Interreg Baltic Sea Region Programme 2014-2020

WATERDRIVE project

CASE AREA:

Luga District, Leningrad Region

St-Petersburg 2021

Summary report

IEEP – branch of FSAC VIM

General provisions

A closed-loop pig breeding farm located in the Luga District became a pilot enterprise of the WaterDrive project *Water-driven Rural Development in the Baltic Sea Region Based on the (Regional) Management of Water Resources*. The development plan of the enterprise included, among other things, an increase in the livestock and cultivation of agricultural crops. Towards this end, the pig breeding farm has purchased and rented farming land in the Luga River catchment basin, Luga District. To ensure effective utilisation of this land with an aim to increase its porcine population, the management of the farm has decided to fertilise the land with organic fertilisers supplied by other livestock and poultry farms, thus helping to sustain the soil fertility and regeneration of the humus.

With this in view, the following objectives have been formulated as outcomes of the first discussions with representatives of the farm:

1. To optimise, based on the analysis of the state of agriculture and water bodies located in the Luga District, the fertilisation of the pilot enterprise farmland using both its own and externally sourced fertilisers in order to enhance the soil fertility while minimising the negative impact on the Luga River catchment area.
2. To calculate the required volume of manure, farmland area and manure storage facilities for each phase of the pig breeding farm construction, in line with the applicable Russian legislation and international regulations (the Baltic Sea Region).

Information resources used:

To achieve stated objectives, a number of resources were used – namely, the outcomes of various international projects, preliminary studies undertaken by the Institute, Russian regulatory documents and foreign legislation:

1. A model for calculating quantitative and qualitative characteristics of animal waste, manure/litter and ready-to-use organic fertilisers, developed as part of the Manure Standards project https://www.luke.fi/manurestandards/en/results/
2. A model for calculating the diffuse nutrient load on catchment areas develoed by the staff of IEEP – branch of FSAC VIM https://www.tf.llu.lv/conference/proceedings2021/Papers/TF103.pdf
3. An interactive tool for monitoring the waste generated by the husbandry / poultry industry and coordinating the use of organic fertilisers, designed as part of the EcoAgRAS project – *The Introduction of the Ecological System of Agriculture is the Basis for Sustainable Development of Border Rural Area* https://organica-lo.ru/login.php
4. Methods of reducing the load from agricultural land on water bodies, examined within the framework of the WaterDrive project
5. *Intensive Pig Breeding* – an information and technical guide on the best available technologies, co-developed by experts of IEEP – branch of FSAC VIM https://docs.cntd.ru/document/556173711
6. Best Available Techniques (BAT) Reference Document for the Intensive Rearing of Poultry or Pigs https://publications.jrc.ec.europa.eu/repository/bitstream/JRC107189/jrc107189_01_irpp_bref_07_2017.pdf
7. GOST P 113.41.01-2019 Best Available Techniques. Intensive Pig Breeding. Recommendations for Production Ecological Control. Co-developed by experts of IEEP – branch of FSAC VIM https://docs.cntd.ru/document/1200166672

8. HELCOM 1993. Convention on the protection of the marine environment of the Baltic Sea area. https://helcom.fi/wp-content/uploads/2019/10/1974_Convention.pdf

9. HELCOM 2013. Summary report on the development of revised Maximum Allowable Inputs (MAI) and updated Country Allocated Reduction Targets (CART) of the Baltic Sea Action Plan. Copenhagen, Denmark: HELCOM. https://helcom.fi/media/documents/Summary-report-on-MAI-CART-1.pdf

