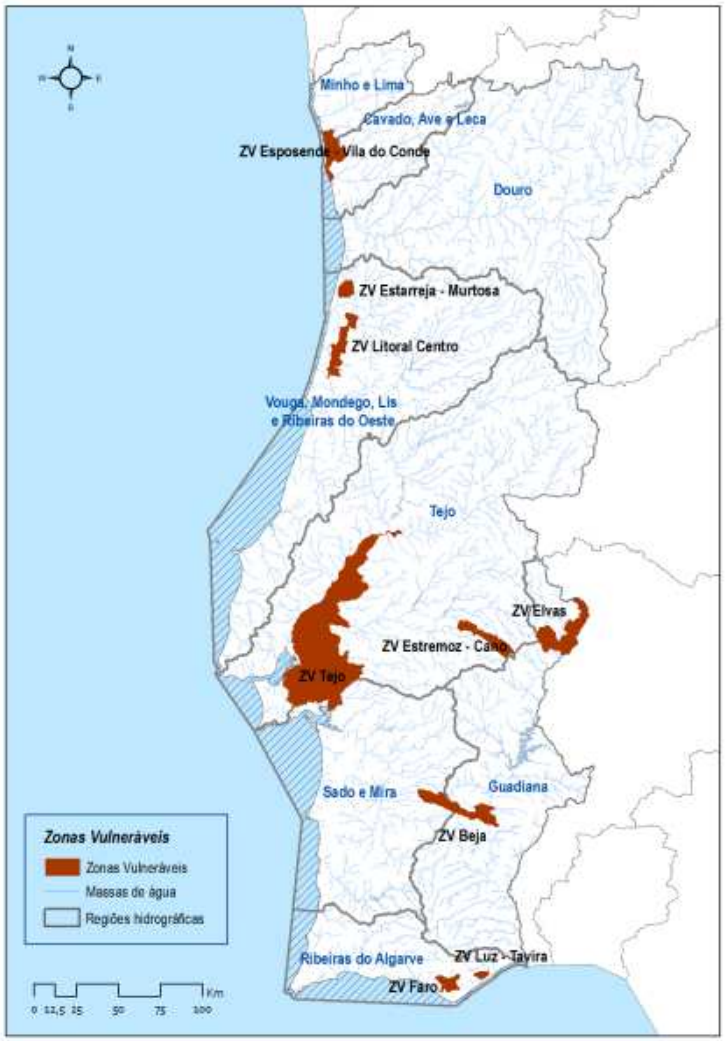
Information related with transferred quantities to other operators

Quantities used in agriculture disposal and by disposal methodology (injection, spreading,…)

Fertilization information by type of culture: Culture theoretical needs *versus* quantitates applied of manure, slurry, animal processing by-products, urban sludge

AGÊNCIA PORTUGUESA DO AMBIENTE

VULNERABLE AREAS



Storage

- Mandatory waterproofing to prevent leakage to groundwater
- Minimum retention times: 120 days

DO AMBIENTE

VULNERABLE AREAS

- Updated records related with the management of livestock effluents must be kept
- Livestock farming: A sufficient storage capacity for the effluents must be in place
- Temporary deposition of manure piles into the ground: ≥ 15 meters from river bank or 25 meters from groundwater abstraction points, for a period not exceeding 48 hours, or 30 days if the deposit is made in waterproofed soils and in protected manure piles

AGÊNCIA PORTUGUESA DO AMBIENTE

VULNERABLE AREAS

Maximum admissible: A maximum load of 250 kg of total organic nitrogen per hectare per year, which should contain no more than 170 kg of total nitrogen from livestock effluents

Slurry should be applied at low pressure

Manure, liquid manure or other fertilizers should not be applied: < 5 meters around groundwater abstraction points for irrigation purposes or <20 meters if other uses are intended

AGÊNCIA PORTUGUESA DO AMBIENTE

STORAGE CAPACITY IN VULNERABLE AREAS

- $AEP = EPP + AR + RS + \frac{1}{4} P$

- AEP – Storage capacity (m^3)
- EPP – Sewage volume, including food and bed wastes and organic matter accumulated outside in areas without pavement and without adequate crop rotation (m^3)
- AR – Cleaning waters from site and equipment and dry stack and silos runoff (m^3)
- P – Annual precipitation from areas without separated flows (m^3)

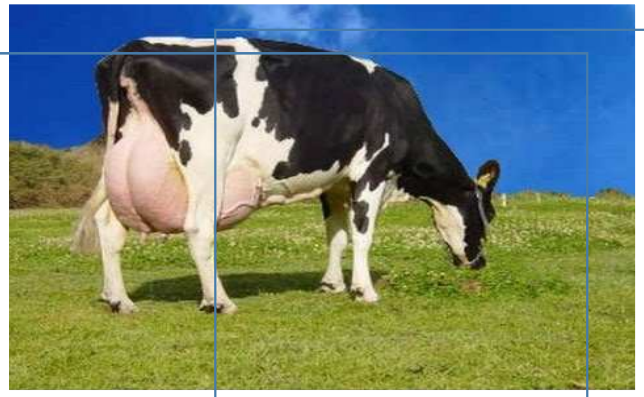
AGÊNCIA PORTUGUESA DO AMBIENTE

CLEANING WATERS

Water Origin	Units	m^3 / year
Cattle in stables	1 NH	7
Water from manure flotation	1 NH	6
Pig farms	0,15 NH	2
Fowl farms (egg production)	13 NH	0,5
Fowl farms (chicken production)	6 NH	0,8
Manure piles without roof	m^2	1

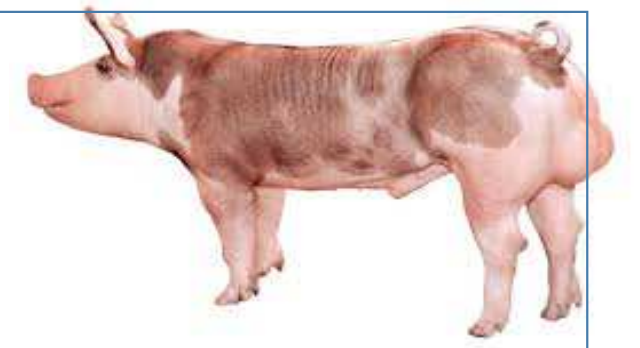
AGÊNCIA PORTUGUESA DO AMBIENTE

NITROGEN PRODUCTION (N_T)



