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INSPIRING
ENVIRONMENT

Feasibility study of areas suitable for the installation of constructed wetlands in Biržai district (NATALIE project)

The feasibility study was commissioned by: Biržai District Municipality Administration

The feasibility study was prepared by: UAB "Estonian, Latvian & Lithuanian Environment" (UAB ELLE)
together with SIA "Estonian, Latvian & Lithuanian Environment" (SIA ELLE)

Biržai, 2025

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Contents

1 Situation overview 4

1.1. Existing natural and artificial water bodies in the Biržai district.....

1.2. Local climate changes and their impact on the environment.....6

Consequences of extreme climate events in the Biržai district 6

Climate forecasts for Biržai district municipality.....9

1.3. Overview of biodiversity of Biržai district municipality 12

1.4. Soil and land use characteristics of the surrounding areas 18

1.5. Wastewater treatment plants in Biržai district 22

1.6. Surface water treatment methods used in the world, applicable to Lithuanian natural conditions and confirmed by scientific research as effective, based on natural solutions 24

Ecological wastewater treatment tower.....24

Peat filters.....24

1.7. Surface water treatment methods used by the Latvian partner using constructed wetlands..... 25

1.8. Situation of the use of natural solutions-based surface water treatment methods in economic activities in Lithuania and Biržai district.....

Constructed wetlands in Stoniskai 25

Constructed wetlands and sedimentation ponds in Kÿdainiai 25

Vegetation protection strips (buffer zones)..... 26

Soil infiltration systems with sand filters 26

Wastewater stabilization ponds (lagoons) 26

UAB "Agaras" complex industrial wastewater treatment process 27

1.9. Overview of legal acts regulating the establishment of constructed wetlands in Lithuania and Biržai district.....

2 Feasibility Study.....33

2.1. Analysis of the needs and expectations of interested parties 33

2.2. Estimation of investment and maintenance costs 34

2.3. Analysis of possible funding sources.....38

Machine Translated by Google

2.3. Assessment of legal validity 44

Pollution permit 45

Installation of artificial water bodies 45

Special land use conditions 47

2.4. Risk assessment 50

Technical risks 50

Environmental risks..... 50

Social and health risks..... 51

Management and supervision risks 51

Regulatory and permitting risks..... 51

Possible risk management measures 52

2.5. Integration of wetlands into existing water management and treatment infrastructure: opportunities assessment..... 53

2.6. Methodology and assessment of location selection for nature-based solutions 53

Selecting a suitable location based on the proposed methodology 54

2.7. Location criteria for farmers for installing nature-based solutions 59

3 Conclusions and recommendations..... 62

3.1. Summary 62

3.2. Conclusions..... 63

3.2. Recommendations..... 66

3.3. Recommendations for legislative acts to be amended and proposed wording of amendments 66

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1 Situation overview

1.1. Existing natural and artificial water bodies in the Biržai district

Biržai district, located in north-eastern Lithuania, is characterized by a dense and diverse hydrographic network – there are many natural and artificial water bodies. These conditions are particularly favorable for the development of nature-based solutions for the treatment of surface water and discharged water, such as constructed wetlands. The terrain in the district is of glacial origin, which has led to the abundance of rivers, lakes and groundwater systems, so each discharged water flow ultimately becomes part of the river basin.

There are a total of 17 lakes in the Biržai district. Among them, Lake Širvÿna stands out - the largest and oldest artificial water body in Lithuania. It was formed back in 1575, by damming the Agluona and Apašÿia rivers. The formation of this lake demonstrates the historical significance of water bodies for the Biržai region, and also reveals the human influence on the formation of the landscape and the importance of water resource management. In addition to Lake Širvÿna, there are other larger lakes in the district - Kiluÿiai, Ruoliškis, Kojeliškis and Kirkilai lakes. They, together with smaller water bodies, are important foci of biodiversity and elements supporting local ecosystems.

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A map of the water bodies currently located in the Biržai district is presented in Figure 1.

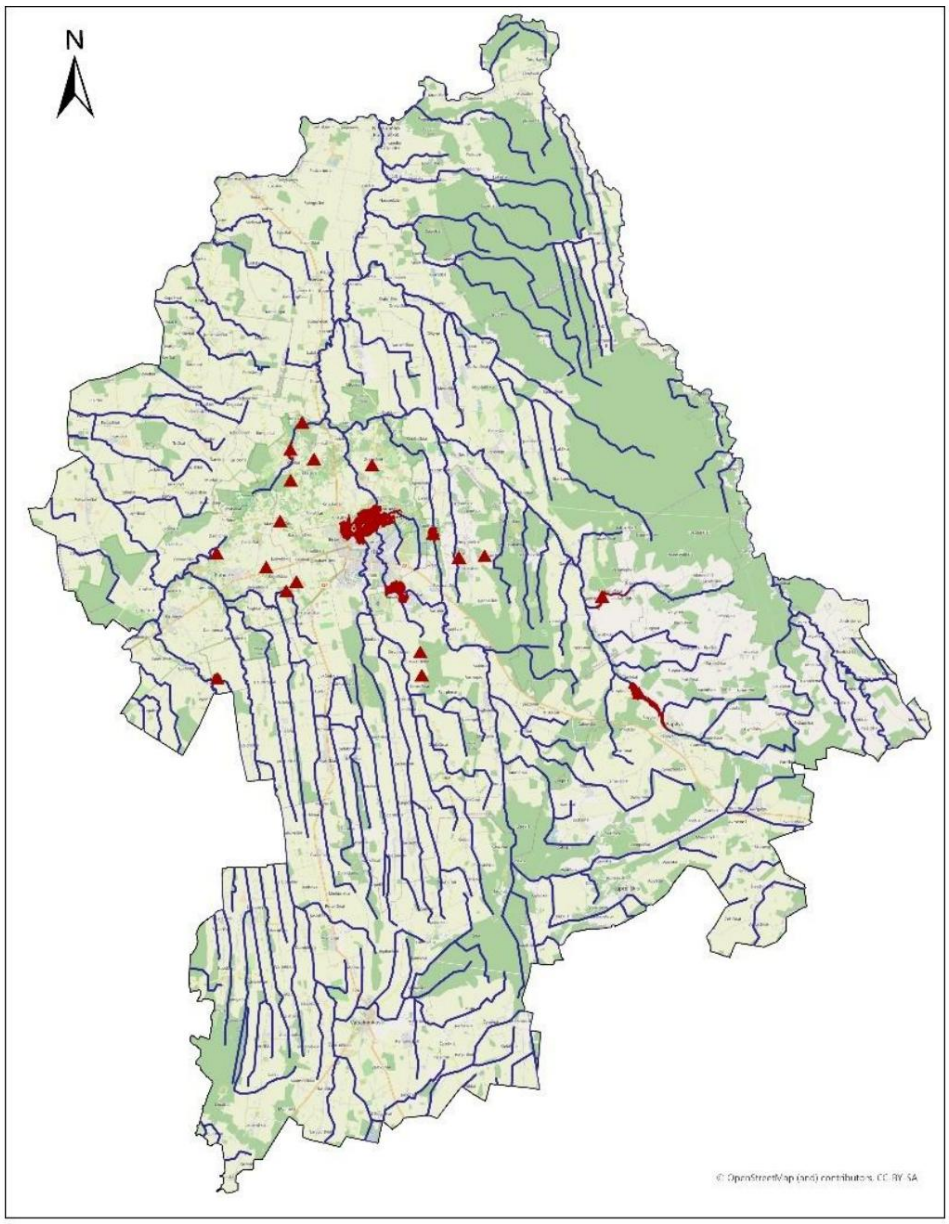


Figure 1. Map of water bodies (Source: Cadastre of rivers, lakes and ponds of the Republic of Lithuania)

The largest river in Biržai district is the Nemunÿlis, which is 191 km long and has a basin area of 4,056 km². The river flows past Lake Lÿšna near Rokiškis and further north, through Biržai district, later crossing the Latvian border and flowing into the Lielupe. One of the main tributaries of the Nemunÿlis is Apašÿia (88 km long), flowing through the city of Biržai itself. The Apašÿia is fed by such important tributaries as

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Rovÿja (35 km) and Agluona (20 km), which together form a significant local hydrographic sub-network, of which constructed wetlands could become a part.

Also important is the Tatula River (66 km long), which flows through the southwestern part of the district. It belongs to the Mÿša basin, another large river in northern Lithuania, whose waters eventually reach the Lielupe in Latvia. The Juodupÿ and Upytÿ rivers flow into the Tatula, while the Tatula itself flows into the Mÿša. These rivers and their tributaries not only form important landscape structures, but also play a role in water purification processes and ecosystem maintenance.

1.2. Local climate changes and their impact on the environment

In recent years, there has been increasing talk about extreme climate events and the resulting consequences for the country's/city's economy, public health, ecosystems, infrastructure, and water resources. Modern technologies can help create future climate forecast models that help to more clearly assess impending climate risks and start preparing for them in advance. Since many different sectors are affected by climate risks, it is understandable that measures to strengthen adaptation capabilities to climate change (risk reduction) must also be comprehensive, including a wide range of stakeholders - public and private sector representatives, residents, NGOs, etc.

In Lithuania, the consequences of climate change are already noticeable to everyone - heavy rains and storms/hurricanes, which cause flash floods and floods, extremely hot summers or unusually warm and rainy winters, the consequences of which have a strong impact on public health, the spread of pests, damage to infrastructure/ buildings, the quality of water bodies, the potential for forest fires, changes in plant species composition, and farmers' yields.

The natural soil formation of particular importance for the Biržai district is that it is collapsing even more actively under the influence of climate change, forming karst sinkholes. This is a unique soil feature that is prevalent only in the northern regions of Lithuania.

Consequences of extreme climate events in the Biržai district

A little over 2 years ago, a sinkhole opened in the cultivated land in Šlepšÿiai, Biržai district, and is the largest in the last 10 years. It was as wide as 17 m at the time it opened. Its size increased slightly over time, as the surrounding soil layers separated and fell into the sinkhole. Currently, the diameter of the sinkhole is about 23 m. The appearance of this sinkhole was an atypical phenomenon, as they usually do not appear during the winter, as happened that time. The more frequent appearance of sinkholes is very closely associated with climate change phenomena, increased precipitation, soil leaching, and rock melting. This phenomenon was usually observed only in the spring, when snow/ice melts and thus water runoff increases, in this case it is observed already in the winter season.

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It is estimated that there are more than 9,000 sinkholes in the Biržai district – the most of all Lithuanian districts.

Sinkholes are a sensitive problem in the Biržai district, which is directly and closely related to the impact of climate change and poses a risk to the health or even life of residents, their property, urban infrastructure and buildings, as well as the economy, as they reduce the value of real estate in the Biržai district.



Figure 2. Photo: LRT.lt portal

Other natural disasters in the Biržai district are often related to droughts, when a municipal-level state of emergency is declared, for example, in 2006 and in June-July 2023.

In May 2014, a strong storm raged in the Biržai district, causing considerable damage to the towns and residents. Slate roofs were torn off houses, trees were uprooted. During the storm, it also rained heavily, which flooded residents' yards and gardens.



Figure 3. Photo: Biržai district municipality, used in an article published by BNS

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In May 2019, heavy rain that turned into hail was reported in the Biržai district.
It was precisely because of the hail that the harvest of farmers' fields and residents' gardens was severely damaged.



Figure 4. Photo: Skrastas portal

In May 2024, there was a heavy downpour in the city of Biržai, which suddenly flooded the city streets, making them impassable.



Figure 5. Photo: portal Northeast

A severe storm with heavy rain occurred in August 2024, when trees fell on the roadway, rain soaked crops, which reduced farmers' yields, and river water levels rose significantly.

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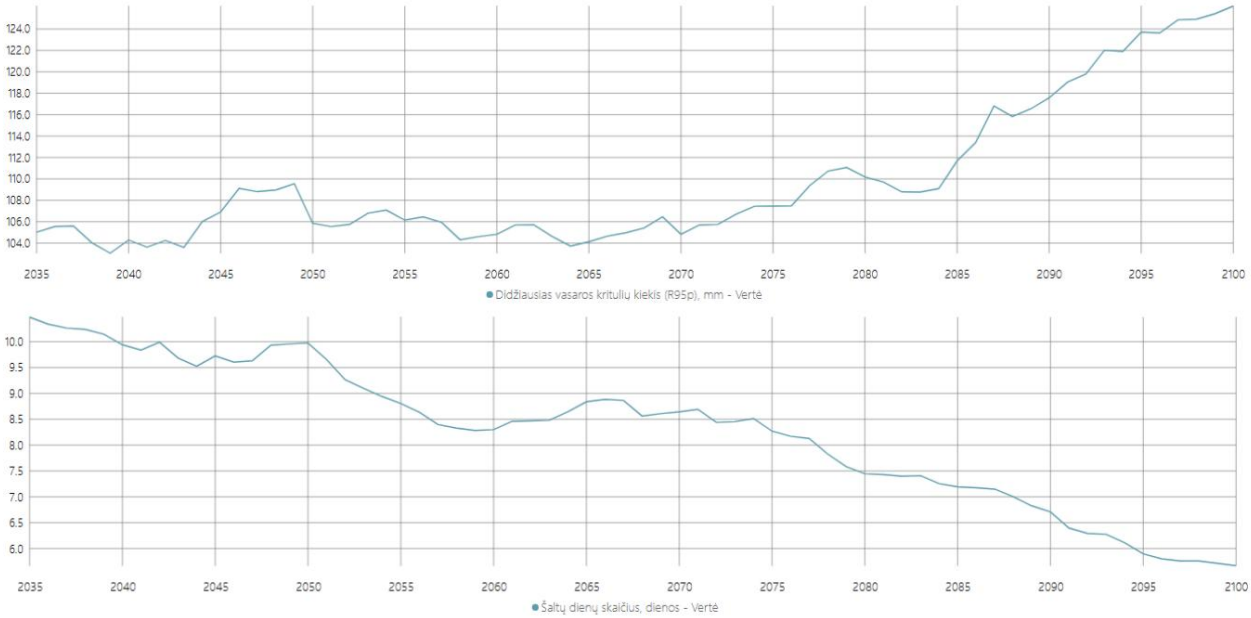
These are just a few of the consequences of extreme climate events, but they There is undoubtedly much more that has happened.

Climate forecasts for Biržai district municipality

In 2023, climate change forecasts for Lithuanian municipalities until 2100 were compiled under 2 scenarios: RCP4.5 and RCP 8.5. Past climate data and trends were used to compile the forecasts. Since the assessment was carried out at the national level, dividing the results into municipalities by territory, the forecasts within municipalities are not so accurate - the entire territory of each municipality reflects only one result/forecast, although it is understood that in different parts of the municipality both climate data and future forecasts may differ, depending on the size and integrity of the municipality in terms of climate. Some of the Lithuanian municipalities have prepared their own Climate Change Adaptation Plans, in which climate risks are separately assessed only in that municipality.

Biržai District Municipality is not ready for such a plan, therefore further analysis was conducted based on the primary document - the Climate Change Sensitivity Report of Lithuanian Municipalities and the forecasts made.

It is understood that the values of all climate indicators will deteriorate over the years throughout Lithuania, but there are several indicators that will be exceptionally worse in the Biržai district than in other parts of Lithuania. It is these indicators that are worth reviewing, as their management will require greater attention. Some of the worst indicator values are predicted by 2100, according to the worst RCP8.5 scenario:



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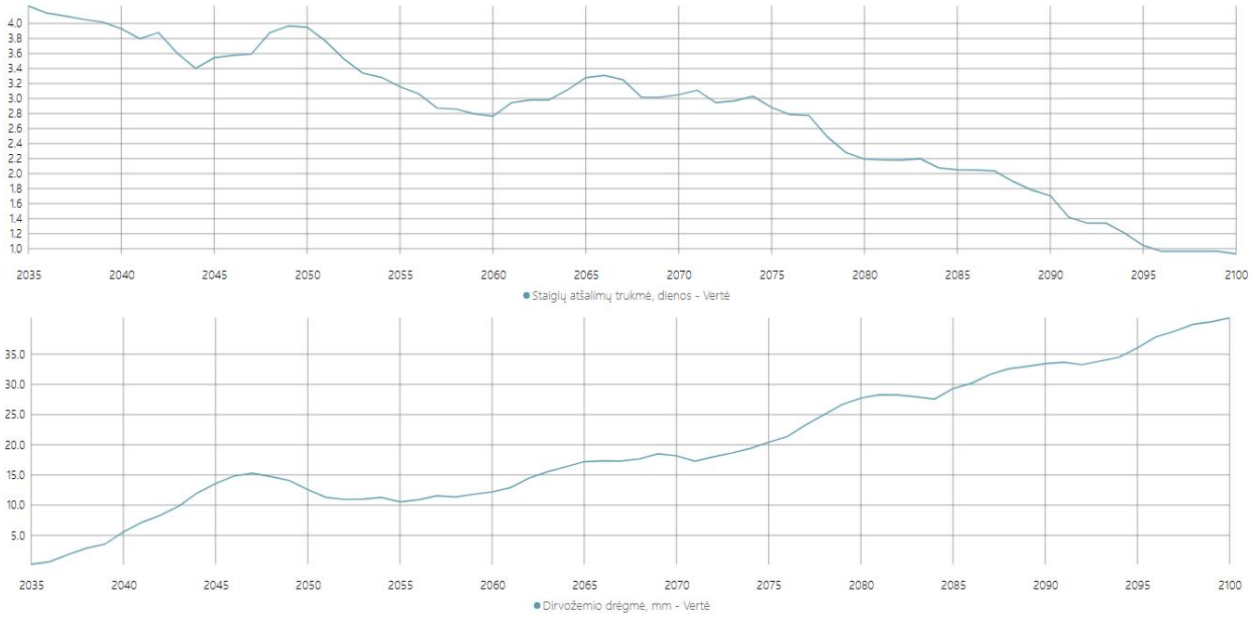


Figure 6. Climate forecasts for Biržai district municipality

Table 1. Climate forecasts for Biržai district municipality

Climate indicator	Meanings comparing current meanings	change are	Associated risks
The largest summer precipitation amount, mm	23 mm more precipitation		Increased incidence of food- and water-borne infectious diseases, increased mortality and morbidity due to flooding, crop loss, soil degradation, vegetation change, freshwater quality, coastal erosion, increased frequency of flash floods, infrastructure damage and disruption of species composition functionality
Number of cold days, days	About 5 days less		Increase in the number of diseases and pests, change in heating and cooling demand, infrastructure damage and functionality disruptions
Sudden chills duration	Will decrease in 3 days		Change in heating and cooling demand, infrastructure damage and functionality disturbances

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Water quantity in the soil, mm	Change 41 mm, from current 0.21 mm	Groundwater level rise

Overall, these predicted climate changes are associated with wetter summers, fewer cold winter days, and rising groundwater levels. All of these processes are significantly accelerating and will accelerate the occurrence of sinkholes in the future, but this risk was not included in the study. evaluated.