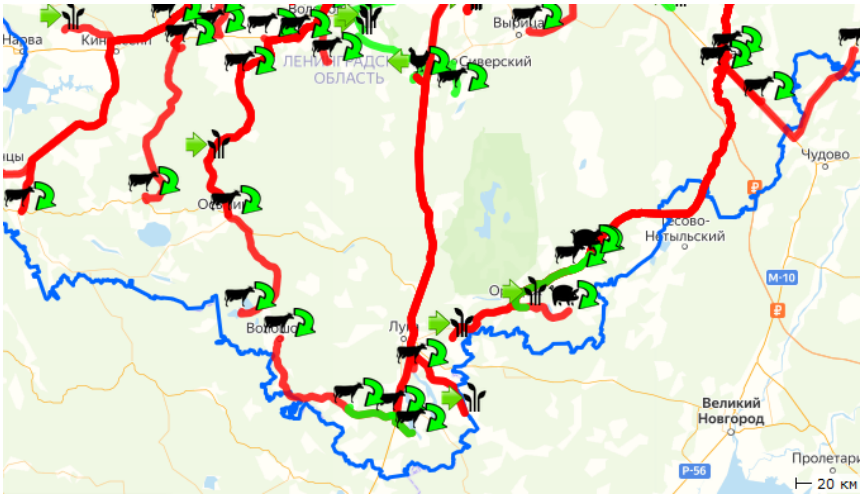
10. РД-АПК 1.10.15.02-17* Methodological Recommendations on Technological Design of Manure and Litter Removal and Treatment Systems https://docs.cntd.ru/document/495876346

11. РД-АПК 3.10.15.01-17 Methodological Recommendations on Design of Manure and Litter Removal, Treatment, Sanitation and Disposal Systems URL:http://files.stroyinf.ru/Index2/1/4293744/4293744156.htm

12. РД-АПК 1.10.02.04-12 Methodological Recommendations on Technological Design of Pig Breeding Farms and Complexes URL: http://docs.cntd.ru/document/1200097957

Implementation of the first objective

The fulfillment of the first objective involved the use of an interactive tool designed for monitoring the waste generated by the husbandry / poultry industry and coordinating the use of organic fertilisers. Its efficiency was comprehensively tested in the Luga District.

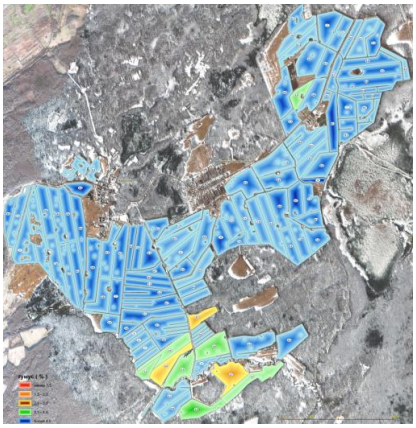


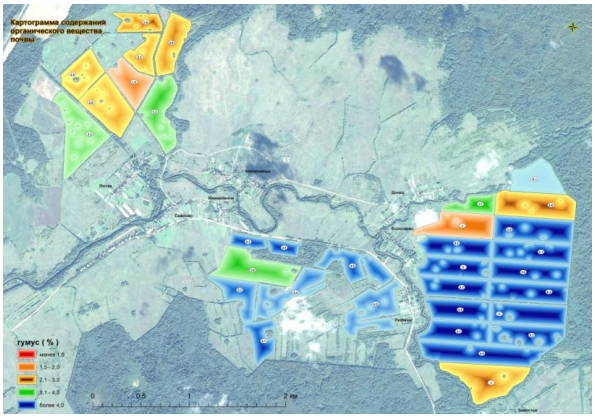
In the first phase, the programme was used to calculate the free farmland area remaining after the application of the farm's own liquid organic fertiliser derived from pig manure.

In the second phase, a Vendor of organic fertiliser was chosen to supply the fertiliser to the pig breeding farm, which in this case is considered as a Consumer of the said organic fertiliser. The Vendor is represented by a poultry farm located in a different district of the Leningrad region.

To ensure the environmentally sound use of organic fertiliser derived from chicken litter on the farm's rented farmland, the following actions were taken:

1. Upon our recommendation, the pig breeding farm carried out an independent inspection of agricultural land, including the inspection of drainage systems.





2. An analysis of the farmland territory and its layout was carried out, including the relief features and the location of water bodies. The maximum possible diffuse load was calculated for these agricultural lands.
3. Laboratory test reports for solid organic fertiliser derived from chicken litter were analysed.
4. The weight of fertiliser to be used was calculated for every field, along with the required dosages with regard to differential fertilisation, taking into account the crops cultivated and the type of rotation system used. Calculation coefficients were taken from Russian and foreign legislation.
5. The use of differential organic fertilisation was justified as a way of reducing the diffused load on neighbouring water bodies.
6. The dimensions and structural design of temporary field storage sites for storing fertiliser before application were validated. The transportation schedule for solid organic fertiliser was validated by taking into account the weight of the transported fertiliser, agrotechnical delivery times and climate conditions.
7. The amount and characteristics of equipment required to ensure environmentally safe transportation of the solid organic fertiliser to the temporary storage site (semi-trailer trucks) and environmentally safe application of organic fertiliser (front loaders, tractors, vehicles for fertiliser application) were calculated.