115 kg per animal per year

52kg per animal per year



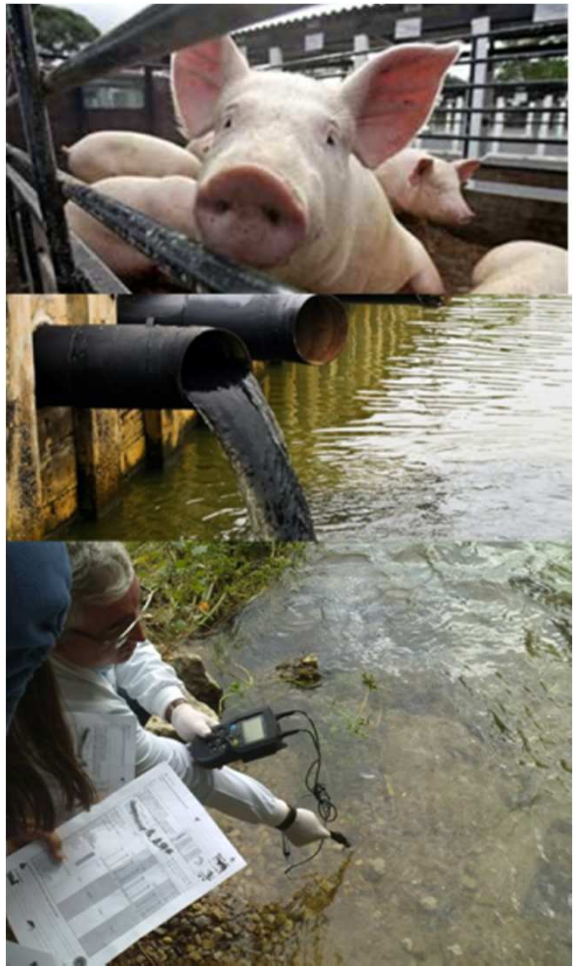
18 kg per animal per year

12 kg per place per year

Examples according action plans for vulnerable areas

AGÊNCIA PORTUGUESA DO AMBIENTE

SITE INSPECTION



- The majority of competences belong to the agriculture authorities (farm licencing process)
- Portuguese Environment Agency has site inspection competences on the water resources domain
  - Private domain (e.g. 10 m from stream banks, in not navigable or floatable waters, boreholes)
  - Public domain (e.g. 50 m from river banks, navigable or floatable waters)
- The Portuguese Inspectorate General for Agriculture, Sea, Environment and Spatial Planning (IGAMAOT) has inspection competencies on agriculture and water resources

AGÊNCIA PORTUGUESA DO AMBIENTE

MAJOR CONSTRAINTS (PHYSICAL/TECHNICAL)

- Insufficient storage capacity at the site production (deficient design or lack of enough space for pounding systems)
- Single drainage systems: High volumes of rainfall into the storage and treatment unit
- Manure/Slurry production is not linked with the agriculture disposal needs: Increasing of the amounts stored
- Inadequate field practices namely when adverse climatic conditions are forecasted
- Quantities applied are not correctly linked with the crop needs

AGÊNCIA PORTUGUESA DO AMBIENTE

MAJOR CONSTRAINTS (ADMINISTRATIVE/LEGAL)

- Farm and storage location *versus* water resources in place
- Compliance with protection perimeter conditions for water public supply: Regulation/water abstraction is newer than farm
- Deficient (technical/physical) conditions lead to runoffs and leakage to water resources: Prosecution processes take to much time and efforts
- The current law (for livestock farming licensing) determines a time extension for its application for existent livestock farms, which has been continually postponed. This delay causes environmental constraints to livestock farming