In the assessment of the sensitivity of Lithuanian municipalities to climate change, climate risks were assessed separately for each sector. Risk scores were calculated by experts based on the methodology applied to the assessment and a set of relevant criteria (the entire assessment process is explained in the aforementioned report). The final results were calculated, indicating the level of risk by 2050 and 2100. by ranking municipalities from the most strongly affected by a certain climate risk. For each risk, the first five municipalities (with the calculated risk level in points and assigned color, Figure 7) were identified, in which this risk is expected to be the highest. Biržai district municipality was singled out as being in the list of the first five municipalities several times according to the expected climate risks (Figure 8).

Nereikšmingas	Žemas	Vidutinis	Aukštas	Labai aukštas
1-16	17-81	82-144	145-400	401-625

Figure 7. Risk levels based on calculated risk scores.

2. Padidėjęs mirtingumas ir sergamumas širdies ir kraujagyslių ligomis					
Metai	Savivaldybės, kuriose yra aukščiausi kiekvienos rizikos balai				
	(1)	(2)	(3)	(4)	(5)
2100	Panevėžio m. sav. (202.5)	Klaipėdos m. sav. (192.53)	Kauno m. sav. (184.38)	Šiaulių m. sav. (180)	Ignalinos r. sav.; Ignalinos r. sav.; Zarasų r. sav.; Anykščių r. sav.; Biržų r. sav. (135)*

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Metai	Savivaldybės, kuriose yra aukščiausi kiekvienos rizikos balai				
	(1)	(2)	(3)	(4)	(5)
1. Derliaus praradimas					
2050	Kėdainių r. sav.; Raseinių r. sav.; Biržų r. sav.; Skuodo r. sav.; Pakruojo r. sav.; Joniškio r. sav.; Pasvalio r. sav.; Šakių r. sav.; Radviliškio r. sav.; Vilkaviškio r. sav.; Kalvarijos sav.; Marijampolės sav. (44.4)*				
2100	Kėdainių r. sav. (108.33)	Pakruojo r. sav.; Pasvalio r. sav.; Skuodo r. sav.; Joniškio r. sav.; Radviliškio r. sav. (100)*			
2. Ligų ir kenkėjų padaugėjimas					
2050	Alytaus r. sav. (32)	Kėdainių r. sav.; Raseinių r. sav.; Biržų r. sav.; Skuodo r. sav.; Pakruojo r. sav.; Joniškio r. sav.; Pasvalio r. sav.; Šakių r. sav.; Radviliškio r. sav.; Vilkaviškio r. sav.; Kalvarijos sav.; Marijampolės sav. (31.11)*			
2100	Kėdainių r. sav.; Pakruojo r. sav.; Pasvalio r. sav.; Skuodo r. sav.; Joniškio r. sav.; Radviliškio r. sav.; Biržų r. sav.; Šakių r. sav.; Vilkaviškio r. sav.; Kalvarijos sav.; Marijampolės sav. (180)*				

Figure 8. Climate risks in Biržai district municipality.

According to the public health sector risk Increased mortality and morbidity from cardiovascular diseases, Biržai district municipality is in fifth place in terms of risk level by 2100 (risk is assessed as medium). According to the agricultural sector risk Crop loss, Biržai district municipality is in first place by 2050, although the risk level is also expected to be low. According to another agricultural sector risk – increase in diseases and pests – Biržai district municipality is in second place, also with a low risk level, but by 2100 this risk is expected to have reached a high level and Biržai district municipality will already be in first place.

1.3. Overview of biodiversity of Biržai district municipality

The protection of the biodiversity of the territory of Biržai District Municipality is ensured by a special system of protected areas established in accordance with the Law on Protected Areas of the Republic of Lithuania, as well as the Natura 2000 network of areas of European biological importance, formed in accordance with the European Union Birds (EEC 79/409) and Habitats (EEC 92/43) Directives.

According to the Law on Protected Areas of the Republic of Lithuania, the protection of territories guarantees the protection of natural and cultural heritage complexes and objects, the ecological balance of the landscape, biodiversity and genetic fund, the restoration of natural resources, and constitutes
conditions for cognitive recreation, scientific research and environmental monitoring, promotes the protection of natural and cultural heritage values. The system of protected areas in Biržai district municipality consists of conservation protected areas, where unique or typical natural and cultural landscape complexes, objects and biodiversity are protected. In accordance with the protection objectives, economic and recreational activities are limited or prohibited in these areas. This category includes reserves, sanctuaries and protected landscape objects. Also, complex-purpose protected areas, where conservation, protection, recreational and economic zones are combined according to a common

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protection, management and use program. This category includes state parks (national and regional) and biosphere monitoring territories (biosphere reserves and biosphere reserves).

According to the General Plan of Biržai District Municipality1, the current basis of the protected area system of Biržai District is formed by Natura 2000 territories, Biržai Regional Park with its affiliated and separate state reserves, and the Biržai Forest Biosphere Reserve. In these territories, along with the protection of biodiversity, the protection of landscape, natural and cultural heritage territories and values is integrated. The most important territories in terms of biodiversity conservation are Natura 2000 territories and Biržai Regional Park, as they directly protect rare species of animals, birds, plants, and fungi, ecosystems and their functions.

When assessing the conservation zones protecting the diversity of the natural landscape of the Biržai Regional Park located in the territory of Biržai district, a large part of them are reserves, 15 of which are located in the territory of the park. Geological, botanical, botanical-zoological, hydrographic, telmological, urban-
architectural reserves, which are of a narrower profile, but have biodiversity protection goals in their regulations. They include biodiversity protection and maintain ecological balance. There is also the Nemunÿlis-Apašÿia State Geological Reserve, the Guodžiai State Geomorphological Reserve, which do not belong to the territory of the regional park, but are assigned to the park's management. 2 biosphere reserves also help ensure biodiversity protection in the Biržai district municipality. The main and largest in the district is the Biržai Forest (a unique forest stretching along the border with Latvia). The size of this biosphere reserve is 17,683 ha, and its goal is to preserve the entire forest ecosystem. According to the State Service for Protected Areas, the populations of the black stork, jeruba, crane, Ural owl, sparrow owl and grey owl are protected in the Biržai Forest Biosphere Reserve. In Biržai District Municipality, there are 2 separate state botanical reserves specialized for the protection of biodiversity, which are not included in the territory of Biržai Regional Park, but fall within the Biržai Forest Biosphere Reserve: Biržai Forest Botanical Reserve and Latveliai Botanical Reserve.
The Biržai Forest Biosphere Reserve also contains 4 genetic reserves, which, along with key forest habitats, are rich in protected botanical values. Figure 9 shows the main and largest protected areas located in the Biržai district municipality and their location within the territory.

[1] Approved by the Biržai District Municipality Council of April 30, 2021. Decision No. T-153 "On the Biržai District "Approval of amendments to the general plan of the municipal territory"

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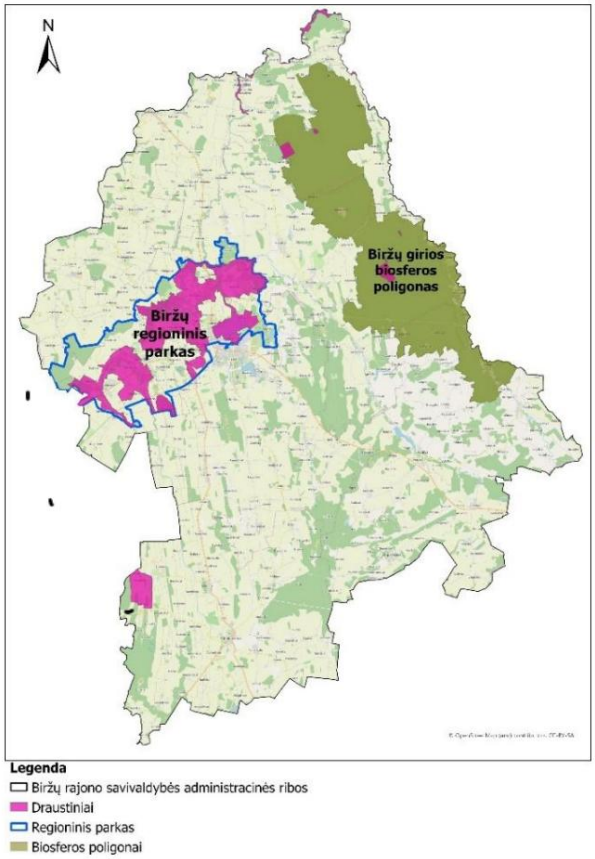


Figure 9. The territories of Biržai Regional Park and Biržai Forest Biosphere Reserve and the reserves located within the territories

As mentioned, one of the most important areas for biodiversity protection is Natura 2000 areas. The Natura 2000 areas of the European ecological network in Biržai district municipality include Important Bird Areas (IBAs) and Important Habitat Areas (IHAs). Figure 10 shows the Natura 2000 areas in Biržai district.

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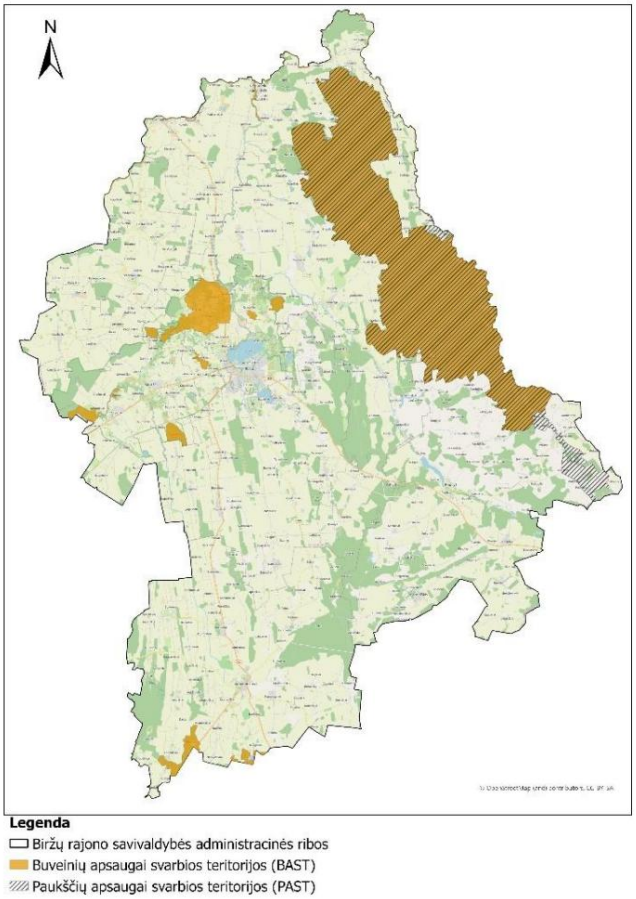


Figure 10. Natura 2000 areas in Biržai district

Table 2. There are 3 territories important for bird conservation in Biržai district municipality. The Order No. D1-281 of the Minister of the Environment of the Republic of Lithuania of 28 May 2014 “On the Determination of Territories Important for Bird Conservation” approves the territories important for bird conservation in Biržai district municipality and the protection priorities therein – protected bird species of European importance are found, as well as territories important for migratory birds.

Serial No.	Area of importance for bird conservation	Conservation priorities – protected bird species of European importance are found; the importance of the area for migratory birds
1.	Biržai Forest	Black storks *(Ciconia nigra),* lesser spotted eagles *(Aquila pomarina),* jeruba *(Bonasa bonasia),* corncrake *(Crex crex),* crane *(Grus grus),* Ural owl *(Strix uralensis),* sparrow owl *(Glaucidium passerinum),* grey woodpecker *(Picus*

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		canus), three-toed geniai *(Picoides (tridactylus)*
2.	Nemunÿlis River Valley	Corncrakes *(Crex crex)*
3.	Green forest	Black storks *(Ciconia nigra),* wasp-eaters *(Pernis apivorus),* barn owls *(Glaucidium passerinum)*

Table 3. The list of sites meeting the criteria for the selection of areas important for the conservation of natural habitats was approved by the Order of the Minister of the Environment of the Republic of Lithuania of 22 April 2009 No. D1-210 “On the approval of the list of sites meeting the criteria for the selection of areas important for the conservation of natural habitats, for submission to the European Commission”. According to this list, the following habitats of European importance are protected in Biržai District Municipality.

Serial No.	**Important for habitat protection territory**	**Values for which the area was selected**
1.	Daudžgiriai Forest (Boundaries coincide with the boundaries of the Daudžgiriai Botanical Reserve of Biržai Regional Park)	9020, Broadleaf and mixed forests; 91D0, Swamp forests
2	Nemunÿlis and Apasÿia river valleys (Middle Nemunÿlis, part Nemunÿlis-Apaštia Geological Reserve)	6210 Steppe grasslands; 6430 Eutrophic uplands grasslands; 6450 Alluvial meadows; 6510 Hayed mesophyte meadows; 8210 Carbonate rock outcrops; 9180 Ditch and slope forests; 91E0 Alluvial forests; 91F0 Riverine elms; Oval shell; Simple hammerhead; common pickerel; otter
3.	Green Forest (Green Forest Biosphere Reserve and surrounding areas)	Greater golden eagle; Lynx; Common lynx; 3150, Natural eutrophic lakes with floats

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		or sharp communities; 6230, Species-rich 6270, Species-rich sand dunes; 6410, Melvennynas; 6450, Alluvial meadows; 6510, Hayed mesophyte meadows; 7110, Active raised bogs; 7120, Degraded raised bogs; 7160, Non-calcareous springs and spring-fed swamps; 9010, Western taiga; 9020, Broadleaf and mixed forests; 9050, Herbaceous spruce forests; 9070, Wooded pastures; 9080, Swampy deciduous forests; 91D0, Wetlands forests; 91E0, Alluvial forests
4.	Plaster coffin lakes and their lakes (Biržai Regional Park, Kirkilas landscape reserve and part park ecological protection zones)	3190, Gypsum karst lakes
5.	Oak groves Forest (Biržai Regional Park)	9020, Broadleaf and mixed forests; 9080, Swamp deciduous forests
6.	Padaicai forest (Biržai Regional Park)	9020, Broadleaf and mixed forests
7.	Drÿseikiai village surroundings (Biržai Regional Park)	3190, Gypsum karst lakes
8.	Karajimiškis village surroundings	3190 Gypsum karst lakes; 8310 Caves

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9.	Biržai Forest (Biržai Forest Biosphere Reserve)	9010 Western taiga; 9020 Broadleaf and mixed forests; 9050 Grass-rich spruce forests; 9080 Swamp deciduous forests; Lynx; Otter; White-tailed deer checkerboard; Great goldenrod

It should be noted that of all the Natura 2000 territories protecting biodiversity designated in the territory of Biržai district municipality, all fall within the boundaries of the protection zones of protected areas of national importance - regional parks, biosphere reserves, reserves. This ensures the continuity of biodiversity protection works and plans, and excellent harmonization of the existing system of protection of natural diversity values.

1.4. Soil and land use characteristics of the surrounding areas

According to the map of geomorphological areas and districts of Lithuania, Biržai district belongs to the North Lithuanian Lowland geomorphological area, which is formed by the Mÿšas–
Nemunÿlis Moraine Plain. This plain was formed during the Ice Age, when melting glaciers left behind layers of sediment, such as sand, gravel, and clay, forming plains and slight hills.

A feature of the Biržai district relief is the abundance of karst sinkholes, formed due to the penetration of groundwater into deeper layers. Groundwater, penetrating through porous rocks and soil, dissolves and washes away gypsum and partially affects dolomite, forming empty or water-filled (often with dolomite flour) cavities.2

The upper layers of the earth, having lost their support, collapse into these cavities together with the remains of rocks, which causes karst collapses – sinkholes – to form on the earth's surface. These sinkholes give the landscape a unique character and are important natural values, but
At the same time, it poses challenges for agriculture and construction. Although most of the region consists of fertile plains suitable for growing various agricultural crops, karst landslides and occasional swamps limit the area of land suitable for use.

The soil cover in Biržai district is composed of brown soils and washed soils, with a predominant loam granulometry, as well as sandy soils, marshy soils and peatlands; the latter account for 4.5% of the municipality's territory, and the largest is the Purvai-Butniÿnai peatland, which covers about 1,400 ha. Forests in the municipality account for 26.4% of the area. The largest forests are

[2] V. Mikulÿnas and I. Satkÿnienÿ, *The Warming Earth* (Vilnius: Lithuanian Geological Survey, 2022)

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in the east of the district, the largest are Biržai grove, Šilÿ, Medžvalakiai, Vabalninkas forests. Meanwhile, land use occupies 64.5% of the territory, of which 46.9% of crops are cereals, 2.6% are potatoes, and the rest consists of cultivated fodder plants, flax, sugar beets, etc. Intensively cultivated loamy areas with dense ceramic drainage generate the greatest nitrogen and phosphorus runoff, and since 2005. the entire territory of the municipality, like the rest of Lithuania, has been classified as a management zone of the European Union Nitrates Directive, therefore nutrient binding is a priority.

The underground drainage system, which has been in operation for more than fifty years, can no longer withstand the increasingly frequent and intense extreme rains. According to the calculations of the Biržai District Municipality, most of the pipelines are already completely outdated and have reached the limit of their service life[3] , but the funds allocated by the state for their repair – only about 330 thousand. EUR[4] per year – are clearly insufficient for the scale of the problem. For this reason, the risk of waterlogging is significantly increasing, causing huge losses to agriculture and the environment, and the need for effective, sustainable solutions is becoming increasingly urgent.

Water bodies are not only harmed by the entry of untreated wastewater from treatment plants, but also by the residues of fertilizers and pesticides washed away from farmers' fields during rain and snowmelt. This form of pollution is particularly relevant in the Biržai district due to dense land reclamation networks, sloping terrain and actively used agricultural lands. Surface water, flowing from fields during rain or snowmelt, can carry fertilizer residues (especially nitrogen and phosphorus), pesticides and particles of the fertile soil layer to nearby surface waters. Such pollution promotes eutrophication - excessive growth of algae, which, when decomposed, reduces the amount of oxygen in the water and harms fish and other aquatic organisms.