8. Economic costs were calculated for two application scenarios: the baseline scenario includes the calculation of fertiliser dosages based on the nutrient depletion and standard application of fertilisers; the proposed scenario includes the calculation of nutrient dosages with regard to the agrochemical soil and crop inspection and differential application of organic fertilisers.

As a result of this work, two operating procedures have been developed for the environmentally sound application of organic fertilisers (solid and liquid) on agricultural land. These procedures will remain in effect until the pig breeding farm starts operating at full capacity (that is, until 2027). After the commissioning of the farm, this farmland will be fertilised with liquid organic fertiliser derived from pig manure.

УТВЕРЖДАЮ
Генеральный директор
ООО «ИДАВАНГ ЛУГА»
Т.В. Шарыгина

СОГЛАСОВАНО
ВРИО Директора
ИАЭП-филиал ФГБНУ ФНАЦ ВИМ
А.В. Трифанов

АКТ
сдачи-приемки разработанного документа
Технологический регламент подготовки и использования навоза в качестве органического удобрения на ООО «ИДАВАНГ Луга»

Мы, нижеподписавшиеся, **Заказчик** ООО «ИДАВАНГ ЛУГА» в лице генерального директора Т.В. Шарыгиной с одной стороны, и **Исполнитель** Институт агроинженерных и экологических проблем сельскохозяйственного производства-филиал Федерального государственного бюджетного научного учреждения «Федеральный научный агроинженерный центр ВИМ» (ИАЭП–филиал ФГБНУ ФНАЦ ВИМ), в лице ВРИО директора филиала Трифанова А.В. с другой стороны, составили акт о нижеследующем:

Исполнитель сдал, а **Заказчик** принял следующую работу – разработка Технологического регламента подготовки и использования навоза в качестве органического удобрения на ООО «ИДАВАНГ Луга» для эффективного обращения с навозом и снижения биогенной нагрузки в водосборном бассейне реки Луга.

Технологический регламент разработан с учетом законодательства и нормативной базы Российской Федерации, учитывая требования к наилучшим доступным технологиям (НДТ), а также с учетом международных экологических рекомендаций.

Технологический регламент разработан при содействии проекта WaterDrive «Развитие сельских территорий в регионе Балтийского моря на основе (регионального) управления водными ресурсами» программы Интеррег региона Балтийского моря 2014 - 2020.

Исполнители:
Менеджер по экологии ООО «ИДАВАНГ ЛУГА» А.В. Киселев
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С.н.с., к.т.н. ИАЭП – филиал ФГБНУ ФНАЦ ВИМ Е.В. Шалавина
С.н.с., к.т.н. ИАЭП – филиал ФГБНУ ФНАЦ ВИМ Э.В. Васильев

Настоящий акт оформлен «13» июля 2020 года

УТВЕРЖДАЮ
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СОГЛАСОВАНО
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АКТ
сдачи-приемки разработанного документа
Технологический регламент применения твердого органического удобрения на основе куриного помета на земельных угодьях ООО «ИДАВАНГ ЛУГА»

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Исполнитель сдал, а **Заказчик** принял следующую работу – разработка Технологического регламента применения твердого органического удобрения на основе куриного помета в 2020 году на земельных угодьях ООО «ИДАВАНГ ЛУГА».

Технологический регламент разработан с учетом законодательства и нормативной базы Российской Федерации, учитывая требования к наилучшим доступным технологиям (НДТ), а также с учетом международных экологических рекомендаций.

Технологический регламент разработан при содействии проекта «Луга-Балт 2», реализуемого в рамках программы приграничного сотрудничества СВС 2014-2020 Юго-Восточная Финляндия – Россия.