AGÊNCIA PORTUGUESA DO AMBIENTE

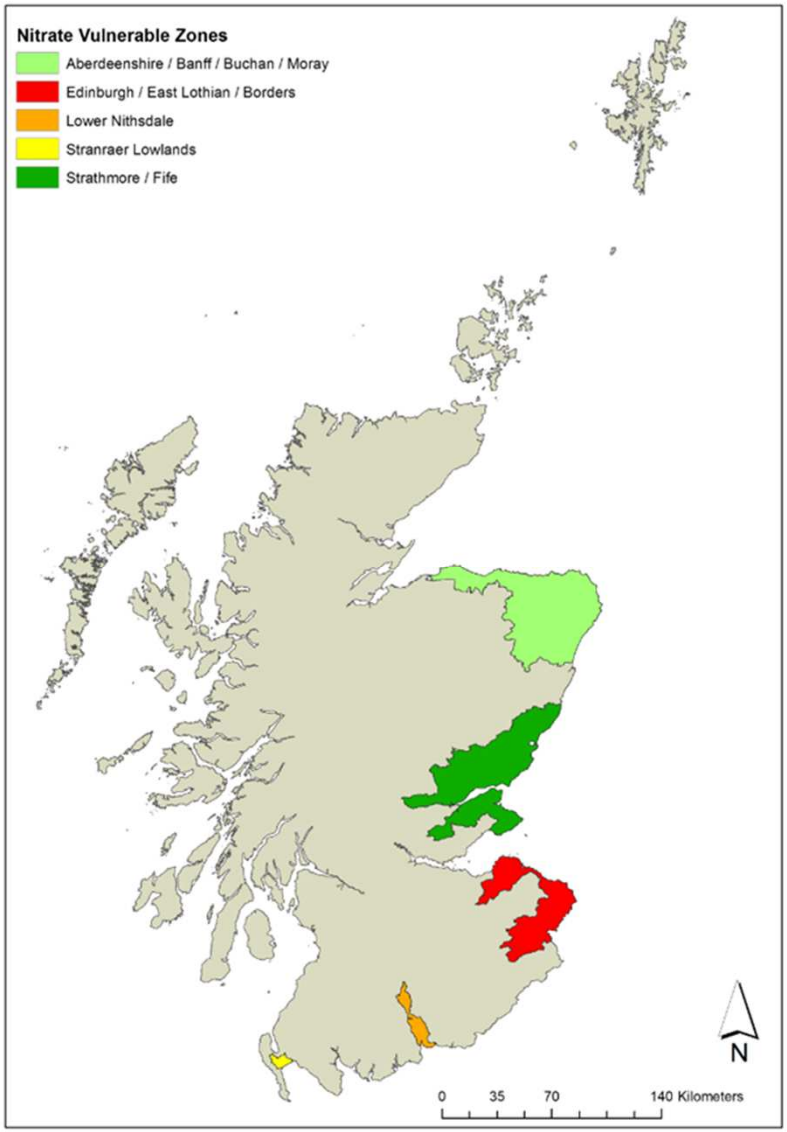
AGÊNCIA PORTUGUESA DO AMBIENTE

REPÚBLICA PORTUGUESA
AMBIENTE

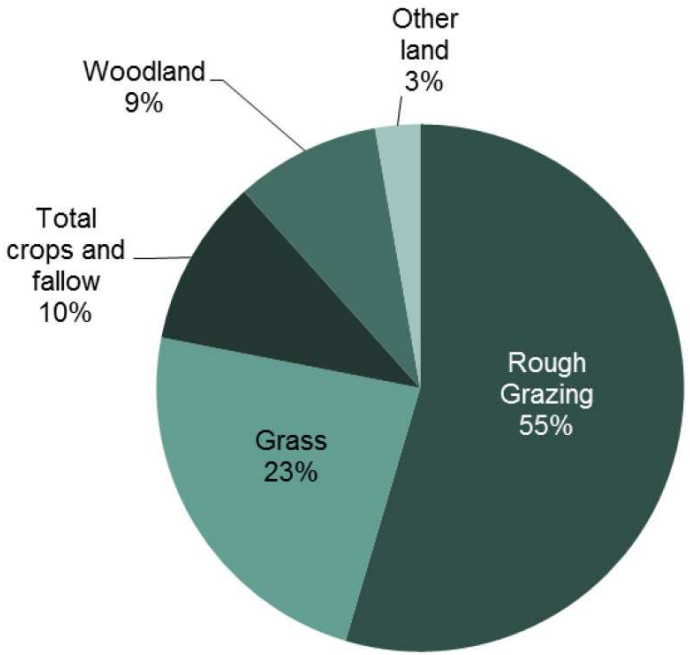
Scotland: Manure Storage

Scottish Government
Riaghaltas na h-Alba
gov.scot

Nitrate Vulnerable Zones



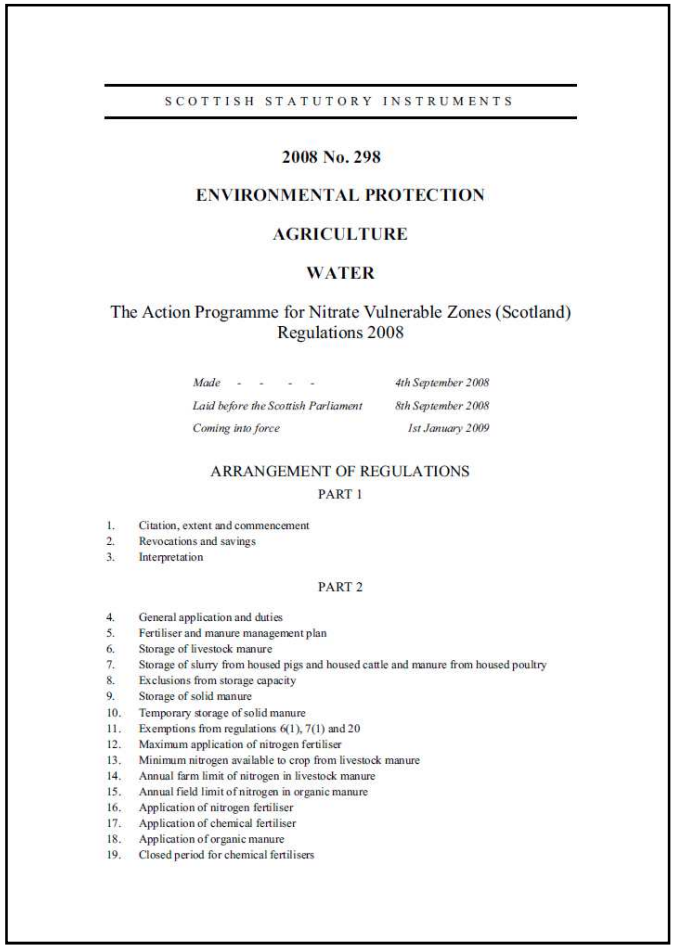
Scotland's agricultural land use:



Scottish Government
Riaghaltas na h-Alba
gov.scot

NVZ Action Programme

- minimum storage capacity for livestock slurries
- storage options for poultry manure and other solid manures
- minimum standards of construction for permanent storage facilities
- maintenance of storage facilities for livestock manure



SCOTTISH STATUTORY INSTRUMENTS

2008 No. 298

ENVIRONMENTAL PROTECTION

AGRICULTURE

WATER

The Action Programme for Nitrate Vulnerable Zones (Scotland) Regulations 2008

Made - - - - *4th September 2008*
Laid before the Scottish Parliament *8th September 2008*
Coming into force *1st January 2009*

ARRANGEMENT OF REGULATIONS

PART 1

1. Citation, extent and commencement
2. Revocations and savings
3. Interpretation

PART 2

4. General application and duties
5. Fertiliser and manure management plan
6. Storage of livestock manure
7. Storage of slurry from housed pigs and housed cattle and manure from housed poultry
8. Exclusions from storage capacity
9. Storage of solid manure
10. Temporary storage of solid manure
11. Exemptions from regulations 6(1), 7(1) and 20
12. Maximum application of nitrogen fertiliser
13. Minimum nitrogen available to crop from livestock manure
14. Annual farm limit of nitrogen in livestock manure
15. Annual field limit of nitrogen in organic manure
16. Application of nitrogen fertiliser
17. Application of chemical fertiliser
18. Application of organic manure
19. Closed period for chemical fertilisers

Scottish Government
Riaghaltas na h-Alba
gov.scot

New NVZs: Transitional Arrangements

Written notice requesting:

- Max 2 year exemption from slurry storage requirements

SRDP grant fund available for slurry store construction to meet NVZ rules

Scottish Government
Riaghaltas na h-Alba
gov.scot

Storage of Slurry

Fertiliser and Manure Management Plan:

- Annual calculation and record of:
  - the capacity of storage facilities required for livestock manures against current storage
    - 22 weeks cattle slurry
    - 26 weeks pig slurry

Scottish Government
Riaghaltas na h-Alba
gov.scot

Slurry production standards

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 (m^3) 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 22 =
1 Dairy cow, over 2 years (6000 to 9000 litre milk yield)	x	0.37 =	X 22 =
1 Dairy cow, over 2 years (up to 6000 litre milk yield)	x	0.29 =	X 22 =
1 Dairy heifer replacement, 13 to first calf	x	0.28 =	X 22 =
1 Dairy heifer replacement, 3 to 13 months	x	0.14 =	X 22 =
1 Beef suckler cow (over 500 kg)	x	0.32 =	X 22 =
1 Beef suckler cow (up to 500 kg)	x	0.22 =	X 22 =
1 Steer/Heifer for slaughter	x	0.22 =	X 22 =
1 Steer/Heifer, over 25 months	x	0.22 =	X 22 =
1 Steer/Heifer, 13 to 25 months	x	0.18 =	X 22 =
1 Steer/Heifer, 3 to 13 months	x	0.14 =	X 22 =
1 Bull beef, 3 months and over	x	0.18 =	X 22 =
1 Bull for breeding, over 25 months	x	0.18 =	X 22 =
1 Bull for breeding, 3 to 25 months	x	0.18 =	X 22 =
1 Calf, up to 3 months	x	0.05 =	X 22 =
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 (m^3) →			**m3**

- standard values for the production of excreta by different livestock types used to calculate storage required

Scottish Government
Riaghaltas na h-Alba
gov.scot

Storage of Solid Manure

Permanent solid manure storage requires:

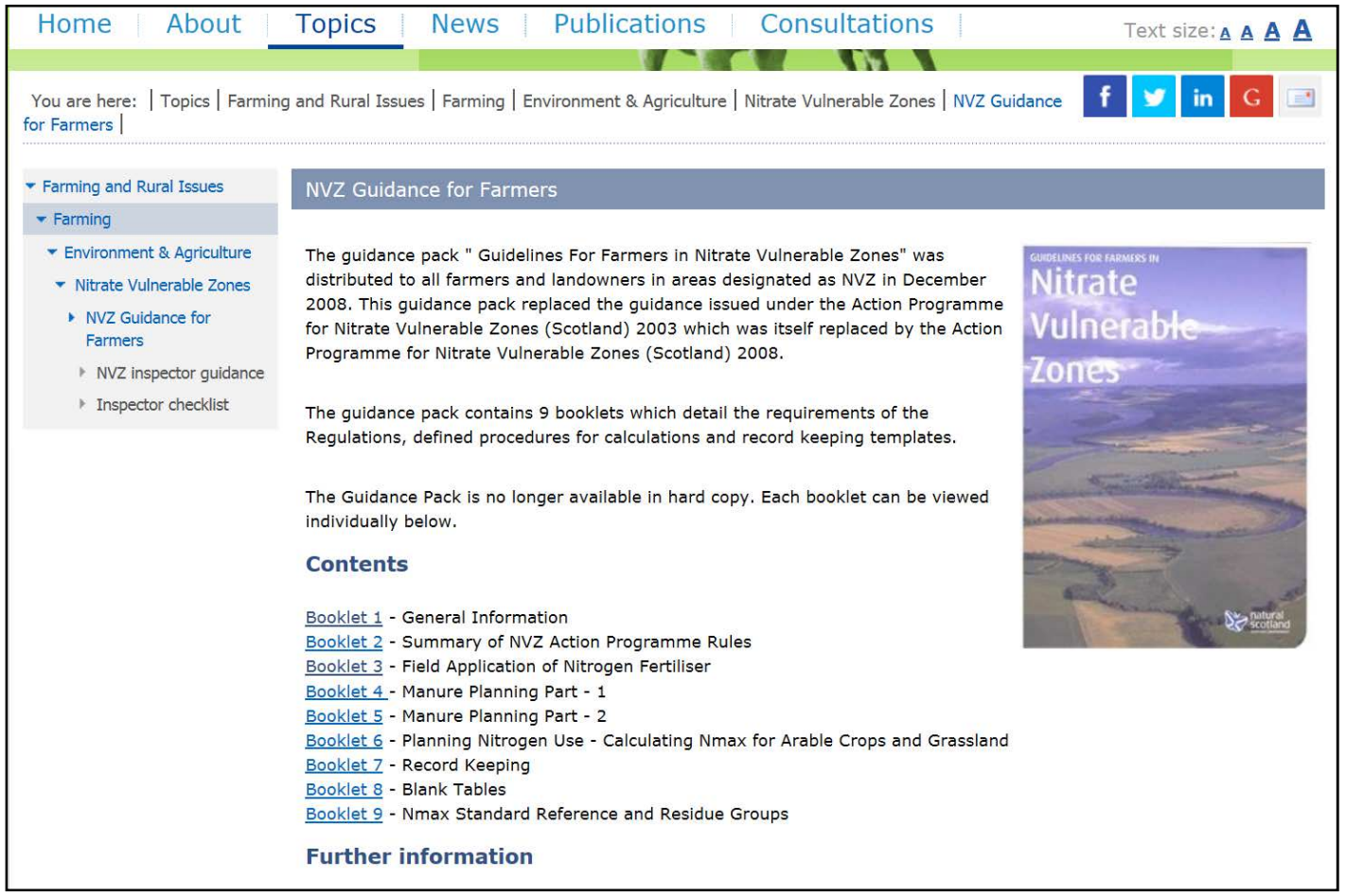
- impermeable surface
- roof or have runoff collection facility

Temporary storage in-field requires:

- max 12 months
- located 10m from surface water and 50m from water supply borehole

Scottish Government
Riaghaltas na h-Alba
gov.scot

NVZ Action Programme Farmers Guidance



Home | About | Topics | News | Publications | Consultations | Text size: A A A A

You are here: | Topics | Farming and Rural Issues | Farming | Environment & Agriculture | Nitrate Vulnerable Zones | NVZ Guidance for Farmers |

- Farming and Rural Issues
  - Farming
    - Environment & Agriculture
      - Nitrate Vulnerable Zones
        - NVZ Guidance for Farmers
          - NVZ inspector guidance
          - Inspector checklist

NVZ Guidance for Farmers

The guidance pack " Guidelines For Farmers in Nitrate Vulnerable Zones" was distributed to all farmers and landowners in areas designated as NVZ in December 2008. This guidance pack replaced the guidance issued under the Action Programme for Nitrate Vulnerable Zones (Scotland) 2003 which was itself replaced by the Action Programme for Nitrate Vulnerable Zones (Scotland) 2008.

The guidance pack contains 9 booklets which detail the requirements of the Regulations, defined procedures for calculations and record keeping templates.

The Guidance Pack is no longer available in hard copy. Each booklet can be viewed individually below.

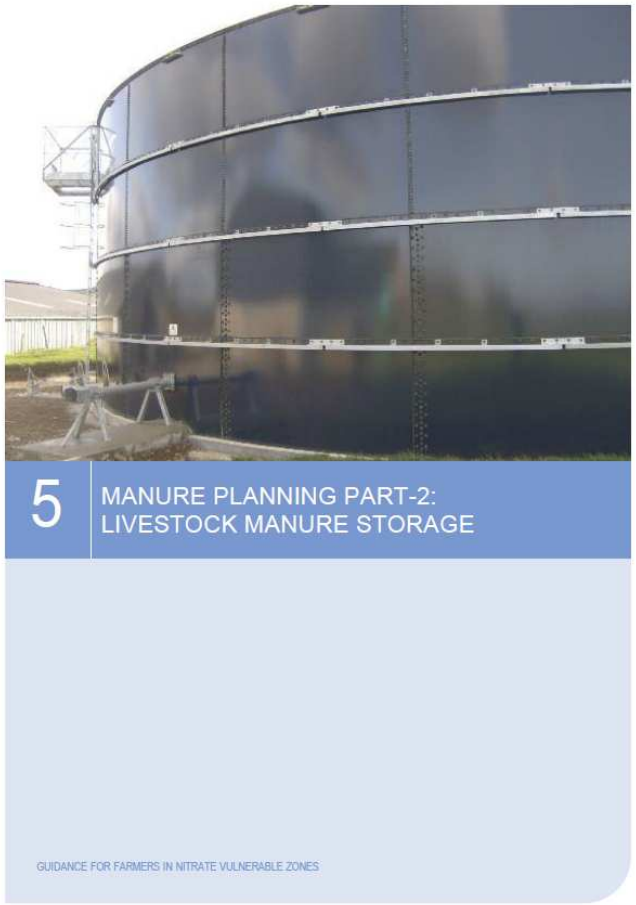
Contents

Booklet 1 - General Information
Booklet 2 - Summary of NVZ Action Programme Rules
Booklet 3 - Field Application of Nitrogen Fertiliser
Booklet 4 - Manure Planning Part - 1
Booklet 5 - Manure Planning Part - 2
Booklet 6 - Planning Nitrogen Use - Calculating Nmax for Arable Crops and Grassland
Booklet 7 - Record Keeping
Booklet 8 - Blank Tables
Booklet 9 - Nmax Standard Reference and Residue Groups

Further information

Scottish Government
Riaghaltas na h-Alba
gov.scot

Slurry Production and Storage Capacity



Calculation steps:

1. volume of excreta produced by animals kept on a slurry based system
2. volume of rainwater falling directly on the slurry store or draining to it from yards and buildings
3. volume of wash-water collected in the slurry store
4. the total volume of slurry to be stored
5. existing slurry storage capacity

6. Compare existing slurry storage capacity with total volume of slurry

Scottish Government
Riaghaltas na h-Alba
gov.scot

PLANET

NUTRIENT MANAGEMENT

Scottish Government
Riaghaltas na h-Alba
gov.scot

Inspections

All land within businesses must meet Cross Compliance standards with 1% of beneficiaries receiving full inspection.