The risk increases in areas where farming is carried out near surface water bodies or on drained lands where drainage ditches or underground drainage pipelines are in operation.
In the Biržai district, these networks are dense and effective – they quickly remove excess water from the soil, but at the same time they provide a quick route for pollutants to enter streams or lakes. For this reason, even farming further from a water body can have a negative impact on water quality. The condition of reclaimed land and reclamation structures is assessed based on the types of damage. The types of damage on the map of reclaimed areas are distinguished by two letters and can be as follows:

- DK – agricultural land in an area with no active drainage, covered with forest and bushes;
- DM – waterlogged drained area; • DP – agricultural land in an area with no functioning drainage that has turned into a swamp;

[3] Biržai District Municipality, "Information on land reclamation"
[4] Biržai District Municipality Strategic Activity Plan for 2024–2026

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• DZ – agricultural land in the area of non-functioning drainage; • DG – soil suction pits in the drainage collector routes; • DA – drained area, according to the territorial planning document or land management project planted with forest or inventoried as forest;

• DU – drained area, built up with buildings, or with roads or other structures built on it communications;

• LV – water irrigation;

• LS – slurry irrigation;

• LI – complete irrigation system; • LN – no irrigation devices;

• LF – the area serves as a filtration field.

In Biržai district, about 86436 ha of land have been drained by drainage, of which about 15-19 percent are in poor condition (Figure 11), in some cadastral areas of the district over 20 percent. The warranty period for the operation of drainage systems is 25 years. Most of them were installed in 1961-1985. from fired clay pipes. The drains affected by soil, tillage equipment, time and frost are brought in by soil deposits, overgrown with horsetail roots, mechanically damaged, and the drainage pipes are crushed, so they need to be replaced with new plastic pipes. The poorly functioning drainage network is not only due to wear and tear, but also due to unmaintained agricultural land - the roots of trees, bushes and other unmowed vegetation clog the drainage network. During the Soviet years, insulating material was not used when developing the drainage network, so in lighter soils, drains were laid with sand or sandy loam deposits.

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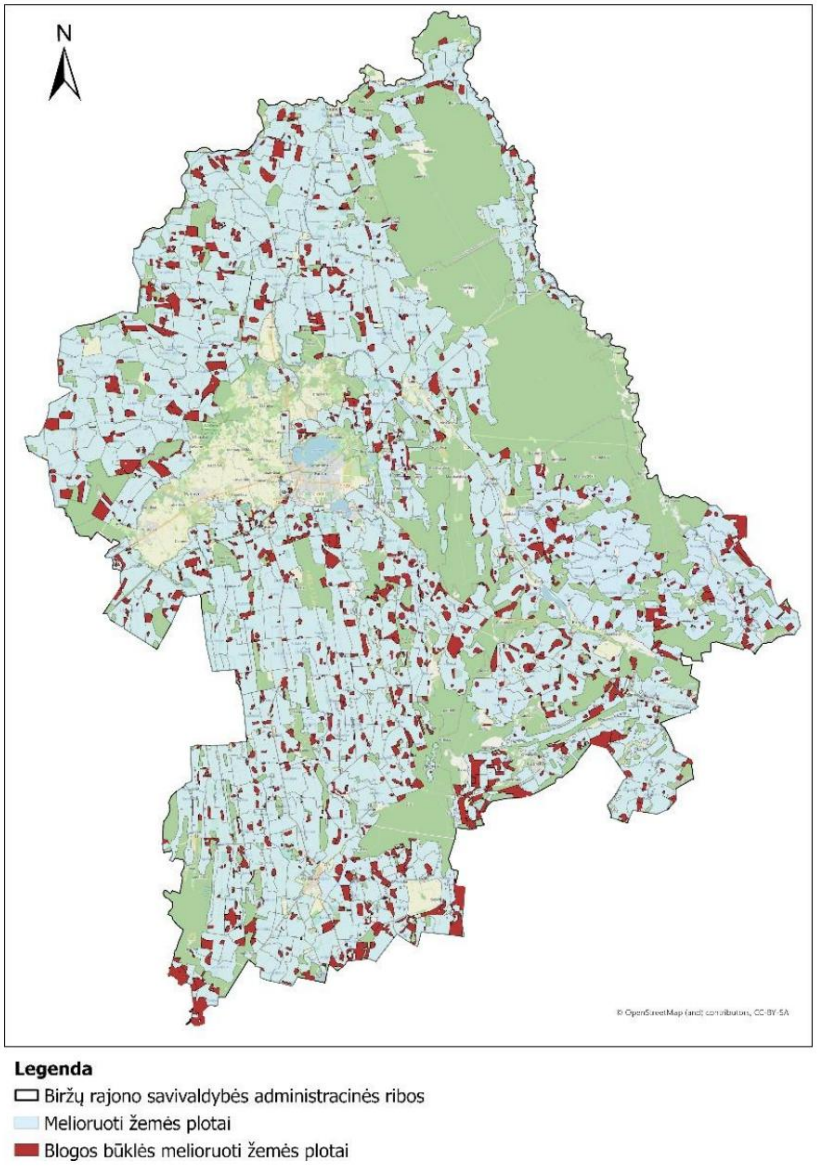


Figure 11. Reclamated land areas in poor condition.

In urbanized areas, the situation is even more complicated. Some villages are built on drainage areas without taking into account existing systems. Drainage often flows under buildings, trees are planted on it, excavations are carried out, sewage is pumped - all of which damage the drainage structure. The municipality annually renews drainage systems in poor condition based on residents' requests - an average of about 20 requests are implemented per year, which is only a small part of the network that needs to be renewed.

One solution is to install constructed wetlands. They could act as natural biofilters, trapping and purifying pollutants and absorbing excess rainwater.

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Such wetlands would not only improve water quality and reduce pollution, but also help preserve biodiversity, becoming a sustainable tool in combating environmental challenges.

1.5. Wastewater treatment plants in Biržai district

According to the 2025 data of Biržai District Municipality, there are 19 main wastewater treatment plants in the district. treatment plants belonging to the centralized wastewater management system, the data of which were evaluated in the preparation of this feasibility study. On average, one wastewater treatment plant serves 130 people connected to the centralized system. In order for the wetlands to effectively clean the generated wastewater, the average number of people connected to the system must be 40-60. Evaluating the data of UAB “Biržų vandenys” and Smilgių k. wastewater treatment plant, 5 out of 19 wastewater treatment plants are in the aforementioned range of connected residents, 11 wastewater treatment plants have more than 60 connected residents, and 2 treatment plants have less than 40

The distribution of wastewater treatment plants is presented in Table 12.
in the figure. The Wastewater Management Regulation5 sets out the main environmental requirements for the collection, treatment and discharge of wastewater in order to protect the environment from pollution. The pollution of domestic and municipal wastewater discharged into the natural environment may not exceed
The maximum permissible concentrations specified in Table 2 of the Wastewater Management Regulation. Municipal wastes are also discharged / domestic wastewater must also comply with other general requirements specified in Chapter III. UAB
According to the data of "Biržų vandenys", the average BOD before treatment in treatment plants varies: less than 150 ml/l is produced in 10 treatment plants, BOD in the range of 150-350 ml/l is produced in
in 8 facilities, over 350 ml/l in one water treatment facility. BOD after treatment in all wastewater treatment facilities is lower than 25 ml/l, which complies with the established wastewater pollution standard. Evaluating the average COD before treatment, the situation in the treatment facilities
respectively similar to BOD. COD less than 210 mg/l is in 9 treatment plants, in the range of 210-740 mg/l is in 8 plants, over 740 mg/l is in 1 treatment plant. Despite different COD amounts before treatment, all treatment plants treat wastewater to the permitted norm, which is 125 mg/l. The operator planning to discharge wastewater into the environment must assess the impact of the planned wastewater on the recipient and determine the acceptable load.

Depending on the capabilities of the recipient and the relevant calculations made in accordance with the requirements of the Wastewater Management Regulation, the established concentration standards for nitrogen and phosphorus pollutants may be different, determined based on the results of calculations or not even determined. This applies only to municipal/ domestic wastewater and only in the case where the permissible level of wastewater pollution by total phosphorus, total nitrogen has been calculated in accordance with the provisions of point 12.
average annual concentration.

[5] Approved by Order No. D1-236 of the Minister of the Environment of the Republic of Lithuania of 17 May 2006 “On Wastewater approval of the processing regulation".

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Considering the dense river network and sensitive surface water ecosystems in Biržai district, wastewater treatment plants play a particularly important role in ensuring the good condition of water bodies. As can be seen in Figure 12, treatment plants are located on the territory of the district, located along the most important rivers or their tributaries - Nemunÿlis, Apašÿia, Tatula, Juodupÿ and others. These plants are an essential part of the infrastructure that reduces direct pollution to surface waters. water bodies.

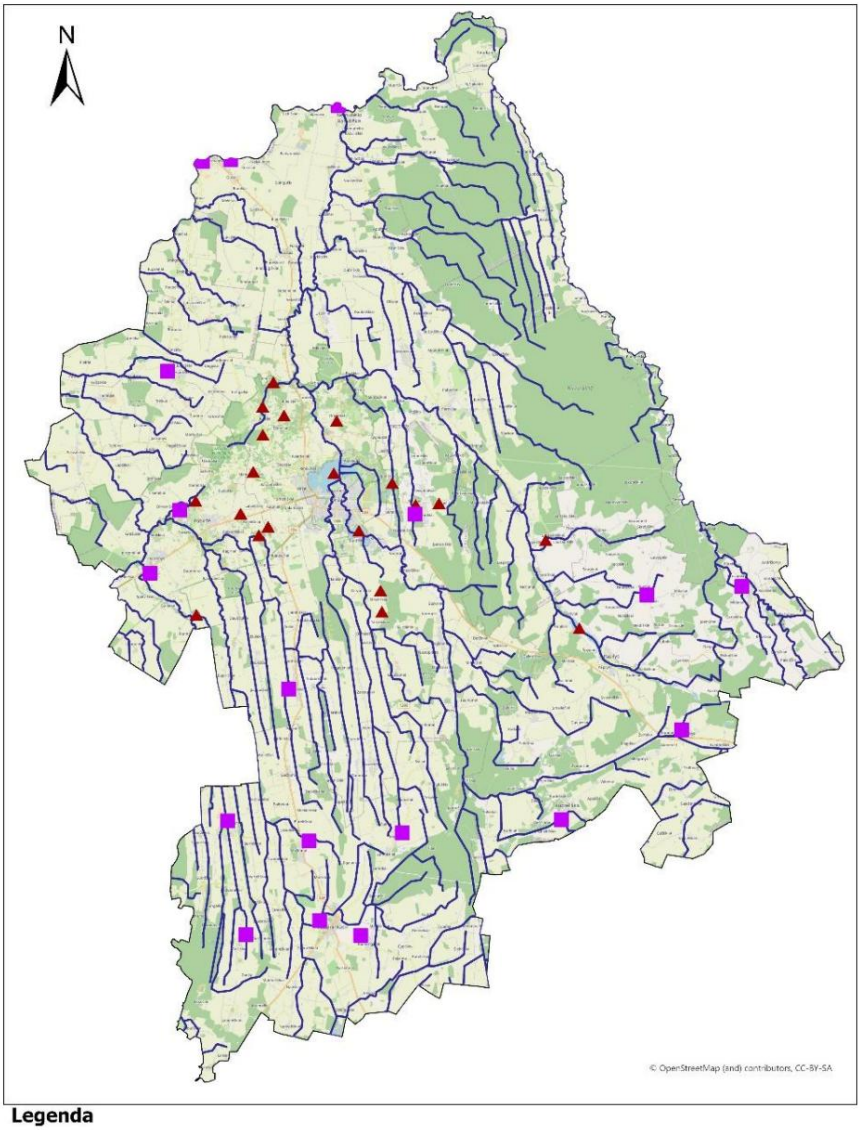


Figure 12. Wastewater treatment facilities in Biržai district.

Wastewater treatment plants are necessary to ensure the purification of discharged wastewater. Additional nature-based measures for wastewater treatment, such as

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Constructed wetlands, operating in conjunction with existing treatment facilities, could further contribute to nutrient retention, thereby reducing their amount in water bodies.
This is especially important in areas where treatment plants serve small villages or individual farms whose wastewater enters sensitive water systems. A two-stage treatment system, combining technological facilities with elements of the natural ecosystem, would allow for an even better level of wastewater treatment.

1.6. Surface water purification methods used in the world, applicable to Lithuanian natural conditions and confirmed by scientific research as effective, based on natural solutions

Ecological wastewater treatment tower

This system is similar to the constructed wetland method, but is applied vertically. This is especially relevant if the territory is limited, as the vertical installation allows the necessary area to be used. reduce to a minimum.

Wastewater is pumped to the very top of the tower with the help of pumps, from where the wastewater treatment process begins. Sand filters are used for mechanical treatment. After primary treatment, the wastewater flows below into a biological treatment tank, which is rich in plants and microorganisms. Finally, the purified water is discharged at the bottom and piped to the desired outlet.

Peat filters

Peat filters for wastewater treatment are widely used in Northern European countries, where peat resources are abundant. Peat filters are biological filters that use peat as a filter material for wastewater treatment.

Peat filters remove pollutants from wastewater through a combination of physical, chemical and biological processes. Mechanical filtration occurs when peat traps suspended solids. Chemical absorption occurs due to the high organic matter content of peat and its large surface area, which allows it to absorb heavy metals, phosphorus and organic compounds. At the same time, microorganisms living in peat decompose organic matter and other pollutants, ensuring long-term filter efficiency.

This method is widely used to treat various wastewaters, including domestic, industrial and agricultural. In Lithuania, where intensively worked loams with drainage create high nitrogen and phosphorus runoff, peat filters could be strategically placed to retain drainage water, thereby reducing pollution before it enters water bodies.

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1.7. Surface water treatment methods used by the Latvian partner using constructed wetlands

The NATALIE project partner, the Latvian region of Zemgale, plans to conduct water and wastewater-related scientific research in the pilot areas, the results of which will be part of the planned installation of nature-based solutions for wastewater treatment. It is planned to install 2 new constructed wetlands and monitor them together with 4 already operating constructed wetlands for wastewater treatment from small settlements and agricultural/industrial activities. A feasibility study is currently being prepared, which will reflect a detailed description of the areas, an overview of the most suitable locations for the installation of constructed wetlands and proposals.

1.8. Natural solutions for surface water treatment

The situation of use in economic activities in Lithuania and the Biržai district

Constructed wetlands in Stoniskai

In 2005, a study was prepared on the treatment of domestic wastewater in Stoniškiai (Šilalÿ district). The study examined 5 locations: Pagiriai wastewater treatment plant, Visockos pig farm and dairy farm, Lifosa and Nematekas6 .

A horizontal underground flow constructed wetland was selected for the installation, designed to treat domestic wastewater from a rural settlement. It was built as part of the improvement of rural infrastructure, financed under the Lithuanian Rural Development Programme. The project was part of an EU-funded rural development initiative to promote environmentally friendly wastewater treatment in remote rural areas. The wetland used a horizontal underground flow system, in which wastewater flows through a gravel layer planted with reeds and wetland vegetation.

Constructed wetlands and sedimentation ponds in Kÿdainiai

In 2016, wastewater treatment plants were installed in the Kÿdainiai district to reduce pollution from agriculture. During the works, pilot measures to reduce diffuse water pollution were installed in the Kÿdainiai district – three sedimentation ponds, a constructed wetland and 10 drainage runoff management systems. These facilities were installed on farmers' lands. The principle of operation of these measures is the same – to slow down the flow of water by various means (stone partitions, rapids, aquatic vegetation, water level regulation systems, etc.) in order to retain, accumulate or use as much phosphorus, nitrogen and

[6] More information can be found in the study *Pollutant Removal by Horizontal Subsurface Flow Constructed Wetlands in Lithuania* https://www.tandfonline.com/doi/abs/10.1081/ESE-200055889

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its compounds, and the water from them would enter natural water bodies already purified from the aforementioned chemical pollution.

Sedimentation ponds can be used separately for the treatment of surface water or runoff from cultivated fields. This method is the most effective way to remove solid particles and some pollutants, such as phosphorus compounds, from wastewater. During sedimentation, some microorganisms and pathogens settle to the bottom along with the solid particles. Once sludge has formed on the bottom, it should be removed so that the ponds can continue to do their job.
This method can be used as a primary cleaning to separate large particles.

The benefits of such a system are not only natural, but also economic for the farmers themselves. By retaining nutrients and fertilizers on the cultivated land and preventing this untreated wastewater from flowing out due to the impact of rain, it reduces the amount of fertilizer used by about 10%.

Vegetation protection strips (buffer zones)

These are plant belts along rivers, lakes and agricultural fields that absorb and filter surface runoff of wastewater, fertilizers and pollutants. These belts stop erosion, reduce the entry of nitrogen and phosphorus into water bodies, thus managing the risk of eutrophication. This measure is applied in Lithuania in the Neris River basin.

Soil infiltration systems with sand filters

This natural remedy is used in very small settlements and individual households, on homesteads, where there is no centralized wastewater treatment system.

This is a specially designed filtration device in which wastewater is passed through a sand layer, where mechanical retention of larger particles (organic matter) and biological treatment occurs due to microorganisms growing in the sand gaps, which decompose organic matter, pathogens, etc. organisms, thus reducing the concentrations of BOD and other pollutants. Pathogens cannot survive for long in an unfavorable environment (soil or sand) without food, when they are affected by competition with other microorganisms, physical retention prevents them from entering further water or the environment. To increase the efficiency of the system, grease traps can be used together with this system for primary treatment.

Wastewater stabilization ponds (lagoons)

Wastewater stabilization ponds are specially designed open water bodies in which wastewater is treated using natural biological, physical and chemical processes. This method can be used to treat wastewater from small settlements or agricultural areas. In addition to the purification function, such ponds can form valuable natural habitats.

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The method is based on several principles, first of all, wastewater enters a pond, which their speed of movement slows down, causing sludge and other solids to settle to the bottom. This initial process could be classified as a sedimentation pond method, followed by other wastewater treatment stages in other ponds. During biological treatment, microorganisms, algae and aquatic plants living in the pond water break down organic matter, thereby reducing biological oxygen demand (BOD) and chemical oxygen demand (COD).
The aerobic and anaerobic processes used break down pollutants in different stages of treatment. The composition of treatment equipment and methods that can be used depends on the type of wastewater to be treated and its contamination.

This type of wastewater treatment plant is used by AB "Siÿlas" to clean production facilities. wastewater, but this method can be applied to various types of wastewater.