Исполнители:
Менеджер по экологии ООО «ИДАВАНГ ЛУГА» А.В. Киселев
Зав. отд., гл.н.с., д.т.н. ИАЭП – филиал ФГБНУ ФНАЦ ВИМ А.Ю. Брюханов
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Настоящий акт оформлен «13» июля 2020 года

Implementation of the second objective

To fulfill the second objective – to calculate the weight of manure, farmland area and manure storage facilities required for each phase of the pig breeding farm construction, in line with the applicable Russian legislation and international regulations (the Baltic Sea Region) – two methods of calculation were used:

1. A method for calculating the weight of manure adopted in the Russian Federation, which uses coefficients set by applicable regulatory documents;
2. A model for calculating quantitative and qualitative characteristics of animal waste, manure/litter and ready-to-use organic fertiliser, developed as part of the Manure Standards project.

In order to pass the environmental assessment and to commission the fully operational pig breeding farm, it was necessary to carry out the required calculations based on the Russian methodology for calculating the weight of manure, which uses the coefficients set by the applicable regulatory documents. However, these coefficients haven not been updated since the 1970s, whereas the animal diet and manure treatment technologies have changed dramatically since that time. For this purpose, we made a suggestion to the pig breeding farm to carry out additional calculations using the European model that considers the animal diet, productivity and digestibility of various types of feed.

Our calculations demonstrated that the values of quantitative and qualitative characteristics of the manure (weight, moisture content, total nitrogen and total phosphorus) and manure-based organic fertiliser obtained through the standard methodology are lower than those obtained using the European methodology.

Upon our recommendation, the pig breeding farm measured the daily volume of manure supplied from animal houses to the storage reservoir. Following up on further recommendations, the pig breeding farm carried out laboratory tests to measure such indicators of pig manure as moisture content, total nitrogen and total phosphorus.

The calculation results (of both methodologies) – moisture content, total nitrogen and total phosphorus – were compared to the values of laboratory test reports. The estimated volumes of the daily manure yield were compared to actual values.

As the results of this comparison demonstrate, the actual values reveal a 9% difference with the European methodology, whereas the difference with our methodology is significantly higher – 23%. This indicates that the commissioning of the farm at full capacity may encounter certain roadblocks associated with insufficient holding capacity of manure storage facilities at every stage of construction, as well as the shortage of farmland area to accommodate the application of the entire volume of pig manure-based organic fertiliser generated at the farm.

We have calculated the required amount of manure storage facilities and land area for every stage of construction based on data obtained using both European and our methodology. According to these calculations, the allocated land area will be sufficient for every stage of construction.

The situation with manure storage facilities, however, is different. It was planned to construct a total of 6 manure storage facilities. Calculations on the final phase of construction have shown that this amount will be sufficient when the pig breeding farm becomes fully operational.

However, when calculations were done for each phase of construction individually, it was revealed that 2 manure storage facilities (as envisaged by the initial plan) would not be sufficient for the first and second phases of construction, and that three such facilities would be required. The facilities will need greater storage capacity to allow for the conversion of pig manure into organic fertiliser, on the one hand, and to provide conditions for storing liquid organic fertiliser during the winter period – no liquid organic fertilisers are applied during the winter period at temperatures below 10 °C and with snow depth over 20 cm, as mandated by the Russian law.

In the context of cooperation with the pilot enterprise, a series of quadripartite meetings were held with the participation of representatives of IEEP – branch of FSAC VIM, representatives of the pig breeding farm, shareholders and designers.

One of the outcomes of these meetings was a decision to move the construction of the third manure storage facility from the third phase to the second phase of construction. This decision helped ensure sustainable operation of the pig breeding farm and prevent the negative environmental impact of pig manure both during manure treatment and during the application of manure-based organic fertilisers.

Deliverables

1. Two operating procedures have been developed for environmentally safe application of organic fertilisers (solid and liquid) on agricultural land.
2. Recommendations on reducing the negative environmental impact during the intensive operation of the pig breeding farm have been developed on the basis of both Russian and foreign regulatory documents.
3. A system of differential application of organic fertilisers has been designed.
4. Proposals have been given regarding the methods of reducing the negative environmental impact at each phase of the pig breeding farm construction.
5. Calculations have been made to evaluate the ecological and economic efficiency of the proposed measures designed to improve the environmental safety of the pilot enterprise operations.
6. The operating procedures and proposals on improving the environmental safety of the pilot enterprise have been incorporated into the Environmental Protection section of design documentation submitted for the State Environmental Expert Review.