- Audit Fertiliser and Manure Management Plan
- All farms with manure storage facilities must be visited to confirm:
  - storage facilities are structurally sound
  - all areas draining to the store are included in storage calculations

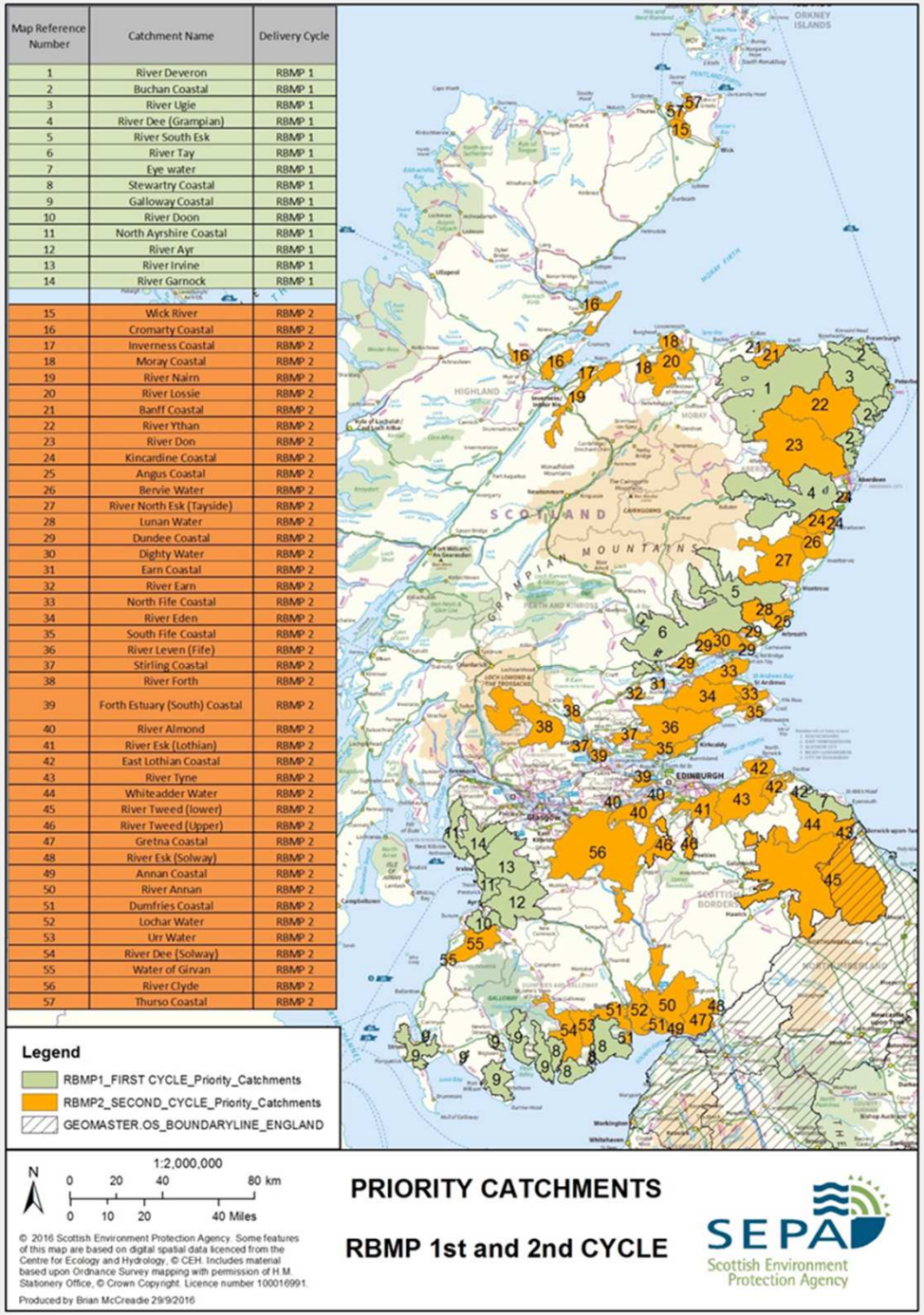
Outwith Nitrate Vulnerable Zones

The Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) (Scotland) Regulations 2003

- sets standards of design and construction
- maximum 6 months storage (can be less)
- Situated >10 m from surface water
- 20 years lifespan
- requires agreement from SEPA before use

Scottish Government
Riaghaltas na h-Alba
gov.scot

Map Reference Number	Catchment Name	Delivery Cycle
1	River Deveron	RBMP 1
2	Buchan Coastal	RBMP 1
3	River Ugie	RBMP 1
4	River Dee (Grampian)	RBMP 1
5	River South Esk	RBMP 1
6	River Tay	RBMP 1
7	Eye water	RBMP 1
8	Stewartry Coastal	RBMP 1
9	Galloway Coastal	RBMP 1
10	River Doon	RBMP 1
11	North Ayrshire Coastal	RBMP 1
12	River Ayr	RBMP 1
13	River Irvine	RBMP 1
14	River Garnock	RBMP 1
15	Wick River	RBMP 2
16	Cromarty Coastal	RBMP 2
17	Inverness Coastal	RBMP 2
18	Moray Coastal	RBMP 2
19	River Nairn	RBMP 2
20	River Lossie	RBMP 2
21	Banff Coastal	RBMP 2
22	River Ythan	RBMP 2
23	River Don	RBMP 2
24	Kincardine Coastal	RBMP 2
25	Angus Coastal	RBMP 2
26	Bervie Water	RBMP 2
27	River North Esk (Tayside)	RBMP 2
28	Lunan Water	RBMP 2
29	Dundee Coastal	RBMP 2
30	Dighty Water	RBMP 2
31	Earn Coastal	RBMP 2
32	River Earn	RBMP 2
33	North Fife Coastal	RBMP 2
34	River Eden	RBMP 2
35	South Fife Coastal	RBMP 2
36	River Leven (Fife)	RBMP 2
37	Stirling Coastal	RBMP 2
38	River Forth	RBMP 2
39	Forth Estuary (South) Coastal	RBMP 2
40	River Almond	RBMP 2
41	River Esk (Lothian)	RBMP 2
42	East Lothian Coastal	RBMP 2
43	River Tyne	RBMP 2
44	Whiteadder Water	RBMP 2
45	River Tweed (lower)	RBMP 2
46	River Tweed (Upper)	RBMP 2
47	Gretna Coastal	RBMP 2
48	River Esk (Solway)	RBMP 2
49	Annan Coastal	RBMP 2
50	River Annan	RBMP 2
51	Dumfries Coastal	RBMP 2
52	Lochar Water	RBMP 2
53	Urr Water	RBMP 2
54	River Dee (Solway)	RBMP 2
55	Water of Girvan	RBMP 2
56	River Clyde	RBMP 2
57	Thurso Coastal	RBMP 2