UAB "Agaras" complex industrial wastewater treatment process

This process begins with primary treatment facilities, where wastewater from production facilities enters the pumping station and is fed to the flotation tank. At this stage, it passes through a rotary screen that traps particles larger than 1 mm, which are collected in special containers. Chemical treatment continues - flocculants and coagulants are fed into the system at the dosing station, which help form sediment in the flotation tank. The foam formed in the flotation tank is removed mechanically, and the purified water is directed to the aeration channel, where further biological treatment takes place. In the aeration channel, intensive mixing and oxygenation of wastewater occurs using aerators, while sedimentation devices are used to reduce the amount of sludge and remove accumulated excess sludge.

From the aerated channel, wastewater is directed to a pumping station, which is equipped with two pumps through which wastewater is pumped into vertical filtration filters. Here it is distributed through collectors and passed through gravel filling, performing biological filtration treatment (a nature-based solution is the use of reeds in the final stage of the wastewater treatment process). Then, wastewater is collected in a distribution well and distributed to horizontal filtration filters. Horizontal filters act as natural earth structures with a layer of plant cover, in which microorganisms further decompose pollutants, and are also planted with reeds. The filters have special drainage systems and wells with water level maintenance devices.

1.9. Legislation regulating the installation of constructed wetlands

Overview in Lithuania and Biržai district

Analysis of Lithuanian legislation has shown that there are no special legal acts regulating the establishment of constructed wetlands. Therefore, the implementation of this activity should be guided by

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both legal acts regulating environmental protection, regulating the performance of economic activities, taking into account the territory and environment in which this activity will be carried out, the scale of the activity, the actions necessary to implement the activity, etc., and legal acts regulating land use and ownership.

The analysis of the current situation in Lithuania conducted by the project "Integrating Green Infrastructure into Urban Planning" (2020-2021) implemented by "Create Lithuania" also noted that in the Lithuanian legal framework *"Natural elements are still associated mainly with ecological and recreational functions, thus not giving sufficient weight to the role they play in other areas - such as health care, energy efficiency of buildings, stormwater management."*

In this regard, an overview of those legal acts whose provisions are relevant for the implementation of the measures envisaged in this feasibility study is provided.

Law on Environmental Protection of the Republic of Lithuania (hereinafter referred to as the Law on Environmental Protection). The provisions of Chapter IV of the Law on Environmental Protection regulate the planning and issuance of permits for economic activities that may have an impact on the environment.

Law of the Republic of Lithuania on Environmental Impact Assessment of Proposed Economic Activities (hereinafter referred to as the EIA Law). The Law regulates the processes of selection of proposed economic activities for environmental impact assessment and assessment of the environmental impact of proposed economic activities, and the relations between the participants in these processes.

Article 3. Environmental Impact Assessment and Selection for Environmental Impact Assessment

1. An environmental impact assessment of a planned economic activity shall be carried out when:

1) the planned economic activity is included in the List of Types of Planned Economic Activities, the Environmental Impact of which must be Assessed, specified in Annex 1 to this Law;

2) during the selection of a planned economic activity for environmental impact assessment (hereinafter referred to as the selection for environmental impact assessment), it is determined that an environmental impact assessment must be carried out for the planned economic activity;

3) the implementation of the planned economic activity may have an impact on the European Ecological Network for Natura 2000 areas and when it is determined in accordance with the procedure established by the Minister of the Environment that this environmental impact may be significant;

4) the organizer of a planned economic activity included in the List of Types of Planned Economic Activities for Which Screening for Environmental Impact Assessment is Required, specified in Annex 2 to this Law, decides to commence an environmental impact assessment without conducting a screening for environmental impact assessment.

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2. Screening for environmental impact assessment shall be carried out for planned economic activities included in the List of Types of Planned Economic Activities for Which Screening for Environmental Impact Assessment shall be Carried Out, specified in Annex 2 to this Law.

3. The screening for environmental impact assessment and/or environmental impact assessment of the planned economic activity (hereinafter referred to as the environmental impact assessment) must be carried out before the issuance of a permit established in the laws (construction permit, permit for the use of subsoil resources or cavities, permit for integrated pollution prevention and control, pollution permit and other permits required for the performance of economic activities included in the lists of types of planned economic activities specified in Annexes 1 and 2 to this Law). If the screening for environmental impact assessment and/or environmental impact assessment is not carried out, the permit shall not be issued.

Annex 1 to the EIA Law

10. ***Other planned economic activities:***

10.4. installation of wastewater treatment plants in cities, towns or villages (where the plants can treat the amount of pollutants equivalent to 150,000 or more inhabitants);

Annex 2 to the EIA Law

1. Agriculture, water management, forestry:

1.6. economic activity, the planning of which involves the preparation of a rural development land management or land plot formation and transformation project (when the area of the planned territory is 1 ha or larger), which changes land use to implement the planned solutions, except for:

1.6.2. when it is planned to carry out an economic activity specified in Annex 1 to the Law of the Republic of Lithuania on Environmental Impact Assessment of Planned Economic Activities or in this Annex in the planned territory;

11. Other planned types of economic activities:

11.9. installation of water treatment facilities:

11.9.1. installation of wastewater treatment plants in cities, towns or villages capable of treating the amount of pollutants equivalent to less than 150,000 but more than 2,000 inhabitants;

11.9.2. installation of surface wastewater treatment plants for surface wastewater collected by sewerage networks from an area of 50 ha or more;

The Law of the Republic of Lithuania on Special Conditions of Land Use (hereinafter referred to as the Law on Special Conditions of Land Use). Section 12 of the Law on Special Conditions of Land Use regulates the karst region of Northern Lithuania, intensive karst lands – territories where more than 5 sinkholes are found per 100 hectares, karst sinkhole protection zones (land strips

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around karst sinkholes, the width of which is 5 meters from the edge of the slope) special land use conditions apply (Article 107(1)).

The boundaries of the Northern Lithuanian karst region and groups of intensive karst lands in this region are determined by the Minister of the Environment (Article 107(2)).

Article 108. Special conditions for land use in the karst region of Northern Lithuania

1. In the karst region of Northern Lithuania it is prohibited to:

1) discharge (infiltrate) untreated wastewater into the ground;

2) carry out economic activities without assessing the impact on surface and groundwater (this provision applies to economic activities for which, according to the Law on Environmental Impact Assessment of Planned Economic Activities, environmental impact assessment procedures must be carried out);

3) to construct new structures without the results of engineering geological and geotechnical surveys carried out and registered in accordance with the established procedure. This provision is not mandatory when constructing new simple structures, non-special structures: residential buildings (one, two apartments) and their annexes, buildings for other purposes (farms, farms, greenhouses and gardens);

4) straighten and deepen natural river beds, change their hydrological regime, build dams, and install hydroelectric power plants near existing dams;

5) to drain (except for the repair of existing drainage) or irrigate land, except for the irrigation of vegetable gardens, orchards, flower beds, and lawns;

6) to spread chemical plant protection products and mineral fertilizers from aircraft;

7) use liquid fertilizers;

8) to pour any liquids and pour any solid materials (wastewater, drainage water, waste, etc.) into karst sinkholes, except for soil when the sinkhole is closed;

9) to dig peat in karst sinkholes, to plough and turn karst sinkholes into arable land;

10) fill in karst sinkholes that have opened up in the territory of Biržai Regional Park without obtaining the approval of the park administration;

11) fill in karst sinkholes without obtaining the approval of a representative of the municipal administration authorized by the director of the administration of the municipality in whose territory the sinkhole has opened (when the karst sinkhole does not fall within the territory of Biržai Regional Park);

12) fill sinkholes with non-clay soil.

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2. In lands of intense karst:

1) a crop structure, fertilisation and plant protection product application system other than those set out in points 4–7 of this Part is prohibited;

2) plant protection products are used (except for intensive karst soils of group IV) in accordance with the Rules of Good Plant Protection Practice approved by the Minister of Agriculture;

3) on all farms, except for private farms, soils may be fertilized only in accordance with fertilization plans prepared in accordance with the procedure established by the Minister of the Environment and the Minister of Agriculture;

4) in intensive karst group I soil:

a) perennial grasses must constitute at least 20 percent of the crop;

b) up to 100 kg/ ha of total nitrogen from mineral and organic fertilizers can be applied to the soil per year during fertilization; up to 20 t/ ha can be applied to the soil per year during fertilization with litter manure alone;

5) in intensive karst group II soil:

a) perennial grasses must constitute at least 30 percent of the crop;

b) up to 80 kg/ ha of total nitrogen from mineral and organic fertilizers can be applied to the soil per year during fertilization; up to 16 t/ ha can be applied to the soil per year during fertilization with litter manure alone;

6) in intensive karst group III soil:

a) perennial grasses and pastures must constitute at least 40 percent of the crops;

b) up to 70 kg/ ha of total nitrogen from mineral and organic fertilizers can be applied to the soil per year during fertilization; up to 14 t/ ha can be applied to the soil per year during fertilization with litter manure alone;

7) in intensive karst group IV soil:

a) there may only be meadows and forests, and honey and medicinal plants may be grown;

b) only organic fertilizers may be used; up to 60 kg/ ha of total nitrogen may be applied to the soil per year or up to 12 t/ ha of litter may be applied to the soil;

(c) the use of plant protection products is prohibited on grassland and arable land.

3. In the protection zone of a caisson sinkhole, it is prohibited to:

1) work the land nearby or in any other way (only perennial grasses can be grown, which must be mowed, and the hay is removed from the area);

2) fertilize with organic and mineral fertilizers;

3) use plant protection products.

~~Law on Territorial Planning of the Republic of Lithuania. The pur~~pose of the Law on Territorial Planning is to ensure the sustainable development of territories and rational urbanization by determining the territorial

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requirements for the systematic nature of planning process solutions, compatibility of documents at different levels and mutual impact, to create conditions for the harmony of the natural and anthropogenic environment, urban quality, while preserving valuable landscapes, biodiversity, and natural and cultural heritage values.

Article 4. Levels of spatial planning

1. Spatial planning levels:

1) state – the entire territory of the state or its parts are planned (general plans and special territorial planning documents are prepared for the entire territory of the state, and, if necessary, for parts of the territory of the state distinguished by administrative (regions, counties) or functional unity, at a scale of M 1:100,000–1:400,000);

2) municipalities – planned territories distinguished by administrative (municipal) or functional unity (general plans and special territorial planning documents are prepared at a scale of M 1:20,000–M 1:50,000);

3) areas – planned parts of the territory of a municipality: cities (or parts thereof), towns (or parts thereof), villages and single-settled areas (general plans (scale M 1:2,000–M 1:10,000), detailed plans (scale M 1:500–M 1:1,000) and special territorial planning documents (scale M 1:500–M 1:10,000) are prepared for individual urbanized or urbanized territories.

5. Land managers and users shall be guided by the lowest-level integrated territorial planning documents in force in the planned territory, and in non-urbanized and non-urbanizable territories – by special territorial planning documents, except for the cases specified in paragraph 6 of this Article.

Law on Reclamation of the Republic of Lithuania. The Law on Reclamation establishes the ownership relations of reclamation structures, the rights and obligations of land owners and other users related to the construction, use and protection of reclamation structures, as well as the organization, management, design, expertise of reclamation, accounting of reclaimed land and reclamation structures, and the procedure for financing reclamation.

Article 3. Ownership of land reclamation structures

1. Land reclamation structures located on a land plot are part of the land plot and belong to the owner of the land plot by right of ownership, unless the contract provides otherwise, except for land reclamation and hydraulic engineering structures owned by the state by right of ownership, specified in paragraph 2 of this Article.

2. The state owns by right of ownership: regulated streams, ditches that drain water from the plots of more than one landowner or other user, land reclamation structures located therein, ponds that border the land of two or more landowners or other users, hydraulic structures, polders and other land reclamation systems, if they are mechanically

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water lifting, canalized ditches and drainage collectors, if their diameter is 12.5 cm or larger and if they are built with state funds, regardless of who is the owner of the land plot on which these land reclamation structures are located.

The Land Reclamation Technical Regulation MTR 1.05.01:2005 “Design of Land Reclamation Structures”, approved by the Order No. 3D-1 of the Minister of Agriculture of the Republic of Lithuania of 3 January 2005 “On the Approval of the Order No. 3D-1 of the Minister of Agriculture of 3 January 2005 “On the Approval of the Land Reclamation Technical Regulation MTR 1.05.01:2005 “Design of Land Reclamation Structures”, establishes the main requirements for the design and construction of newly constructed, reconstructed and repaired land reclamation structures, taking into account the peculiarities of the use of land reclamation structures. The Regulation establishes the composition of documents for the preparation of land reclamation structures and the procedure for their preparation, the procedure for the approval, amendment, supplementation, completion and storage of land reclamation structures.

Surface Wastewater Management Regulation, approved by Order No. D1-193 of the Minister of the Environment of the Republic of Lithuania of 2 April 2007 “On the Approval of the Surface Wastewater Management Regulation” (hereinafter referred to as the Surface Wastewater Regulation). The Surface Wastewater Regulation establishes environmental requirements for the collection, treatment and discharge of surface wastewater in order to protect the environment from pollution.

2 Feasibility study

2.1. Analysis of the needs and expectations of interested parties

In order to assess the needs and expectations of the residents of Biržai district as accurately as possible, a survey was conducted, focused on target groups of stakeholders – Biržai Farmers' Union, Biržai District Rural Communities' Union, UAB "Biržų vandenys". Questionnaires with accompanying documents for each stakeholder group can be found in Annexes No. 1, 2, 3. After conducting the survey, responses were received from UAB "Biržų vandenys" and 6 farmers, therefore these will be further evaluated (completed questionnaires are presented in Annexes No. 4 and 5). Similar questions were asked to all stakeholders, only slightly adapted to the specifics of the individuals. UAB "Biržų vandenys" identified in the survey that they were familiar with

with the concept of constructed wetlands and indicated that there are already similar examples in the Biržai district.
It is emphasized that wastewater treatment plants operating on the principle of constructed wetlands have not proven themselves and there are no plans to install more of them in the future, while the existing ones are planned to be reconstructed into biological wastewater treatment plants. However, the need to improve the operation of existing wastewater treatment plants and the efficiency of wastewater treatment by reducing environmental pollution is noted, since the existing infrastructure often no longer cleans wastewater to the required standards is noted.
It is indicated that reconstruction is required at the following treatment plants: Kiršoniai, Kirdoniai, Mieliŷnai,

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In the areas of Šukionys, Germaniškis, N.Radviliškis, Anciškis, Skrebiškis, Kvetkÿs, Kuÿgalis, Kupreliškis, Ramongaliÿ, Kratiškis, Obelaukias. As indicated by UAB "Biržÿ vandenys", the operation of the treatment plants constructed on the principle of wetlands has not proven to be successful so far, so the possibility of constructing more such wetlands and being responsible for their maintenance is not conceivable. This would not be a suitable solution at the moment due to the lack of human resources and the increased need for centralized wastewater networks, and a much larger area would be required to install the constructed wetland so that it would be able to treat the increased amount of wastewater.

The responses of the farmers who participated in the survey were quite similar to each other. It is worth noting that most of the surveyed farmers are familiar with the concept of constructed wetlands, but there is no interest in installing such wetlands in their territories for surface water treatment. Some farmers admit that they have a lack of knowledge about constructed wetlands, but only one of them expressed a possible interest in exploring this type of solution in more detail, but still would not plan to install such a wetland. Two respondents mentioned that the limiting factor for installing a constructed wetland is the lack of space.

The Biržai District Union of Rural Communities did not submit completed questionnaires, so they did not participate in the survey - their position on these issues is not known.

2.2. Estimation of investment and maintenance costs

To date, there are not many examples of constructed wetlands in Lithuania. The initial analysis of investment needs was based on publicly available information on
The experience of the project (Strengthening the Management of Marine and Inland Waters) implemented by the Environmental Protection Agency in 2016–2017.

One of the activities of this project was to install and test the tools (constructed wetlands, drainage runoff management systems and sedimentation ponds) designed to reduce water pollution from diffuse agricultural pollution sources in pilot river basins. During the implementation of the activity, the locations for the installation of the aforementioned mitigation measures were justified, and the measures themselves were designed and installed: a wetland on the regulated Stabÿ stream in the village of Terespolis, Kÿdainiai district, 3 sedimentation ponds and 10 drainage runoff management systems.

Table 4. Main technical indicators of the constructed wetland. Source: “Installation of diffuse water pollution reduction measures in the pilot basin” final report (AAA)

Name	Unit	Quantity
Wetland mirror surface area	ha	2,38
Wetland water volume	m3	12734
Wetland shoreline length	m	1722

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Wetland deep area	ha	0,21
Volume of the deep part of the wetland	m3	2486
Thin-walled practical profile thresholds	Units	2
Local automatic water parameter measurements Units.		2

During the project, only pilot measures were implemented, the installation costs of which depended not only on the scope of work, but also on additional structures and equipment required for monitoring.

A project implemented by the Environmental Protection Agency developed recommendations for potential developers of agricultural pollution reduction measures. Based on these recommendations, the cost of installing a wetland per 1 ha was calculated at EUR 21,164 (in 2015 prices).

The estimated cost of installing a pilot measure, i.e. a 2.38 ha wetland in Lithuania, was 137,000 EUR. The cost of installing three sedimentation ponds ranged from 5,300 to 24,000 EUR, and the cost of installing ten drainage runoff management systems (on an area of 21.06 ha) was 25,300 EUR. The table below shows the cost of designing and installing a pilot wetland in Lithuania (based on 2015 prices).

Table 5. Cost of designing and installing a pilot wetland (Eur).

	Estimated neither price	**Projects but**	**Orders in books**	**Construction and installation as**	**Work wages tis**	**Material you**	**Mechaniz may**
Footsteps (2.38 ha)	165779	13701	15071	137007	16846	47483	24745
Footsteps 1 ha price	69655	5757	6332	57566	7078	19951	10397

The actual cost of designing and installing pilot sedimentation ponds (in 2015 prices) was EUR 37,389, while the cost of designing and installing pilot drainage runoff management systems was EUR 28,831. The price includes the costs required for installation and maintenance, i.e. the value of materials, including delivery costs, costs of mechanized work,

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labor costs and overhead costs, maintenance and use costs of installed technical equipment.

After installation, the maintenance of wetlands and sedimentation ponds is also costly, as it requires periodic cleaning of accumulated sediment. Maintenance work includes monitoring the functioning of the installed facilities, checking and eliminating damage to structural parts that may occur due to erosion and/or landslides. It is also necessary to monitor the amount of sediment accumulated in the deep part, i.e. in the sedimentation pond. Other maintenance work requires constant mowing of grass at the inflow and outflow points and removing accumulated sediment that may impede the flow of water. Periodic mowing also stimulates the growth of many plant species, and mowing also removes accumulated nutrients and excess organic matter.