River Basin Management Planning Inspection Programme

Scottish Government
Riaghaltas na h-Alba
gov.scot

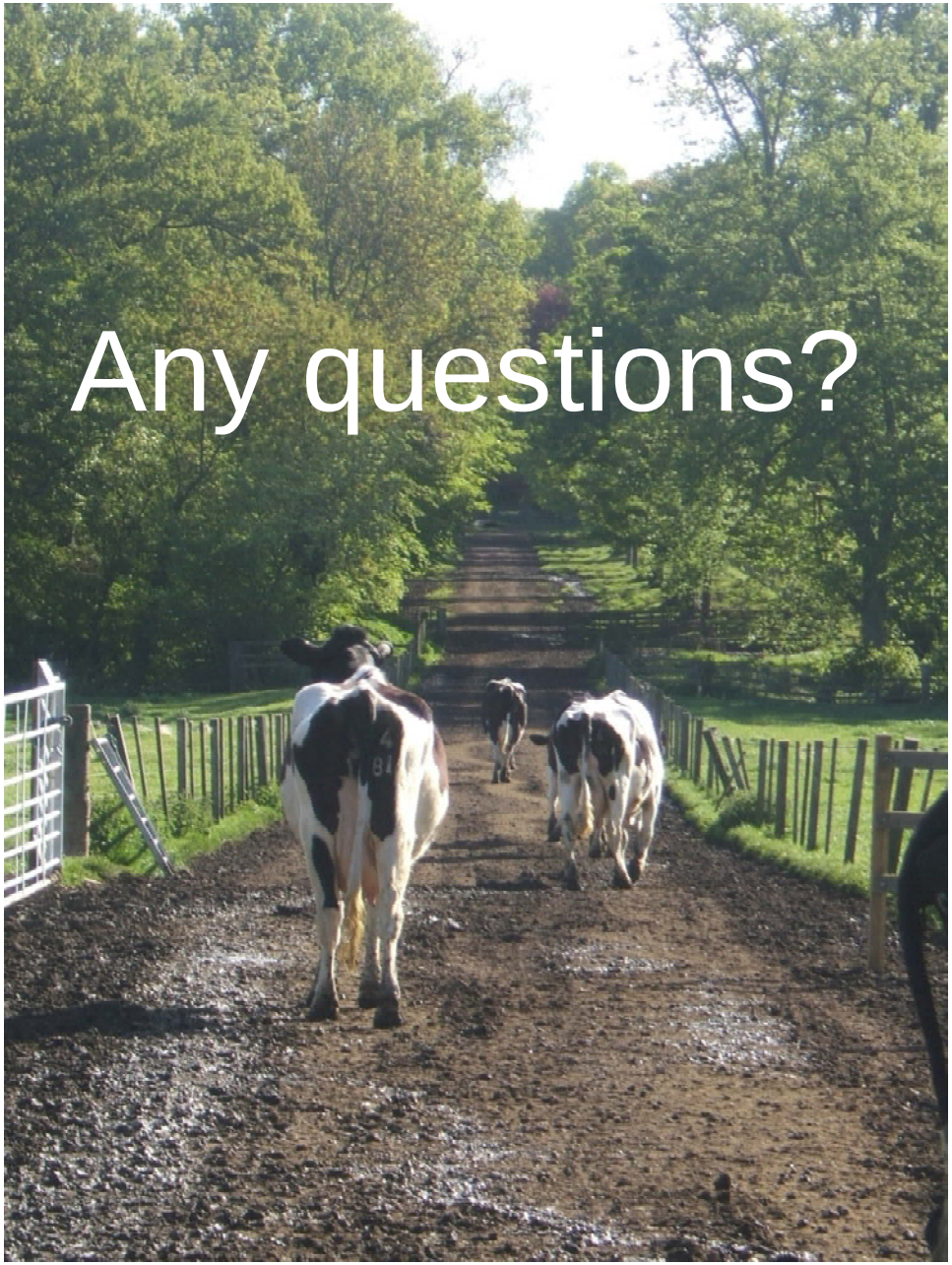
Challenges controlling storage capacity

- health & safety aspects at inspection
- paper audit exercise
- low risk of detection
- attitude of farmers
- poor national records on slurry storage

Non-Compliance

- aging infrastructure causing pollution
- increased livestock numbers
- rainfall ingress:
  - poor farm steading maintenance
  - draining new steading areas

Scottish Government
Riaghaltas na h-Alba
gov.scot



- E: david.lister@gov.scot

Scottish Government
Riaghaltas na h-Alba
gov.scot

IMPEL Water and Land Team project

Workshop on manure storage capacity (SWETE PROJECT)

25th - 26th September 2017 - Aarhus Denmark

INSPECTORATE OF REPUBLIC OF SLOVENIA FOR ENVIRONMENT AND SPATIAL PLANNING

Romana SUMAK

European Union Network for the Implementation and Enforcement of Environmental Law

Ministry of the Environment and Spatial Planning
(responsible for legislation and policy maker)

Environmental Agency (permitting authority)

Inspectorate for the Environment and Spatial Planning of the RS (inspection control):

- **Environment and nature inspection service**
- Construciton, surveying & mapping and housing inspection service

European Union Network for the Implementation and Enforcement of Environmental Law

REGIONAL UNITS

NUMBER OF ENVIRONMENTAL INSPECTORS (6 IN MAIN OFFICE, 50 IN 8 REGIONAL UNITS)

RU Murska sobota
4 inspectors

RU Maribor, 8 inspectors

RU Kranj
5 inspectors

RU Celje
6 inspectors

RU Nova Gorica
4 inspectors

RU Ljubljana, 15 inspectors

RU Novo Mesto
4 inspectors

RU Koper
4 inspectors

Environment and nature protection Inspection service (EI)

Legislation:

The Environment Protection Act

Waters Act

Nature Conservation Act

Management of Genetically modified organisms Act

Different regulations issued under above mentioned laws (400).

Inspection Act
General Administrative Procedure Act
Minor Offences Act

IMPEL
European Union Network for the Implementation and Enforcement of Environmental Law

Fields of supervision

Air Quality (22)
Waste Management (58)
Water - water quality, discharges into water, water regulation and their management (130)
Conservation of nature (94)
Chemicals and genetically modified organisms (23)
Industrial pollution and risk (32)
Noise (7)
Electromagnetic radiation (2)
Light pollution (1)
General (28)

IMPEL
European Union Network for the Implementation and Enforcement of Environmental Law

Environment and nature protection inspection service (EI)

Number of installations:

- cca. 10 000

- IED installations: about 210:

(31 intensive rearing of animals and 9 biogas installations, most of them in NE part of Slovenia)

- SEVESO installations: 62

IMPEL

European Union Network for the Implementation and Enforcement of Environmental Law