Based on the experience of the project carried out by the Environmental Protection Agency, the following is described: The main possible stages of maintenance and a preliminary cost estimate are provided:

- monitoring of vegetation overgrowth and removal of excess vegetation, which is carried out once a year when the amount of debris reaches a limit that optimally interferes with the functioning of the installed facilities. This work can be carried out by farmers or community members. The costs can range from 500 to 1000 EUR;
- nitrogen (N) and phosphorus (P) measurements and soil removal. If determined during the research significant accumulations of nitrogen and phosphorus, which can occur when using large amounts of fertilizer in adjacent fields. The costs can range from 2,000 to 4,000 EUR;

- water retention measurements[7], needed during the period of average water content. The costs can range from 5,000 to 6,000 EUR;
- wildlife regulation, damage removal if it is determined that wildlife (e.g. beavers and their dams) prevent the optimal operation of the installed measures. The costs can range from 100 to 1500 EUR;

- maintenance after floods or landslides and restoration of facilities as needed, carried out immediately after these events. Costs based on the extent of the damage;
- inspection and cleaning of drainage mouths. Costs can range from 100 to 300 EUR;
- restoration of facilities after acts of vandalism, if any. Costs according to damage size.

[7] Water retention time, together with water volume and depth, are the most important ecohydrological indicators. Water retention time is measured during the average water content period. Powdered markers (paints) were used to determine water retention time, after which their spreading and movement speed were monitored. The retention time was calculated as the moment when the markers completely disappeared from the studied object, i.e., the water became clear at the wetland outlet.

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The cost-effectiveness of environmental measures was also assessed during this pilot project. It is stated that engineering and technical measures to reduce diffuse agricultural pollution require considerable financial resources. It is proposed that agronomic measures, such as optimal fertilizer rates, fertilizer application dates, etc., should be provided to reduce nitrogen and phosphorus inputs from drainage systems. If agronomic measures fail to achieve the desired results, they are proposed to be combined with additional engineering measures.

When comparing the costs of installing wetlands, the project used several foreign sources, based on which the installation costs range from 16,000 to 247,400 EUR. Meanwhile, the cost of installing a sedimentation pond ranges from 356 to 3,940 EUR per unit. A protective strip – from 300 to 1,000 EUR/ha, drainage wells from 44 to 196 EUR/ha, bioreactors – from 7,056 to 10,600 EUR per unit. In Lithuania, due to its specific conditions, installation costs may vary.

The installation of environmental measures is not financially profitable and landowners may not be interested in losing part of their cultivated land and investing their funds in the installation of such measures. It is important to motivate farmers and local communities to participate in environmental programs and to seek opportunities to use existing support mechanisms.
schemes.

According to the analysis carried out by the aforementioned project, such projects are most often supported by state funds. Information collected during the project implementation period showed that, for example, Sweden finances up to 90% of the cost of installing wetlands and allocates annual payments for maintenance (150 EUR/ha in meadows and up to 400 EUR/ha in arable land per year). Similar support conditions have been analyzed in Finland. It is understood that the size of the payments may also determine the interest of landowners in participating in the implementation of environmental measures. Already in 2014 - 2020.
The Lithuanian Rural Development Programme prioritized restoring, preserving and improving ecosystems dependent on agriculture and forestry. The measure "Agri-environment and climate" was available for implementing measures to reduce diffuse agricultural pollution, under which extensive wetland management was also supported, with a contribution of EUR 208/ha.

Based on the information provided in the Lithuanian Agricultural and Rural Development Strategic Plan for 2023–2027 on the calculations of the average amount of support for the installation of regulated drainage, the average cost of installing regulated drainage is approximately EUR 850/ha.

The WaterMan project was implemented in the city of Gargždai, the aim of which was to apply a nature-based solution for collecting rainwater, directing it to a pond and reusing the water for own needs. The project is currently implemented (2025), the total project estimate is 318,000 EUR.

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2.3. Analysis of possible funding sources

According to the 2022–2030 Development Programme of the Ministry of the Environment of the Republic of Lithuania, which manages the Development Programme for Environmental Protection and Climate Change Management (MOE Development Programme)8, progress measure No. 02-01-06-07-01 “Improving the condition of water bodies”9 Sub-activity No. 1.3 provides for the allocation of 18.885 million euros from the State budget (funds from the Environmental Protection Support Program) for the implementation of industrial and surface wastewater treatment technologies.

Potential recipients of this funding are industrial enterprises, surface wastewater managers, and municipalities that have prepared projects that meet the conditions of the Description of Financing Conditions for Projects Implementing Industrial and Surface Wastewater Treatment Technologies10.

Supported activities:

- financing the purchase of equipment that reduces wastewater pollution, transportation, installation and adjustment;
- installation and/or construction of surface wastewater treatment plants (hereinafter referred to as WWTPs) or other pollution reduction measures when an industrial enterprise discharges wastewater into the environment; installation and/or construction of surface wastewater treatment plants or other pollution reduction measures when an industrial enterprise discharges wastewater into a surface wastewater collection system from which wastewater discharged into the environment is not treated; installation of measures for the treatment or pollution reduction of surface wastewater generated in a potentially polluted area;
- installation of measures to reduce the pollution of surface wastewater at the point of its generation;
- Redesigning the existing surface water collection system to ensure that clean surface water (e.g. from roofs) is not mixed with water from potentially polluted areas;
- Eligible costs also include costs of works and environmental restoration related to the project being implemented, which are provided for in the legal acts regulating construction as necessary.

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[8] Resolution of the Government of the Republic of Lithuania of 30 March 2022 No. 318 “On the approval of the Environmental Protection and Climate Change Management Development Programme of the Ministry of the Environment of the Republic of Lithuania, the manager of the 2022–2030 Development Programme” (progress objectives 6.4, 6.6–6.8, 6.10 and 6.11).

[9] Approved by Order No. D1-231 of the Minister of the Environment of the Republic of Lithuania of 15 July 2022 "On the approval of the description of the progress measure No. 02-01-06-07-01 "Improving the condition of water bodies" of the Ministry of the Environment of the Republic of Lithuania, the manager of the 2022–2030 development programme".

[10] Approved by Order No. D1-276 of the Minister of the Environment of the Republic of Lithuania of 13 August 2024 “On Amendments to Order No. D1-231 of the Minister of the Environment of the Republic of Lithuania of 15 July 2022 “On the Implementation of Progress Measure No. 02-01-06-07-01 “Improving the Status of Water Bodies” of the Environmental Protection and Climate Change Management Development Programme of the Ministry of the Environment of the Republic of Lithuania, the Manager of the 2022–2030 Development Programme”.

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Financial support provided under this measure is a potential source of financing for industrial enterprises or surface water managers installing a constructed wetland to reduce industrial or surface water pollution. It should be noted that the National Water Area Plan 2022–2027 (hereinafter referred to as the NVSP) Implementation Action Plan11

It is envisaged that the Biržai District Municipality must improve the treatment of surface wastewater at the facility UAB “Biržų ranga” (outlet code – 1360109) by installing suspended particle settlers and oil traps (NVSP implementation action plan action No. 1.3.1.5. “Install stormwater treatment facilities at outlets that indirectly discharge wastewater into the lake (Annex 3)).

The source of funding for the support is the European Economic Recovery and Resilience Fund.
Fund for Rural Development, European Agricultural Fund for Rural Development.

Form of financing – grant. The maximum possible financing of project activities – 70 percent. of eligible costs. The remaining part of the project activities is financed from the applicant's own contribution. Calls for submission of project implementation plans for financing projects are prepared by the Environmental Project Management Agency (hereinafter – APMA), the call is published on the APMA website.

The total amount allocated for the activities for 2024–2026, for which calls are being published, is 6,133,289 Eur.

Over 3.6 million euros in support were allocated to those who won the calls for proposals in the 2024-2025 period. Eur.

The additional 2025 call for applications for the implementation of industrial and surface wastewater treatment technologies ended on 30 June 2025. 2.36 million euros were allocated from the state budget for the support measure under this call. **Legal entities and individuals engaged in economic activities whose activities generate industrial and/or surface wastewater were invited to apply for support.** According to the information provided on the APVA website12, during the call that lasted more than a month, only 1 project implementation plan was received for the amount of 94 thousand euros.

Further calls for applications for support will be announced after evaluating the results of the calls.
results and after a decision has been made by the Ministry of the Environment regarding the conditions of the invitation.

Lithuanian Agricultural and Rural Development Strategic Plan 2023–2027 (hereinafter referred to as the Strategic Plan) aims for the sustainable development of Lithuania's agriculture and food sector, increasing the sector's

[11] Approved by the Minister of the Environment of the Republic of Lithuania and the Minister of Agriculture of the Republic of Lithuania on 26 April 2023 Order No. D1-122/3D-286 "On the approval of the action plan for the implementation of the National Water Area Plan for 2022–2027".

[12] https://apva.lrv.lt/lt/naujienos-24316/baigesi-kvietimas-gamybiniu-ir-pavirsiniu-nuoteku-valymo-for-technology-implementation/

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added value and competitiveness, supporting the income of viable farms (especially small and medium-sized ones), generational renewal, creating a vibrant countryside attractive for farming and business, and contributing to the implementation of environmental and climate objectives. Environmental and climate objectives – to contribute to climate change mitigation and adaptation, including by reducing greenhouse gas emissions and increasing carbon sequestration, as well as developing sustainable energy; promoting sustainable development and efficient management of natural resources, such as water, soil and air, including by reducing dependence on chemicals.

The installation of constructed wetlands in agricultural fields, in order to reduce diffuse pollution due to economic activities carried out in these fields, contributes to the implementation of environmental and climate goals: reducing negative environmental impacts (reducing pollution of surface water bodies and groundwater) and mitigating climate change (increasing carbon dioxide sequestration).

The Strategic Plan provides for various intervention measures, under which it is planned to provide financial support to projects contributing to the implementation of the objectives set out in the Strategic Plan, however, financial support is not specifically provided for the activity of constructing a constructed wetland. **Taking this into account, financial support under the intervention measures could be obtained if the construction of a constructed wetland was a component of the project activity, e.g., the installation of regulated drainage, the use of rainwater for irrigation.**

The objective of the Strategic Plan intervention measure KP10mel "Investments in land reclamation systems" is to reconstruct existing land reclamation systems, enabling farms to increase the productivity of agricultural activities and at the same time ensure sustainable protection of natural resources (water) from the leaching of pollutants by installing regulated drainage. Well-functioning drainage systems help reduce the leaching of nutrients into surface or groundwater and thus allow farmers to reduce losses due to hydrometeorological phenomena unfavorable to agricultural activities, create opportunities to obtain higher yields and reduce the amount of fertilizers used.

When providing support, special attention will be paid to areas with high levels of diffuse agricultural pollution, poor surface water quality, and projects that envisage additional environmental investments (e.g., installation of double-profile melioration ditch slopes, etc.). Intervention measure KP10mel encourages the installation of regulated drainage systems in existing, renovated melioration systems, which contribute to reducing the use of mineral fertilizers, reducing pollution leaching into surface water bodies, and significantly contributing to the reduction of leaching of nitrogen compounds into inland waters.

For projects contributing to environmental and climate objectives (i.e. where support is provided only for the installation of regulated drainage in existing reconstructed land reclamation systems), the selection criteria may not apply. Where only the installation of regulated drainage in existing

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reconstructed land reclamation systems, at least one of the following environmental investments must be provided for - double-profile land reclamation ditch slopes, constructed wetlands, sediment ponds, stable annuals of stones or logs, installation.

The intervention measure KP10mel has been allocated 40 million euros, of which 36 million euros are allocated for the reconstruction of existing land reclamation systems, and 4 million euros for the installation of regulated drainage in already reconstructed land reclamation systems. The average amount of support for projects whose activity is the installation of regulated drainage in reconstructed land reclamation systems is 40,000 euros. In total, it is planned that 100 projects will receive support under this activity.

Beneficiaries:

- agricultural entities;
- associations of users of land reclamation systems;
- a group of natural and/or legal persons whose legally controlled land boundaries coincide with the boundaries of a specific (reconstructed) land reclamation system, operating under a joint activity agreement;
- municipalities.

Projects submitted by applicants specified in paragraphs 1–3 must be submitted with a partner – municipality. The partnership is based on the fact that the municipality manages the majority of the state-owned land reclamation structures under the right of trust, which are reconstructed by the applicants specified in paragraphs 1–3. When submitting applications with a partner municipality, a joint activity agreement must be concluded. Before submitting an application, the applicant must agree on the ownership rights of the results created during the project, the assets purchased or created and the works performed and establish these rights in the joint activity agreement13 .

When the applicant municipality must be presented at a municipal council meeting protocol on project financing.

The strategic plan provides that under this measure, about 30 percent of projects will be implemented by individual farms, while the rest will be implemented by associations of users of land reclamation systems, municipalities, and other natural and legal persons.

Under the Strategic Plan intervention measure KP12vld "Investments in agricultural holdings", it is planned to support investments in tangible and intangible assets related to supported activities, which include investments in primary production, processing, and marketing of agricultural products produced on one's own holding. The intervention measure is planned to provide support in all agricultural sectors by providing support for real estate

[13] Rules for the implementation of the intervention measure “Investments in land reclamation systems” of the Lithuanian Strategic Plan for Agriculture and Rural Development 2023–2027, approved by Order No. 3D-563 of the Minister of Agriculture of the Republic of Lithuania of 24 August 2023 “On the approval of the rules for the implementation of the intervention measure “Investments in land reclamation systems” of the Lithuanian Strategic Plan for Agriculture and Rural Development 2023–2027”, p. 21.

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to finance construction and/or improvement costs, new facilities and/or equipment (including new machinery), and the costs of installing and/or improving the infrastructure of the holding.
When providing support, it is planned to focus on investments related to the implementation of innovative, advanced and digital technologies focused on reducing production costs and saving energy, creating greater added value by processing products grown on one's own holding, implementing alternative energy sources, supporting investments in solar panels, collectors, solar modules, geothermal heating, air-to-air, air-to-water heating systems, when they are related to the needs of a production building being built or reconstructed in order to use all the energy produced on one's own holding, **and using rainwater for irrigation.**

The project - the installation of a constructed wetland - could qualify for financial support under the intervention measure KP12vld if the treated rainwater coming out of it will be used for field irrigation.

Potential beneficiaries: farmers (natural persons (who have registered a farmer's farm and holding in their own name) and legal persons (who have registered a holding)) or a group thereof engaged in agricultural activities and/or processing and placing on the market agricultural products produced and/or grown on the holding(s), recognised agricultural cooperatives (i.e. which purchase and sell only agricultural products produced or grown on the holdings of their members or process and sell food and non-food products produced from the agricultural products purchased from their members and grown on their holdings). Intervention measure support is provided to farms whose registered agricultural holding has an economic size, expressed in standard output (SP) value, of at least EUR 30,001.

The same activities as those specified in the intervention measure KP12vld are also supported under the following intervention measures of the Strategic Plan, however, the economic size of the registered agricultural holding or the duration of economic activity of the farms that may be supported differs:

– under the intervention measure KP32svp "Development of small and medium-sized farms", support is granted to farms whose registered agricultural holding has an economic size, expressed in standard output (SP) value, of at least EUR 16,001 and no more than EUR 30,000;

– under the intervention measure KP19sÿp "Development of very small farms", support is granted to farms whose registered agricultural holding has an economic size, expressed in standard output (SP) value, of at least EUR 4,000 and no more than EUR 16,000;

– under the intervention measure KP17jÿs "Setting up of young farmers", support is provided to new farms.

Strategic Plan Ecological Systems Intervention Measure TI05eko1.5 -
The maintenance of landscape elements aims to restore and preserve the traditional mosaic

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landscape. Areas with high mosaicity create conditions (niches) for various plant and animal species to live and reproduce, thus contributing to the preservation of biodiversity. This intervention measure encourages the establishment of new and/ or maintenance of existing landscape elements.

Under this intervention measure, 3 compensatory payments have been established for: maintenance of existing landscape elements; establishment of new herbaceous elements; planting of new woody elements. Applicants participating in this intervention measure may apply for one of these three compensatory payments for the same area, at their discretion.

EUR 39.73 million has been allocated for the implementation of this ecological system. The planned amount of compensation for the maintenance of existing landscape elements is EUR 150/ha, for the establishment and maintenance of new herbaceous elements – EUR 206/ha, for the planting of new woody elements – EUR 1,329/ha.

Support is provided for the management and establishment of landscape elements on arable land and perennial meadows. According to this ecological system, linear, point and area landscape elements are distinguished. Area landscape elements include:

• annually flooded areas on arable land; • water bodies (ponds,
ponds, lakes).

Specification of these elements: the element must be interspersed with or adjacent to the applicant's declared as arable land or perennial meadows; minimum area 100 m2 ; maximum area 0.5 ha.

By choosing a technical nature-based solution for wastewater treatment that would be in line with the landscape element, its installation and maintenance could qualify for support under this ecological system intervention measure.

For the implementation of each intervention measure of the Strategic Plan, rules are approved by order of the Minister of Agriculture, which establish a list of eligible costs and actions. In accordance with these rules, the National Paying Agency under the Ministry of Agriculture (hereinafter referred to as the NPA) prepares and publishes calls for applications for financial support14, and assesses the compliance of submitted projects with the requirements and financing conditions set out in the rules.

At the end of each calendar year, the schedule for accepting applications under the intervention measures of the Strategic Plan for the following calendar year is approved.
Applications for support under the Lithuanian Agricultural and Rural Development Strategic Plan 2023–2027

[14] https://www.paramakaimui.lt/index.php/parama/12?tab=1

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The schedule for adopting the plan's intervention measures in 2025 was approved on 1 October 2024 by Order No. 3D-69615 of the Minister of Agriculture .

The strategic plan also provides for the offering of a combination of preferential loans and subsidies for those seeking to invest in agricultural holdings. Farmers (including managers of small and medium-sized farms, as well as young farmers) are provided with additional opportunities to apply for financing under the following financial instruments: individual guarantees (UAB ILTE, state budget funds), portfolio guarantees (UAB ILTE, European Regional Development Fund (ERDF) and returning funds), interest compensation (UAB ILTE, state budget funds), preferential loans (UAB ILTE, state budget funds, returned funds)16 .

2.3. Assessment of legal validity

The study examines various technical nature-based solutions for wastewater treatment. These solutions can be:

- forming a gravel layer, planted with reeds and marsh vegetation, cleaning it flowing wastewater;
- installing infiltration systems with sand filters; • forming sedimentation ponds with stone/vegetation barriers, thresholds, and water regulation systems, which slow down the flow of water and allow purified water to enter natural water bodies;
- by installing wastewater stabilization ponds, wastewater is treated using natural biological, physical and chemical processes; • by planting areas along rivers, lakes and agricultural fields, which absorb and filters flowing surface wastewater.

The technical solution chosen for implementation, the size of the facilities (e.g., pond area), the location of the solution, the environment and the impact on it determine which permits (licenses) specified in legal acts must be obtained for the implementation of this activity. The following is an analysis of essential permits, etc., which may be relevant (depending on the specifications of a specific project) when implementing nature-based solutions for wastewater treatment.

[15] https://www.e-tar.lt/portal/lt/legalAct/68e69e317fe411efabdbb4a1fc8b0b63/asr

[16] Strategic Plan, page 274, https://zum.lrv.lt/public/canonical/1741099952/17543/Strateginis_planas_v._5.2_20250303.pdf

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Pollution permit

Part 1 of Annex 1 to the Rules for Issuance, Amendment and Cancellation of Pollution Permits (hereinafter referred to as the Pollution Permit Rules)17 specifies the criteria that require a special part of the permit for the operation of facilities meeting the criteria for wastewater treatment and discharge. Pollution permits are issued by the Environmental Protection Agency upon receipt of an application for a pollution permit prepared in accordance with the requirements set out in the Pollution Permit Rules. Given that wastewater from a wastewater treatment facility (constructed wetlands, etc.) enters the natural environment, a pollution permit is required for their installation if:

- it is planned to release 5 m3 per day or more of domestic, industrial, etc. (except surface) wastewater into the natural environment (surface water bodies, filtration facilities, fertilization fields, etc.) (calculated by dividing the amount of wastewater discharged or expected to be discharged per year by the number of days of discharge) (Annex 1, paragraph 1.1);
- it is planned to discharge surface wastewater into the environment, which is collected from potentially polluted territories with a surface wastewater collection area of more than 1 ha (excluding parking lots) (Annex 1, paragraph 1.2);
- surface wastewater discharged into the environment, collected from surfaces of 10 ha and larger, intended for road transport (streets, access roads, parking lots) (Annex 1, paragraph 1.3);
- wastewater discharged into the natural environment, except for domestic wastewater, in which, regardless of the amount/flow of wastewater, the concentration of priority substances is equal to or higher than the limit concentration value for the natural environment specified in Part A of Annex 2 to the Wastewater Management Regulation18 and/or in which the concentration of priority hazardous substances is higher than the environmental quality standard specified in Annex 1 to the Wastewater Management Regulation, expressed as the maximum permissible concentration (hereinafter referred to as the MRL-AQS), for inland surface waters, and when no MRL-AQS has been established for the substance, the environmental quality standard expressed as the annual average value for inland surface waters (Annex 1, point 1.4);
- it is planned to release 5 m3 per day or more of water into surface water bodies (calculated by dividing the amount of water released or expected to be released per year by the number of days of release) from fishery ponds (Annex 1, paragraph 1.6).

Installation of artificial water bodies

The construction of ponds is regulated by the Description of the Requirements for the Protection of Environmental Protection and Land Reclamation Systems for the Construction and Use of Impermeable Artificial Water Bodies (hereinafter referred to as the

[17] Approved by Order No. D1-259 of the Minister of the Environment of the Republic of Lithuania of 06 March 2014 “On Pollution Permits” "approval of the rules for the issuance, amendment and cancellation of

[18] approved by the Order No. D1-236 of the Minister of Environment of the Republic of Lithuania dated 17 May 2006 “On Wastewater Management” approval of the regulation".

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Description of artificial water bodies)19. Paragraph 4 of this description states that when installing, using or managing a non-flowing artificial water body, the provisions of the Water Law, the Law on Protected Areas, the Law on Subsoil, the Law on Special Conditions for Land Use, the Law on Reclamation, and the Law on Protected Species of Animals, Plants and Fungi must be followed and it must be ensured that there will be no:

4.1. felled protected trees and shrubs, except in cases where a permit has been obtained or a decision has been made in accordance with the procedure established by the Law on Greenery of the Republic of Lithuania to fell, otherwise remove from the place of growth or intensively prune protected green spaces;

4.2. protected landforms are destroyed or altered, protected plant, animal or fungal habitats or habitats, natural habitats of European Community importance are destroyed or affected;

4.3. the land reclamation systems and structures owned by the state or affecting the drainage of third party lands, the hydrogeodynamic regime created by the structures and facilities are damaged;

4.4. flooded areas of adjacent land plots.

In accordance with the provisions of the description of artificial water bodies, when planning to install **an impermeable artificial water body with an area of more than 0.1 ha or of any size in the karst region of Northern Lithuania,** the territories of which were approved by Order No. D1-655 of the Minister of the Environment of the Republic of Lithuania of 2008-12-04 "On the determination of intensive karst lands of the Northern Lithuanian karst region, classifying them into karst phenomena intensity groups", it is mandatory to submit the documents and information specified in paragraph 14 of the description of artificial water bodies **to the Environmental Protection Department under the Ministry of the Environment and the Lithuanian Geological Survey under the Ministry of the Environment** (p. 12).

When planning to install a non-flowing artificial water body of any size in a state park, biosphere reserve, in the buffer protection zone of a state park or state reserve, including the Natura 2000 network territories located in these territories, the installation of a non-flowing artificial water body **must be coordinated with the Directorate of Protected Areas.** When such a body is planned to be installed in a state reserve, biosphere reserve, restoration plot or Natura 2000 network territory where there is no Directorate of Protected Areas, the installation of such a body must be coordinated with the Directorate of Protected Areas, which is entrusted with the approval of the Director of the State Service for Protected Areas under the Ministry of Environment by Order No. V-9 of 21 January 2019 “On protected areas established by the state that do not have directorates and territories of the European ecological network Natura 2000 that do not fall within the scope of the Directorate of Protected Areas”.

[19] The Order of the Minister of the Environment of the Republic of Lithuania and the Minister of Agriculture of the Republic of Lithuania of 12 July 2012 No. D1-590/3D-583 "On the Approval of the Description of Environmental Protection Requirements for the Installation and Use of Impermeable Artificial Water Bodies Regulating the Installation of Ponds and Land Reclamation Systems" was approved.

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state parks, reserves or biosphere reserves, the protected area is assigned to the Directorates of Designation of Protected Areas (p. 13).

When providing information about the planned construction of a non-flowing artificial water body to the responsible institutions, the following documents specified in point 14 must be submitted together with the application (the application form is provided in the appendix to the description of artificial water bodies):

14.1. a drawing of a non-flowing artificial water body, indicating the parameters of the planned non-flowing artificial water body (depth, area, profile), coastal protection strips (if the coastal protection strips of the planned water body fall on a land plot owned by another person, it is necessary to submit their written consent for the installation of a non-flowing artificial water body);

14.2. a plan of the land plot with a marked location and coordinates of the impermeable artificial water body in the Lithuanian coordinate system;

14.3. the method of handling the excavated soil and/or fertile soil layer during the installation of a non-permeable artificial water body, the locations of spreading the excavated soil and/or fertile soil layer are marked on the land plot plan. If the excavated soil and/or fertile soil layer is planned to be handled on another land plot owned by the owner, the coordinates of this plot are indicated;

14.4. other information related to the installation of a leak-proof artificial water body that, in the opinion of the person submitting the request, is important.

When planning to install an impermeable artificial water body of any size on reclaimed land, a project for the installation of an impermeable artificial water body and the reconstruction of reclamation structures (hereinafter referred to as the project) must be prepared, which is prepared by the persons specified in the Rules for the Certification of Reclamation Companies and Specialists, approved by Order No. 3D-258 of the Minister of Agriculture of the Republic of Lithuania of 2005-05-05 "On the Approval of the Rules for the Certification of Reclamation Companies and Specialists". The project must **be coordinated with the administration of** the municipality in whose territory it is planned to install an impermeable artificial water body.
by submitting the application specified in paragraph 14 of these rules, documents proving the ownership of the land plot and the location of the impermeable artificial water body marked on the topographic and engineering network plan of the plot at a scale of 1:500 with coordinates in the Lithuanian coordinate system (p. 17).

Special land use conditions

In accordance with the Special Land Use Conditions of the Republic of Lithuania (hereinafter referred to as Article 41 of the Law on Water Supply and Sewage, Surface Water Management Infrastructure Protection Zones must be established:

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- water supply and wastewater, surface wastewater treatment pipelines installed up to 2.5 at a depth of one meter;
- water supply and wastewater, surface wastewater treatment pipelines installed at a depth of more than 2.5 meters;
- water supply and wastewater, surface wastewater treatment pipelines with a diameter of is 400 mm and larger;
- water tanks, clarifiers;
- water supply towers, water and wastewater pumping stations, wastewater tanks.

Protection of water supply and wastewater, surface water management infrastructure

The sizes of the zones are specified in Article 42 of the Law on SŽNS:

- The protection zone for water supply and wastewater and surface wastewater treatment pipelines installed at a depth of up to 2.5 meters is a strip of land along the pipeline route, the boundaries of which are 2 meters on both sides of the pipeline axis, the land below this strip and the water above this strip.

- Water supply and wastewater, surface wastewater treatment pipelines installed at a depth of more than 2.5 meters, the protection zone is a strip of land along the pipeline route, the boundaries of which are 3 meters on both sides of the pipeline axis, the land below this strip and the water above this strip.
- The protection zone for water supply and wastewater and surface wastewater treatment pipelines with a diameter of 400 millimeters to 1,000 mm is a strip of land along the pipeline route, the boundaries of which are 5 meters on both sides of the pipeline axis, the land below this strip and the water above this strip.
- Protection zone for water supply and wastewater, surface wastewater treatment pipelines with a diameter of 1,000 mm and larger – a strip of land along the pipeline route, the boundaries of which are 7 meters on both sides of the pipeline axis, the land below this strip and the water above this strip.

- Water tank and clarifier protection zone – a 30-meter-wide strip of land around the outer limits of these devices.
- Protection zone for water supply towers, water and wastewater pumping stations, and wastewater tanks – a 5-meter-wide strip of land around the outer boundaries of these structures or facilities.

Protection zones are registered in the Real Estate Register (hereinafter referred to as the NTR). An application for registration of a protection zone in the NTR shall be submitted by a person interested in the performance of economic activities for which a protection zone must be established, or by another person specified in Article 9, Part 2 of the Law on the Law on the Protection of Land. For registration of a protection zone in the NTR, it is necessary to have a written consent of the owners of land plots registered in the NTR falling within the protection zone, trustees of state or municipal land, and when the land plot has not been formed, trustees of state

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consent to the establishment of a protection zone (hereinafter referred to as the consent of the land owner, state or municipal land trustee). The consent of the state land trustee shall be given in accordance with the procedure established by this state land trustee, the consent of the municipal land trustee shall be given **in accordance with the procedure established by the council of that municipality.**

Article 6 of the Law on the Protection of Natural Resources and Environment specifies the documents that establish protection zones, taking into account the documents prepared for the conduct of economic activities. Article 9, paragraph 4, specifies the deadlines within which applications for registration of a protection zone in the National Register of Natural Resources and Environment must be submitted.

Restrictions on water supply and wastewater, surface water management infrastructure in protection zones specified in the provisions of Article 43 of the Law on SŽNS.

Article 43, paragraph 1 of the Law on Water Supply and Sewerage indicates that water supply and wastewater, In the protection zones of surface water treatment infrastructure, it is prohibited to:

- pour salt (except when roads are salted);
- store fertilizing products and other substances and chemicals used for fertilizing, except for the cases specified in paragraph 2, point 8 of this Article;
- construct and/or equip landfills and bulky waste collection sites;
- pour chemicals and their solutions, oil and its products;
- carry out ground blasting works;
- to lower anchors in water bodies, to swim with lowered anchors and other tools reaching the bottom of water bodies. This requirement does not apply in the protection zones of water supply and wastewater, surface wastewater treatment pipelines with a diameter of 400 mm and larger, deepened at least 10 meters from the bottom of the water body, taking into account the possible leaching and change of the bottom of the water body;
- to destroy vegetation in water bodies with chemicals;
- damage, block or close roads intended to access water supply and sewage, surface water treatment infrastructure.

Article 43, paragraph 2 of the Law on Water Supply and Sewage Treatment Plants states that without obtaining the consent of the owner or manager of the water supply and wastewater and surface wastewater management infrastructure for which a protection zone has been established, it is prohibited to:

- construct, reconstruct, demolish structures and install, dismantle facilities, except for structures and facilities the construction (installation) of which is prohibited in accordance with paragraph 1 of this Article;
- plant greenery;
- to meliorate, irrigate and drain the land;
- change the elevation of the ground surface by more than 0.3 meters (digging or filling the ground) additional soil layer) or carry out underground works;
- dredge water bodies, dig and pump their bottom;

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- carry out direct geological research of the earth's depths and other work related to drilling of wells and taking soil (except soil) samples;
- store any materials, except for materials intended for construction and repair works of water supply and wastewater, surface wastewater management infrastructure, and materials specified in point 1 of paragraph 1 of this Article;
- in the port area – to store fertilizer products and other materials used for fertilization materials, chemicals.

2.4. Risk assessment

When preparing for installation, developing constructed wetlands or maintaining them after installation, there may be various risks, which can be divided into:

- technical;
- environmental;
- social/health;
- management/supervision, and
- regulatory/permits.

Technical risks

Technical risks can affect the effectiveness and durability of a constructed wetland. One of the main risks is improper design, when the size of the wetland is too small, the depth is inappropriate, the types of plants and microorganisms, permeability parameters, etc. are not consistent with the expected amount of wastewater and the level of contamination. Another possible risk is violations of the hydraulic regime: too high a wastewater flow can lead to insufficient contact time with the substrate used, and too low a flow can lead to water stagnation, these violations would lead to inefficient wastewater treatment. In addition, the effectiveness of a constructed wetland can fluctuate significantly depending on the season: in the cold season, biological processes slow down and plants stop growing, which reduces the efficiency of pollutant removal. Therefore, it is important that the design is based on hydrological calculations and the specifics of the are consistent and periodic, in order to ensure the functionality of the system in the long term.

Environmental risks

The installation or operation of constructed wetlands can present various environmental risks that may arise from improper operation or lack of maintenance of the wetland.
One of the main threats is possible secondary environmental pollution, when wetlands become nutrient-poor or polluted due to disruption of the constructed wetland function or accumulated silt.

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source of pathogens. In addition, standing water creates favorable conditions for insects, especially mosquitoes, to breed, which can have an impact on both the environment and the quality of life of people. Another environmental risk is related to changes in biodiversity - if the selected vegetation is not native, or if invasive species enter the system, they can spread beyond the boundaries of the wetland and pose a threat to natural ecosystems. Therefore, it is necessary to ensure an appropriate biological balance, monitor the condition of the constructed wetland and take timely corrective actions in order to avoid negative environmental impacts.

Social and health risks

Constructed wetlands can affect the quality of life of local residents and their attitudes towards this wastewater treatment facility. An improperly designed or poorly maintained wetland can emit unpleasant odors, which can cause dissatisfaction among residents and reduce the attractiveness of the area. Bodies of standing water can become favorable habitats for mosquitoes and other insects, potentially spreading diseases or disrupting daily life. Open, unfenced wetlands can also pose a safety risk to children and animals, especially in more densely populated areas. Social unacceptability can also arise from a lack of information or lack of involvement of residents in the planning process - if the public does not perceive the benefits or does not have the opportunity to express their opinion, they may oppose the creation of such infrastructure. In order to reduce social and health risks, it is necessary to ensure the safety of constructed wetlands, constant maintenance, as well as information and dialogue with the local community.

Management and supervision risks

Although constructed wetlands are often presented as low-maintenance wastewater treatment systems, in practice they may require consistent monitoring, regular vegetation maintenance, sludge removal and hydraulic permeability. The greatest risks arise when there is a lack of clearly defined responsibilities or when those responsible for operating the wetland do not have sufficient knowledge and competence. The long-term operation of a constructed wetland can be financially challenging – although operating costs are usually low, certain maintenance tasks, such as sludge removal or plant renewal, may require additional resources. Without a proper maintenance plan, technical problems or decreasing treatment efficiency may be noticed late.

It is important to create a clear maintenance plan, involve competent responsible persons, and have long-term financial planning at the design stage in order to reduce operational risks and ensure the reliability of the wastewater treatment system.

Regulatory and permitting risks

One of the main threats is unclear or insufficiently clearly regulated legal status – constructed wetlands can be classified into different categories

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(e.g. as wastewater treatment plants, hydrotechnical structures or green infrastructure elements), which leads to different requirements for design, installation and operation. In addition, several different permits or procedures may be required: land use change, environmental impact assessment, pollution permit, etc. If these aspects are not assessed in advance, there may be a risk of delays, additional costs. It is also important to take into account possible conflicts with other territorial planning or land use interests (see section 1.9). Therefore, it is necessary to consult with the responsible authorities at an early stage of the design, ensure legal clarity and plan the process of obtaining all necessary permits.

Table 6. Summary of the analysis of potential risks for the installation of constructed wetlands.

Technical	**Environmental Social / health**	**Management / supervision**	**Regulatory/permits**
Inappropriate design	Secondary pollution	Insect breeding	Insufficient care	Legal restrictions
Hydraulic flow problems	Invasive species	Fragrances and aesthetics	Missing competence	Compatibility are other land use
Seasonal efficiency fluctuation		Population security	Initial finance requirement	

Possible risk management measures

- conduct a comprehensive environmental impact assessment that clearly identifies the risks for a specific constructed wetland installation project;
- involve the local community before designing a constructed wetland;
- to select competent designers for the preparation of the technical project, who would be able to assess not only the engineering aspects of the structure, but also the hydrological and biological aspects, important for the appropriate selection of the composition of organisms;
- assess and plan the funds needed for the maintenance of the constructed wetland throughout the entire period of its operation. Also, establish a clear maintenance plan and appoint competent persons responsible for maintenance.

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2.5. Assessment of the feasibility of integrating wetlands into existing water management and treatment infrastructure

Based on the results of the survey (Chapter 2.1 and Appendix No. 4), UAB “Biržų vandenys” does not see the installation of constructed wetlands as a possible scenario and assesses that the integration of wetlands into the existing wastewater management system is not worth considering. However, The methodology of the NATALIE project partners is applicable specifically to centralized wastewater treatment systems serving smaller settlements and villages, therefore, section 2.6. presents a methodology for the most suitable locations for the installation of wetlands, relevant for the future, if the necessary circumstances for the installation of constructed wetlands change and the possibility of wetland maintenance arises.

2.6. Methodology for selecting a location for the installation of nature-based solutions and assessment

Selection of a suitable location for connecting constructed wetlands to a centralized wastewater treatment system, according to the methodology developed by the NATALIE project partners, is based on three main groups of criteria:

- technical parameters,
- administrative factors and
- additional criteria.