NITRATE DIRECTIVE (91/676/EC) implementation and enforcement

- Nitrate Directive is transposed into Environment protection act (ZVO-1B, OJ RS, No 39/06) mostly through Regulation on the protection of waters against pollution by nitrates from agricultural sources (OJ RS, No 113/09, 5/13, 22/15) and also throug IED environmental permits
- Responsible authorities for the enforcement of Nitrate Directive in Slovenia are Ministry of agriculture, forestry and food/Inspectorate for Agriculture, forestry, hunting and fisheries (IAFHF) and Ministry for Environment and spatial planning/Inspectorate for environment and spatial planning (IESP)

- Inspection control:

- Agricultural inspectors as part of IAFHF/ Regulation on the protection of waters against pollution by nitrates from agricultural sources

- EI as part of IESP: environment permits in IED installations – intensive rearing of animals

IMPEL
European Union Network for the Implementation and Enforcement of Environmental Law

Whole teritory of Slovenia is identified and designated as vulnerable zone and action programe was established and implemented in order to reduce water pollution from nitrogen compounds :

- Measures for reducing and preventing of water pollution with nitrates from agricultural sources: Load of agriciltural land with N from livestock fertilizers (170 kg N / ha)
- periods in which fertilization is prohibited
- fertilization of steep land
- manure storage
- fertilization prohibition
- limit the input of N into the ground
- fertilization records with livestock manure
- fertilization techniques

IMPEL
European Union Network for the Implementation and Enforcement of Environmental Law

- Slovenia has a population of 2 million inhabitants, of which 58.6% live in predominantly rural areas and 41.4 % in intermediate areas. Slovenia covers an area of 20 273 km², of which 39.9 % is agricultural area and 56.1 % is forest. Of the total agricultural land (602.000 ha in 2013) 57.9 % is permanent grassland and 36.5 % is arable land. 8.1 % of the Utilised Agricultural Area is used for organic farming.
- Whole teritory of Slovenia is identified and designated as vulnerable zone; 37.9 % of the territory is designated as NATURA 2000 areas and 75.3 % as facing natural constraints. Slovenia has more than 72000 agricultural holdings – with an average size of 6.6 ha.

2016:

- 488.826 cattle
- 265.746 pigs
- 6.115.817poultry
- Most of the farms within the eastern territory of Slovenia

1. IED environmental permit for intensive rearing of poultry or pigs:

- (a) with more than 40 000 places for poultry;
- (b) with more than 2 000 places for production pigs (over 30 kg), or (c) with more than 750 places for sows.

2. IED environmental permit for disposal or recycling of animal carcases or animal waste with a treatment capacity exceeding 10 tonnes per day (biogas installations if manure is used)

IMPEL

European Union Network for the Implementation and Enforcement of Environmental Law

The Environment and Nature Inspection Service inspects environment permits (EP) which contain also demands for a proper treatment of manure/slurry and waste waters (very general demands):

- storage of slurry in waterproof tanks which could prevent leaching into the environment
- slurry tanks should provide enough capacity for the whole period when treatment of fertilizers is prohibited by regulation, which regulates input of dangerous substances and fertilizers into soil
- Manure landspreading demands
- WW must be collected in in waterproof tanks and treated in accordance with Regulation on the protection of waters against pollution by nitrates from agricultural sources

IMPEL

European Union Network for the Implementation and Enforcement of Environmental Law

MANURE STORAGE

The Slovenian regulations stipulate that 3.5 m2 of fertilizer must be available with 2 m3 cavity pit for each LSU or 8 m3 of tanks or lagoons for slurry.

Agricultural institut of RS survey (2010?):

- About 85% of farms have both manure caves and slurry tanks, 2% of farms have only solide manure storage and 13% solely slurry tanks. The storage capacities of the facilities are comparable to the EU average. Concrete manure strages are dominant outside the barn (55%), inside slurry tanks (39%), while the rest are open over ground tanks and lagoons. On farms with combined warehouses, storage capacities are relatively large, as they are sufficient for more than 6 months of storage of livestock manure. In most of the cases manure storages are concrete and uncovered (above 90%).
- Inadequate storage capacities account for about 15% of the surveyed farms, on which 19% of the livestock are grown.
- On farms with exclusively manure there is a lack of capacity for 25% farms with 26% LSU.

IMPEL

European Union Network for the Implementation and Enforcement of Environmental Law

Checks

- Visual tightness control of constructions (without leak detection facility below tank)
- Regular maintenance and record keeping
- Usually slurry and WW are colected in concrete tanks; visual tightness control of base and walls by emtying tanks, ouside control once per months.
- No special anticoroison protection of tanks.
- No special checks of tightness of tanks by independent authorities.
- Visual control of eqipement for colleciton and transfer of slurry by emtying of storage tanks.
- In the case of incompliances with IED permit considering manure storage or treatment on the field EI inform agriculture inspector and Agency of the Republic of Slovenia for Agricultural Markets ad Rural Development. Agricultur inspectors - responsible for administrative and violation procedure / Agency - responsible for subsidies in agriculture

IMPEL
European Union Network for the Implementation and Enforcement of Environmental Law

Challenges in controlling storage capacity

- Defining permit conditions based on BAT techniques set out by BREFs (BREFs legal status in national legislation?!)
- Environmental permits demands in other MS (more general/ detailed requestements?!)
- Perscribed maximum storage time of manure/slurry
- Practicality / cost of covering existing storage
- Minimum distances between farms (storage facilities) and dwellings (plot conditions as determined by the municipal Spatial Acts)
- Existing slurry lagoons
- Testing is difficult - methods are not very accurate or practical e.g. tanks may be shallow or inaccessible

IMPEL
European Union Network for the Implementation and Enforcement of Environmental Law

Thank you for your attention !

European Union Network for the Implementation and Enforcement of Environmental Law

IMPEL W&L 2017 CONFERENCE

LAND USE AND WATER QUALITY:

WHICH INTERCONNECTIONS?

Anette Dodensig PEDERSEN
Danish Environmental Protection Agency

Cagliari, October 4th and 5th, 2017

Sufficient manure storage capacity as a measure to protect water against nitrate leaching from fields

Preliminary reporting from IMPEL Workshop held in Aarhus, Denmark, 25th – 26th September 2017

Part of the SWETE project (Safeguarding the Water Environment Throughout Europe)

Manure storage capacity in EU directives

Nitrates Directive

The capacity of storage vessels for livestock manures is among measures under the Nitrates Directive

Annex 2: Code(s) of good agricultural practice in general

Annex 3: Measures to be included in action programmes for Nitrate Vulnerable Zones

Industrial Emissions Directive

Sufficient storage capacity is among the techniques in BAT conclusions for the intensive rearing of poultry or pigs

BAT 15 and BAT 18: Select a storage facility with sufficient capacity to hold the solid manure/slurry during periods in which landspreading is not possible

How does manure storage capacity protect water against nitrate leaching from fields?



It reduces the risk of farmers spreading manure during closed periods, cf. Nitrates Directive, when the risk of leaching is high.