The technical parameters provided by the Latvian University of Life Sciences and Technology allow for the assessment of the suitability of a site for wastewater treatment using constructed wetlands. These parameters should be applied to specific sites that are to be selected. The assessment of technical parameters is carried out for a specific site in order to determine its suitability for treating a certain type of wastewater. This includes the technical assessment of factors such as water flow, soil conditions, etc.

Administrative criteria for selecting suitable sites for the installation of constructed wetlands areas related to the responsibilities and obligations of the municipality where the wetland is planned to be constructed. One of them is to support the construction and maintenance of wetlands. Another important criterion was the permission and commitment of the NATALIE project partner, the municipality where the wetland will be constructed, to provide the opportunity to monitor the wetland during its operation and to organize information events for educational purposes in order to popularize nature-based solutions. By applying the constructed wetland method in the wastewater treatment process and connecting it to a centralized wastewater treatment system, the company operating the treatment facilities could become responsible instead of the municipality. However, Biržai district municipalities

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In this case, based on the results of the survey, UAB Biržÿ vandenys does not currently see the possibility of carrying out maintenance work.

Additional criteria include an analysis of the municipality's strategic documents and the physical adaptation of the area to connect the wetland to the centralised wastewater system. It is relevant that the application of nature-based solutions is promoted in the municipality's development strategy and that the impact on local biodiversity and water quality is taken into account. This is measured by the distance
from Natura 2000 or other natural protected areas. These criteria ensure that the construction of wetlands is supported and planned as a strategic direction of the municipality. Other necessary physical parameters for connecting a constructed wetland to a centralized wastewater system are: the number of households connected to the centralized system and the possibility of discharging treated wastewater into a surface water body.

Selection of a suitable location based on the proposed methodology

The administrative criteria are intended to conduct a preliminary assessment to determine whether it is worth developing a constructed wetland installation project. If the criteria evaluation values are negative, the methodology developers propose to reject the project (see Table 8. Summary of administrative and additional criteria and assessment of the Germaniškis village School and Pušÿ aklg. wastewater treatment plant sites). If we were to follow this proposal, the installation of a constructed wetland could not be considered, because, based on the survey results, UAB “Biržÿ vandenys” would not be ready to carry out maintenance work on the constructed wetland during its operation period. This is one of the essential criteria due to which the installation of a wetland could not be considered. However, if alternative methods of wetland maintenance were considered, for example, more active municipal

involvement and organization of maintenance work from its own funds or etc. then the installation of a wetland could be considered. According to another essential criterion, the municipality does not raise any objections to the permission to conduct monitoring and organize information events for the NATALIE project, since information events are already being held at the moment.

When assessing additional criteria, no mention of nature-based solutions was found in the municipal strategic documents. Direct installation of constructed wetlands is also not mentioned, so the worst possible rating should be given – 0 points.

It is understood that the establishment of wetlands is most encouraged in protected areas and where wastewater is not treated to the required standard, because in this way protected areas are additionally polluted. The aim is to establish wetlands precisely in those areas where their benefits would be greatest in terms of environmental protection and other aspects. More information about protected areas in Biržai district is provided in section 1.3. The map provided (Fig. 9) shows that the highest concentration of protected areas in Biržai district municipality is in the north-eastern and south-western parts.

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According to the number of households connected to centralized wastewater collection systems, 5 treatment plants are suitable – Germaniškis village Mokyklos and Pušÿ aklg., Ramongaliÿ village Egliÿ aklg., Kupreliškis village Malÿno g. and Anciškiÿ village Liepÿ aklg. (suitable value between 40-60, see Table 7 and Section 1.5). In other treatment plants, the number of households connected is either too high or too low. Having identified these suitable wastewater treatment plants, it is important to identify where the wastewater is discharged.
treated wastewater:

- Germaniškis village School district – to the ditch that reaches the Nemunÿlis River;
- Germaniškis village, Pušÿ aklg. – to the ditch that reaches the Nemunÿlis River;
- Ramongaliÿ village, Egliÿ aklg. – to the canal, which reaches the Vabala River 0.8 km away; • Kupreliškis village, Malÿno g. – to the Krašÿias River;
- Anciškiai village, Liepÿ aklg. – to the Griauzdÿ stream.

The treated wastewater of all selected wastewater treatment plants is discharged into surface water bodies, so based on this criterion, all are suitable for the installation of constructed wetlands.

After selecting wastewater treatment plants based on the criteria of connected households, wastewater discharge location and entry into protected areas, two treatment plants remain – Germaniškis village. Mokyklos and Pušÿ aklg. These treatment plants do not fall within protected areas, but are located very close to the territory important for the protection of NATURA 2000 habitats – the Nemunÿlis-Apašÿia geological reserve (about 30 m and about 90 m). These treatment plants may have an impact on protected areas due to their close distance, therefore the highest score is assigned in the assessment (Figure 13).

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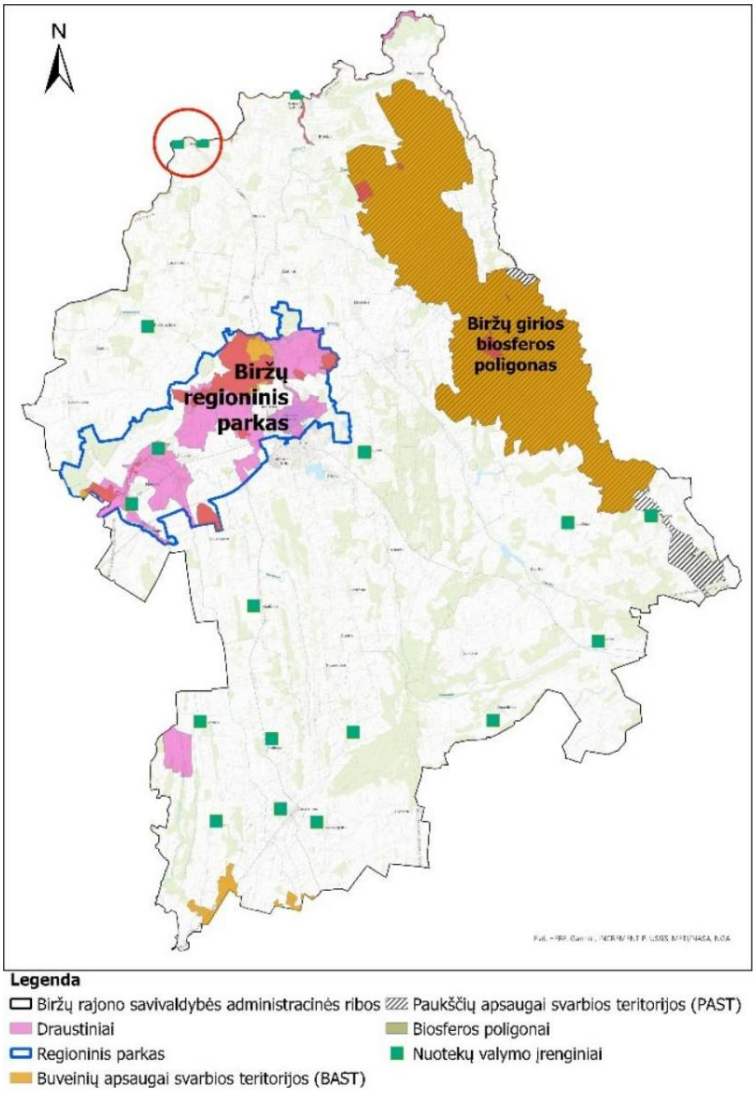


Figure 13. Wastewater treatment plants marked on the map of protected areas, among which are the ones in red two are marked, located in Germaniškis village School and Pušų district.

The aforementioned wastewater treatment plants are due to the increasing need for centralized networks and the growing of households connected to the water supply system face difficulties in properly treating wastewater before it is discharged into the environment. According to the 2024 measurement data, the most problematic are the indicators of total nitrogen and total phosphorus, especially in the summer and autumn periods (see Table 7). The increase in these parameters is associated with more intensive agriculture, especially in the warm season, because fertilizers are used, and due to the effect of rain, fertilizers (nitrogen, phosphorus) flow into wastewater collection networks, surface water bodies or direct absorption into the soil.

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Table 7. Results of total nitrogen and total phosphorus tests at the wastewater treatment plants in Germaniškis village, Pušai and Mokyklos agglomerations, 2024.

Analyte, measurement unit	Time of research	Before cleaning	After cleaning
Germaniškis village, Pušų district.			
Total nitrogen, mgN/l	2024-02-01	27	10,5
	2024-04-11	40,7	7,37
	2024-07-22	206	24,3
	2024-11-11	125	57,3
Total phosphorus, mg/l	2024-02-01	3,96	1,29
	2024-04-11	5,72	0,866
	2024-07-22	14,6	3,36
	2024-11-11	12,2	5,05
Germaniškis village School district.			
Total nitrogen, mgN/l	2024-02-01	31,9	9,62
	2024-04-11	28,7	6,65
	2024-07-22	192	28,3
	2024-11-11	127	54,3
Total phosphorus, mg/l	2024-02-01	3,38	1,37
	2024-04-11	5,05	1,15
	2024-07-22	13,2	3,10
	2024-11-11	12,9	5,46

As can be seen from the results of the study, both phosphorus and nitrogen removal from wastewater in the summer and autumn periods is not always satisfactory. Finally, since the amount of wastewater treated by the Pušai and Mokyklos municipal wastewater treatment plants is 18 m3 /d. and 12 m3 /d., respectively, the 80% minimum pollutant removal requirement is applied to these wastewater treatment plants. When wastewater is most contaminated with nitrogen and phosphorus, the treatment plants often do not reach the minimum percentage of pollutant removal. This is another strong argument to rethink wastewater treatment methods and take corrective actions.

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It is proposed to include “distance to a poorly maintained reclamation area” in the existing set of criteria for selecting the most suitable location, as these areas indicate poor ecological conditions and increased environmental pollution in the area. The two selected wastewater treatment plants are located in the vicinity of poorly maintained reclamation areas, as shown in Fig. 11 (approximately 150 m and 900 m), which makes the environment near these treatment plants even more sensitive. The table below shows the combined assessment of both Germaniškis village wastewater treatment plants according to the selection criteria.

Table 8. Summary of administrative and additional criteria and assessment of the locations of the Germaniškis village School and Pušai district wastewater treatment plants

El. No.	Administrative criteria	Description	Possible evaluations options	Evaluation
1.	Municipalities (or the wastewater company) facility operating confirmation that it is ready to carry out maintenance work on the facility constructed at its own expense during the operation of the swamp	constructed swamp service time up to 30–50 years. Supervision includes – cutting, pipe flushing, etc.	Yes/No (rejection criterion)	Yes
2.	Approval from the municipality for monitoring permission specialists to take samples in the constructed wetland and organize demonstration events during and the implementation of the NATALIE project	Project implementation time – until 2028.	Yes/No (rejection criterion)	Yes

El. No.	Additional criteria	Description	Possible evaluations	Evaluation
1.	Nature-based solutions are mentioned in the municipality's strategic development documents	The municipality must provide the relevant document	Yes (specifically mentioned) constructed swamp) – 2 points Yes (nature-based solutions are commonly mentioned) – 1 reply No – 0 points	0 points

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2. The location of the object affects a Natura 2000 site or another protected natural area.	It must be clear identified location and to which protected area is it assigned, if assigned	Yes – 2 points No – 0 points	2 halls
3. Number of households connected to a centralized wastewater collection system	Municipalities data on the number of consumers connected to wastewater treatment plants	50-60 – 2 halls 40-50 – 1 hall <40 – 0 hall	2 halls
4. Treated wastewater can be discharged into the environment	Surface water reservoir or infiltration with low groundwater level You have to be clear treated wastewater discharge point	Yes (water body) – 2 points Yes (infiltration) – 1 reply No – 0 points	2 halls
		Total:	6 halls

2.7. Location criteria for nature-based solutions for farmers

The NATALIE project partner has developed a methodology and criteria to assess the feasibility of installing nature-based solutions by connecting them to existing wastewater treatment plants, but a methodology to select the most suitable locations on farms is currently not available.

In order to provide farmers with the widest possible opportunities to participate in financing programs

In tenders, it is important to consider the criteria for funding programmes to receive certain support. Based on this, several key criteria have been identified that farmers should consider when searching for the most suitable funding sources for the implementation of nature-based solutions.

A more detailed description of each funding option is provided in section 2.3.

Criteria that projects meet to have a higher chance of receiving financial support:

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1. Installation of a constructed wetland in the catchment areas of at-risk water bodies affected by diffuse pollution.

According to the List of Water Bodies at Risk20, in the Biržai district, the Lielupe River basin has an average ecological status due to diffuse pollution in 14 river sections, a bad ecological status in 3 sections, a very bad ecological status in 1 section, and an average ecological status in 3 lake-type water bodies. According to the Map of the Status and Risk Factors of Surface Water Bodies21, the majority of the territory of the Biržai district municipality falls within the area of risk due to diffuse agricultural pollution (Figure 14).

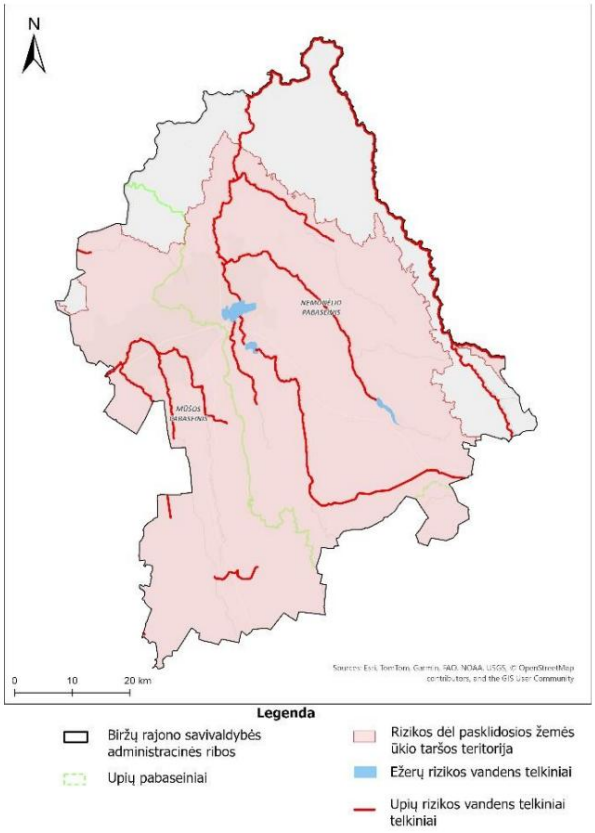


Figure 14. Map of the condition and risk factors of surface water bodies in the Biržai district.

According to the Strategic Environmental Impact Assessment (hereinafter referred to as SEA) of the Strategic Plan (Summarized SEA conclusions and recommendations: Consequences for water resources)22, 8 rural development measures will contribute to the reduction of water pollution, in addition to other measures provided for in the Strategic Plan, of which the most significant direct consequences will be *investments in regulated drainage, sustainable investments in agricultural holdings* and support for continuous

[20] Order No. D1-908 of the Minister of the Environment of the Republic of Lithuania of 2017-11-07 “On Risky Water Bodies” approval of the list" (edition from 2023-05-11 https://www.e-tar.lt/portal/lt/legalAct/047a5fc0c48611e79122ea2db7aeb5f0/asr

[21] https://experience.arcgis.com/experience/8148b39e88064e3380a7a54bcf068d6a

[22] Strategic Plan, page 962.

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commitments to organic farming. The SEA draws attention to the fact that the actual contribution of the Strategic Plan to achieving water protection objectives will largely depend on the proportion of measures implemented *in risk water basins* where pollution reduction is required, as well as on the competences and awareness of farmers in choosing and properly implementing ecological systems. The SEA notes that in order to achieve water protection objectives, nitrogen pollution loads need to be reduced by 60-70%, especially in the most affected river basins, while the measures of the Strategic Plan will allow reducing agricultural nitrogen pollution loads by approximately 25%.

2. Construction of a constructed wetland by implementing an existing land reclamation system reconstruction.

Sub-clause 40.4 of the Implementation Rules for the Strategic Plan Intervention Measure “Investments in Land Reclamation Systems”23 states that projects that implement environmental protection measures (installation of double slopes for ditches, sedimentation ponds, **constructed wetlands at drainage mouths,** formation of constructed wetlands)
floodplains, stable annuals of reinforced stones, weirs or logs, regulated drainage wells and valves are installed) and their value consists of:

40.4.1. 10% or more of the requested project investment value (including VAT, excluding general expenses) – 20 points are awarded;

40.4.2. 7–9.99 percent of the requested project investment value (including VAT, excluding general expenses) – 10 points are awarded;

40.4.3. 5–6.99 percent of the requested project investment value (including VAT, excluding general expenses) – 5 points are awarded.

3. Installation of a constructed wetland in reconstructed/renovated land reclamation areas systems.

When providing support for the installation of regulated drainage in existing reconstructed land reclamation systems under the Strategic Plan intervention measure KP10mel "Investments in land reclamation systems", the selection criteria do not apply to the submitted projects.

4. Installation of a constructed wetland with the use of rainwater for irrigation.

[23] Approved by Order No. 3D-563 of the Minister of Agriculture of the Republic of Lithuania of 24 August 2023 "On the approval of the rules for the implementation of the intervention measure "Investments in land reclamation systems" of the Lithuanian Agricultural and Rural Development Strategic Plan for 2023–2027".

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The implementation rules for the Strategic Plan intervention measure “Investments in agricultural holdings”24 provide that the costs of installing irrigation systems that use rainwater are eligible for financial support.

5. Installation of a constructed wetland on arable land that floods annually
in place.

The support provided under the Strategic Plan's ecological systems intervention measure "Landscape Elements Maintenance" is a direct payment for permanent areas of arable land that are flooded annually, with an area of at least 0.01 ha and no more than 1 ha (support is granted for no more than 0.5 ha), and which are interspersed with or border the arable land declared by the applicant. 3 Conclusions and recommendations

3 Conclusions and recommendations

3.1. Summary

The network of water bodies in Biržai district includes natural lakes, rivers and man-made water bodies, such as Lake Širvÿna. The hydrographic structure creates favorable conditions for constructed wetlands, which could become an effective solution for surface wastewater treatment. The impact of climate change is the most important factor determining extreme weather events.
phenomena – increasing sinkholes, droughts, heavy rains and storms – these phenomena have an impact on public health, farms and infrastructure. Projections show that increasing precipitation and rising groundwater levels will further increase these risks.