The manure storage capacity workshop

Small focused workshop with 6 participants (from Denmark, Malta, the Netherlands, Portugal, Scotland, Slovenia)

Not only a comparative study but a more in depth view on challenges of controlling manure storage capacity

Three steps:

1. Discussions and presentations at the workshop, exchanging experiences
2. Gathering discussions etc. in a project report
3. In the longer run: Examples of good practice for control

Typical assessment of supply to manure storage facility
Example: slurry volume

Volume of excreta produced by animals kept on a slurry based system
+
Volume of rainwater falling directly on the slurry storage or draining to it from yards and buildings
+
Volume of wash-water collected in the slurry storage
+
Volume of silage effluent led to the slurry storage

All done by using standard values

Typical assessment of necessary volume of capacity

The calculated volume of supply throughout closed periods (+ maybe other legislation)
+
Extra safety volume (in case of adverse weather, fx unusually heavy rainfalls, long period of frost after end of closed period etc.)

Some countries have a fixed minimum (fx at least 3 months' supply)

Standard values for manure volumes
Example shown from Scotland

Animal types after:
- Species
- Breed
- Age
- Weight
- Yield

Manure system:
- Slurry
- Deep litter
- Solid manure and cesspit

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 (m^3) 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 22 =
1 Dairy cow, over 2 years (6000 to 9000 litre milk yield)	x	0.37 =	X 22 =
1 Dairy cow, over 2 years (up to 6000 litre milk yield)	x	0.29 =	X 22 =
1 Dairy heifer replacement, 13 to first calf	x	0.28 =	X 22 =
1 Dairy heifer replacement, 3 to 13 months	x	0.14 =	X 22 =
1 Beef suckler cow (over 500 kg)	x	0.32 =	X 22 =
1 Beef suckler cow (up to 500 kg)	x	0.22 =	X 22 =
1 Steer/Heifer for slaughter	x	0.22 =	X 22 =
1 Steer/Heifer, over 25 months	x	0.22 =	X 22 =
1 Steer/Heifer, 13 to 25 months	x	0.18 =	X 22 =
1 Steer/Heifer, 3 to 13 months	x	0.14 =	X 22 =
1 Bull beef, 3 months and over	x	0.18 =	X 22 =
1 Bull for breeding, over 25 months	x	0.18 =	X 22 =
1 Bull for breeding, 3 to 25 months	x	0.18 =	X 22 =
1 Calf, up to 3 months	x	0.05 =	X 22 =
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 =

How can storage capacity be controlled?

On farm facilities (slurry tanks, lagoons, yards, manure cellars or deep litter in stable):

- Construction drawings or direct measuring at inspection.
- Challenges: Older storages and no construction drawings are present. Difficult to estimate volume of storage in use, especially if partially buried.
- Solutions: Requirement for construction drawings for any new storage. Extra inspections in transition period if estimated high risk of inadequate capacity.

Heaps in field:

- Ascertain that manure system is suitable for in field storage at inspection.
- Capacity is not the main problem here, but the manner of the storage might be (risk of leaching).

Transfer to other holding (or manure processing or incineration):

- Administrative check.
- Challenges: The capacity on the individual farm is not the problem here, but keeping track of the manure might be. Administrative and legal challenges.
- Solutions: A fertiliser accounting system makes it easier to control.

Reasons for non-compliance with requirement for storage capacity

- Financing the storage vessels
- Increased livestock numbers
- Draining new steading areas
- Unrealistic calculations (fx not taking into account worst case weather conditions)

Solution no. 1: Awareness raising among farmers?

Finding the incentives for farmers to be compliant (saving money, saving time, avoiding hassle)

Preliminary conclusions

- Standard values for supply of manure depends on local agricultural practices and climate
- Lack of data and physical accessibility to measuring are challenges to effective control
- Supporting farmers incentive for compliance could be more effective than control

Thank you for your attention

Calculation of slurry amounts and storage capacity for pigs

Name	Donald Duck
Adress	Duck City
Phone	+99 99 99 99

Print

Calculation made by	Torkild Birkmose, SEGES
Date	September 26th, 2017

To front page

Slurry tank name: Tank for pig slurry

Current storage capacity: 3.000 m³

☑ Covered slurry tank

Basic information about the production

Normproduktion	Type of stable	Number	Number of piglets/sow	Entry, kg	Exit, kg			Normprod., ton/year
Barn for pregnant sows	Individual, partly slattered	200	29,6	-	7,1			668
Barn for farrowing sows	Boxes	200	29,6		7,1			306
Piglets	Partly slatter	6.000	-	7,1	31			638
Slaughter pigs	Partly slatter	6.000	-	31	107			2.587
Total								4.198

Correktions:

Correction for feed consumption	Current situation			Efter actions to reduce water use			Change, m³
	Feed compsumption	Correction, m³ per unit	Tonne in total	Feed compsumption	Correction, m³ per unit	Tonne in total	
Sows	Normal feed consumption	0	0	Low feed consumption	-0,3	-60	-60
Piglets	Normal feed consumption	0	0	Low feed consumption	-0,006	-36	-36
Slaughter pigs	Normal feed consumption	0	0	Low feed consumption	-0,025	-150	-150
Total			0			-246	-246

Correction for feed system	Current situation			Efter actions to reduce water use			Change, m³
	Feeding system	Correction, m³ per unit	Tonne in total	Feeding system	Correction, m³ per unit	Tonne in total	
Sows	Dry feed, water in cups	0,4	80	Dry feed, water in automat +	0	0	-80
Piglets	Dry feed, water in cups	0,015	90	Dry feed, water in automat +	0	0	-90
Slaughter pigs	Dry feed, water in cups	0,06	360	Dry feed, water in automat +	0	0	-360
Total			530			0	-530

Correction for washing rutines	Current situation			Efter actions to reduce water use			Change, m³
	Washing system	Correction, m³ per unit	Tonne in total	Washing system	Correction, m³ per unit	Tonne in total	
Sows	Manuel washing	0	0	Manuel washing	0	0	0
Piglets	Manuel washing	0	0	Manuel washing	0	0	0
Slaughter pigs	Washing robot	0,03	180	Manuel washing	0	0	-180
Total			180			0	-180

Correction for showering	Current situation			Efter actions to reduce water use			Change, m³
	Level of showering	Correction, m³ per unit	Tonne in total	Level of showering	Correction, m³ per unit	Tonne in total	
Sows	Normal shower	0	0	Normal shower	0	0	0
Piglets	Normal shower	0	0	No shower	-0,012	-72	-72
Slaughter pigs	Normal shower	0	0	No shower	-0,05	-300	-300
Total			0			-372	-372

Correction for surface water	Current situation			Efter actions to reduce water use			
	m² area	Norm, m³ per m²	Tonne in total	m² area	Norm, m³ per m²	Tonne in total	
Storage for FYM	500	0,4	200	0	0,4	0	-200
Other surfaces	500	0,7	350	0	0,7	0	-350
Other water	-	-		-			0
Total			550			0	-550

Corrections in total			1.260				-618	-1.878

Total production	5.458		3.580	-1.878
Storage capacity, month	6,6		10,1	3,5

Demand for crop rotation and emtering of tank in autumn

	Current situation	Efter actions to reduce water use
Share of OSR og grass in the rotation	40 pct.	10 pct.
Max. slurry amount on October 1st, month	1 month production	4 month production
Max. slurry amount on October 1st, tonne	500 ton	900 ton