Biodiversity and habitats in the Biržai district are protected in Natura 2000 areas, Biržai Regional Park and Biosphere Reserves. They protect rare species and ensure the balance of ecosystems. Another important aspect is the characteristics of soil and land use –
fertile lands with dense land reclamation networks, which due to wear and tear become pathways for pollutants to enter water bodies, which causes eutrophication. Analysis of wastewater treatment plants shows that there are 19 centralized wastewater treatment plants in the Biržai district, which, due to the increasing number of connected households and wastewater pollution, are not always able to treat wastewater to the established standards. The efficiency of wastewater treatment could be enhanced by installing constructed wetlands. In addition to constructed wetlands, there are other nature-based solutions that can be applied in the conditions of the Biržai district – ecological towers, peat filters, sedimentation ponds or buffer strips. More details about each of them are provided in sections 1.6. and 1.8.

[24] Approved by Order No. 3D-640 of the Minister of Agriculture of the Republic of Lithuania of 2023-10-04 "On the approval of the rules for the implementation of the intervention measure "Investments in agricultural holdings" of the Lithuanian Agricultural and Rural Development Strategic Plan for 2023–2027".

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The second part of the report assesses the practical application of the solutions and the analysis of the needs and expectations of stakeholders. The survey method was chosen to conduct the analysis, with questionnaires designed separately for farmers, UAB “Biržÿ vandenys” and
communities (elderly authorities). Unfortunately, no responses were received from the latter, but the responses collected showed the following main results: so far there is a noticeable lack of knowledge about nature-based solutions and their benefits and an unexpressed need to change this situation. The section on investment and maintenance costs assessed that although the costs of establishing a wetland may be considerable, in the long term wetlands become economically beneficial due to lower maintenance costs. The analysis of financing options emphasizes EU structural funds, national programs and local government measures. Concentrated information is provided for everyone interested in taking advantage of existing opportunities and programs.

When examining the legal validity of constructed wetlands, it was found that there are no specific laws on constructed wetlands, therefore it is necessary to rely on general environmental, environmental impact assessment and land use documents. As with any new project, it is important to analyze the potential risks of the project. Technical, environmental, social and regulatory risks were analyzed and methods for their management were proposed, such as monitoring, community involvement and regular maintenance.

Finally, a methodology was presented to select the most suitable location for the installation of a constructed wetland (or other nature-based solution) at the Biržai district wastewater treatment plant sites. Clear criteria were provided for farmers, according to which they can assess their own situation and be better prepared to submit applications for funding.

3.2. Conclusions

Survey results were obtained from 6 farmers and UAB "Biržÿ vandenys". Main conclusions:

- UAB “Biržÿ vandenys” does not see the installation of constructed wetlands as an applicable method of wastewater treatment and is not interested in maintaining the wetland, even after receiving funding for its installation;

- Farmers are not interested in installing constructed wetlands on their territories, although this practice was known to most respondents, at least in general terms. However, some emphasized that these solutions are not known and it would be of interest to learn more about it.

An assessment of investment and maintenance costs was carried out based on the experience of the project “Strengthening Marine and Inland Water Management” implemented in Kÿdainiai district in 2016–2017. The important message is that maintenance costs are significantly lower than those of conventional wastewater treatment solutions, so the project is financially viable in the long term.

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Since there is currently no more publicly available information about similar projects that have been implemented, this indicative information is used.

The analysis of possible funding sources was conducted with the aim of providing beneficiaries with concise information about their options and possibly adapting their situation to one of the programs and seeking funding. The proposed programs are:

- Environmental Protection and Climate Change Management of the 2022–2030 Development Programme development program;
- European Economic Recovery and Resilience Fund, European Agricultural Fund for rural development fund;
- Lithuanian Agricultural and Rural Development Strategic Plan 2023–2027.

The study assessed all possible legal requirements for the installation of constructed wetlands (or other nature-based solutions). No specific legal restrictions were found for this type of project, but they are subject to general requirements for the installation of an artificial water body, wastewater treatment (Pollution Permit) and special land use conditions.

In order to avoid certain inconsistencies, financial loss or damage to nature, it is important to assess the potential risks of the project. During the analysis, 6 types of risks were identified:

- technical;
- environmental;
- social/health;
- management/supervision;
- regulatory/permits.

Suggested risk reduction methods and measures:

- conduct a comprehensive environmental impact assessment that clearly identifies the risks for a specific constructed wetland installation project;
- involve the local community before designing a constructed wetland;
- to select competent designers for the preparation of the technical project, who would be able to assess not only the engineering aspects of the structure, but also the hydrological and biological aspects, important for the appropriate selection of the composition of organisms;
- assess and plan the funds needed for the maintenance of the constructed wetland throughout the entire period of its operation. Also, establish a clear maintenance plan and appoint competent persons responsible for maintenance.

The NATALIE project partner developed a methodology and criteria to assess the feasibility of installing nature-based solutions by connecting them to existing wastewater treatment plants, the methodology was analyzed in detail and applied to the case of Biržai district. All 19 were assessed

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wastewater treatment plants, of which two were selected – Germaniškis k. Mokyklos and Pušÿ aklg. wastewater treatment plants. Applying the location selection methodology proposed by the NATALIE partner, these treatment plants scored the highest number of points (6 points) and have the highest priority for the implementation of nature-based solutions. The proposed methodology is suitable for assessing not only suitable locations for the installation of a constructed wetland, but also for other nature-based solutions. Other nature-based solutions could be applied in the proposed Germaniškis k. Mokyklos and Pušÿ aklg. wastewater treatment plants, but detailed hydrological and ecological studies would need to be carried out.

Based on the measurements of wastewater pollution from the aforementioned wastewater treatment plants, the main problematic indicators are total nitrogen and total phosphorus. During the warm season, the values of these indicators increase significantly and the treatment plants are often not prepared to treat such a large amount of pollutants. The installation of constructed wetlands or other nature-based solutions would help regulate the amount of these pollutants and release treated wastewater that meets the standards into the natural environment. However, the operator of the wastewater treatment plants, UAB “Biržÿ vandenys”, currently does not see the possibility of installing constructed wetlands (as indicated in the survey), so the project may
to move.

The methodology proposed by the NATALIE project partner is applicable only to wastewater treatment plants, but the methodology, according to which the most suitable locations on farms could be selected, is not yet available. for the treatment of rainwater or industrial wastewater, is currently not available. In order to provide farmers with the widest possible opportunities to participate in funding program competitions, it is important to consider the criteria for funding programs for receiving certain support. Based on this, several main criteria were identified that should be taken into account by farmers looking for the most suitable funding sources for the implementation of nature-based solutions. A more detailed description of each funding option is provided in section 2.3. This set of criteria will help you to qualitatively assess your situation and have greater opportunities to implement these projects.

Criteria that projects meet to have a higher chance of receiving financial support:

1. Installation of a constructed wetland (or other nature-based solution) in a water risk area in the basin areas of reservoirs affected by diffuse pollution.
2. Installation of a constructed wetland (or other nature-based solution) by carrying out reconstruction of the existing land reclamation system.
3. Installation of a constructed wetland (or other nature-based solution) in reconstructed/rehabilitated land reclamation systems.
4. Installation of a constructed wetland (or other nature-based solution) with the use of rainwater for irrigation.
5. Installation of a constructed wetland (or other nature-based solution) on arable land in an area that floods annually.

It is emphasized that the variety of nature-based solutions is large and it is worth considering all options before choosing the most suitable one; their diversity is described in more detail in sections 1.6. and 1.8.

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3.2. Recommendations

The land reclamation systems in the Biržai district have been transferred to the Biržai district municipality, therefore the Biržai district municipality administration is responsible for ensuring that the land reclamation systems are maintained. would function properly and would be installed in such a way that it would not have a negative impact or this impact would be reduced as much as possible. It should be noted that renovated land reclamation systems in which regulated drainage is not installed further increase the leaching of nitrogen and other substances into water bodies. For this reason, the municipality itself should take the initiative to ensure that regulated drainage is installed during the reconstruction of land reclamation systems, as well as that regulated drainage systems are installed in those places where the land reclamation system was repaired without installing regulated drainage. In the strategic plan, under the intervention measure "Investments in land reclamation systems", about 70 percent of the financial support is intended to be allocated to associations of users of land reclamation systems and municipalities implementing projects. Taking this into account, we recommend that the municipality itself be an applicant for financial support for projects implementing nature-based solutions when renewing land reclamation systems.

3.3. Recommendations for legislative amendments and proposed amendments wordings

The description of the financing conditions for projects under the sub-activity “Installation of industrial and surface wastewater treatment technologies” of the progress measure No. 02-01-06-07-01 “Improving the condition of water bodies” of the 2022-2030 development programme of the Ministry of the Environment of the Republic of Lithuania (hereinafter referred to as the “Description of Financing of Industrial and Surface Wastewater Treatment Projects”)25 2.21 states that projects contributing to the output indicator P-02-001- of the progress measure are financed.

06-07-03 Implementation of "Installation of wastewater treatment plants". The desired result is 50 projects that implement technological equipment or measures that reduce the pollution of wastewater generated **during production or other economic activities .** Project selection criteria – treatment efficiency (e.g. reduction of BOD7 or other chemicals specified in paragraph 9.12 by more than 50% – 2 points; from 25% to 50% – 1 point) and project effectiveness - The project is assessed against the planned reduction in the amount of polluting wastewater (during the entire period of use of the installed measure, but not longer than 15 years from the start of project implementation) and the requested funding amount specified in the project implementation plan (PIP).

[25] Approved by Order No. D1-276 of the Minister of the Environment of the Republic of Lithuania of 13 August 2024 “On the implementation of the progress measure No. 02-01-06-07-01 “Improving the condition of water bodies” of the Environmental Protection and Climate Change Management Development Programme of the Ministry of the Environment of the Republic of Lithuania, which manages the 2022–2030 Development Programme”.

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ratio. However , in the requirements for projects specified in paragraph 2.1.2 of the Description of Financing of Industrial and Surface Wastewater Treatment Plants26 , the scope of potential applicants is reduced, indicating that the supported activities are: installation and/or construction of surface waste water treatment plants or other pollution-reducing measures when **an industrial enterprise** discharges wastewater into the environment; installation and/or construction of surface waste water treatment plants or other pollution-reducing measures when an industrial enterprise discharges wastewater to the surface wastewater collection system, from which wastewater is discharged into the environment not cleaned.

In accordance with the Description of Financing of Industrial and Surface Water Resources Projects, the administering authority (Environmental Project Management Agency) announces a call for applications for financing, assesses the compliance of the submitted applications with the requirements set out in the Description of Financing. In view of this, it is proposed to revise Sub-paragraph 2.1.2 of the Description of Financing of Industrial and Surface Water Resources Projects and to set it out as follows:

"2.1.2 installation and/or construction of surface wastewater treatment plants (hereinafter referred to as WWTPs) or other pollution reduction measures, where an industrial enterprise or an agricultural company or a livestock farm discharges wastewater into the environment; installation and/or construction of surface wastewater treatment plants or other pollution reduction measures, where an industrial enterprise discharges wastewater into a surface wastewater collection system, from which wastewater discharged into the environment is not treated; installation of measures for the treatment or pollution reduction of surface wastewater generated in a potentially polluted area."

The description of financing of industrial and surface WWTP projects is prepared by the Ministry of the Environment of the Republic of Lithuania. Proposals for the clarification of the provisions of this description are submitted to the Ministry of the Environment.

We draw your attention to the fact that both the Ministry of Environment of the Republic of Lithuania and the Ministry of Agriculture of the Republic of Lithuania are constantly reviewing and improving the legal acts under which support is provided for projects contributing to the reduction of pollution of Lithuanian rivers and lakes. In this regard, it is suggested that the Biržai Municipality Administration join in and actively participate in the preparation of draft amendments to the legal acts, providing the ministries with information about the initiatives of both the municipality and residents to contribute to the reduction of pollution of inland waters.

[26] Approved by Order No. D1-276 of the Minister of the Environment of the Republic of Lithuania of 13 August 2024 “On Amendments to Order No. D1-231 of the Minister of the Environment of the Republic of Lithuania of 15 July 2022 “On the Implementation of Progress Measure No. 02-01-06-07-01 “Improving the Status of Water Bodies” of the Ministry of the Environment of the Republic of Lithuania, the Manager of the 2022–2030 Development Programme”

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2025-07-14 Nr. SN-1305

DĖL INFORMACIJOS TEIKIMO GALIMYBIŲ STUDIJAI PARENGTI

Biržų rajono savivaldybės administracija išbando jėgas Horizon Europe (HORIZON) programoje, kur partnerio teisėmis dalyvauja NATALIE projekte, apimančiame gamta pagrįstų sprendimų taikymą siekiant prisitaikyti prie klimato kaitos.

Gamta pagrįsti sprendimai – tai gamtos įkvėpti sprendimai, kurie vis veiksmingesni mažinant su klimatu susijusių pavojų poveikį.

Pagrindinis projekto tikslas yra paspartinti ir skatinti gamta pagrįstų sprendimų integravimą, formuojant ekosistemomis pagrįstą prisitaikymą prie regioninio atsparumo klimato kaitai.

Savivaldybė inicijuoja ir organizuoja galimybių studijos, kurios tikslas – nustatyti tinkamiausias vietas dirbtinėms pelkėms įrengti Biržų rajone, parengimą. Siekiant kuo tikslesnio ir išsamesnio rezultato, renkami duomenys apie dirbtinių pelkių įrengimo poreikį, galimybes bei tikslingumą Savivaldybės teritorijoje.

Prašome jūsų iki š. m. liepos 30 d. užpildyti parengtą klausimyną (pridedama), taip pat pasidalinti šiuo klausimynu su Biržų rajono kaimo bendruomenėmis (užpildytus klausimynus siųsti el. paštu ieva@environment.lt). Nuoširdžiai dėkojame už pagalbą.

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NATALIE

Klausimai bendruomenėms

- Ar esate suinteresuotas (-a), kad Jūsų bendruomenė taikytų daugiau tvarių/ aplinkai draugiškų sprendimų?
- Ar matote poreikį pagerinti nuotekų valymo procesą?
- Jeigu taip, kuriose vietovėse / valymo įrenginiuose? Ir kodėl?
- Ar bendrais bruožais yra žinoma kas yra dirbtinės pelkės ir kaip jos veikia ?
- Ar pritartumėte idėjai dirbtinių pelkes įrengti kaip dalį nuotekų valymo įrenginių, padėsiančių geriau išvalyti nuotekas? Jeigu ne, kodėl?
- Ar taikytumėte dirbtines pelkes savo veikloje nuotekoms valyti ?
- Jeigu taip, dėl kokių priežasčių iki šiol netaikėte? Variantai:
    - Žinių apie dirbtines pelkes trūkumas;
    - Institucinio palaikymo stygius;
    - Lėšų trūkumas;
    - Vietos dirbtinėms pelkėms įrengti trūkumas;
    - Kita, įvardinti...

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2025-07-14 Nr. SN-1308

DĖL INFORMACIJOS TEIKIMO GALIMYBIŲ STUDIJAI PARENGTI

Biržų rajono savivaldybės administracija išbando jėgas Horizon Europe (HORIZON) programoje, kur partnerio teisėmis dalyvauja NATALIE projekte, apimančiame gamta pagrįstų sprendimų taikymą siekiant prisitaikyti prie klimato kaitos.

Gamta pagrįsti sprendimai – tai gamtos įkvėpti sprendimai, kurie vis veiksmingesni mažinant su klimatu susijusių pavojų poveikį.

Pagrindinis projekto tikslas yra paspartinti ir skatinti gamta pagrįstų sprendimų integravimą, formuojant ekosistemomis pagrįstą prisitaikymą prie regioninio atsparumo klimato kaitai.

Savivaldybė inicijuoja ir organizuoja galimybių studijos, kurios tikslas – nustatyti tinkamiausias vietas dirbtinėms pelkėms įrengti Biržų rajone, parengimą. Siekiant kuo tikslesnio ir išsamesnio rezultato, renkami duomenys apie dirbtinių pelkių įrengimo poreikį, galimybes bei tikslingumą Savivaldybės teritorijoje.

Prašome jūsų iki š. m. liepos 30 d. užpildyti parengtą klausimyną (pridedama), taip pat pasidalinti šiuo klausimynu su Biržų rajono ūkininkais (užpildytus klausimynus siųsti el. paštu ieva@environment.lt). Nuoširdžiai dėkojame už pagalbą.

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NATALIE

Klausimai ūkininkams

- Ar bendrais bruožais jums yra žinoma, kas yra dirbtinės pelkės ir kaip jos veikia ?

- Ar yra girdėtos dirbtinių pelkių įrengimo naudos, pvz., užteršto vandens, patenkančio į upes bei ežerus su lietumi, taršos mažinimas?

- Ar taikytumėte dirbtines pelkes savo veikloje lietaus nuotekoms valyti ?

- Jeigu taip, dėl kokių priežasčių iki šiol netaikėte? Variantai:
  - Žinių apie dirbtines pelkes trūkumas;
  - Institucinio palaikymo stygius;
  - Lėšų trūkumas;
  - Vietos dirbtinėms pelkėms įrengti trūkumas;
  - Kita, įvardinti...

- Ar esate pastebėję vandens žydėjimą ar kitokią taršą paviršiniuose vandens telkiniuose, esančiuose Jūsų vykdomos veiklos aplinkoje? Ar matote poreikį pagerinti dabartinę šių vandens telkinių situaciją ?

- Jeigu taip, kuriose vietovėse / vandens telkiniuose / melioracijos grioviuose?

- Jeigu būtų suteikiamas finansavimas dirbtinių pelkių įrengimui, ar būtumėte pasirengę atlikti priežiūros darbus iš savo lėšų dirbtinių pelkių eksploatavimo metu? Eksploatavimo laikas gali būti 30-50 metų, o priežiūra susidarytų daugiausia iš augalijos šienavimo, vamzdžių praplovimo ir kt. Pakomentuokite.

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2025-07-14 Nr. SN-1308

DĖL INFORMACIJOS TEIKIMO GALIMYBIŲ STUDIJAI PARENGTI

Biržų rajono savivaldybės administracija išbando jėgas Horizon Europe (HORIZON) programoje, kur partnerio teisėmis dalyvauja NATALIE projekte, apimančiame gamta pagrįstų sprendimų taikymą siekiant prisitaikyti prie klimato kaitos.

Gamta pagrįsti sprendimai – tai gamtos įkvėpti sprendimai, kurie vis veiksmingesni mažinant su klimatu susijusių pavojų poveikį.

Pagrindinis projekto tikslas yra paspartinti ir skatinti gamta pagrįstų sprendimų integravimą, formuojant ekosistemomis pagrįstą prisitaikymą prie regioninio atsparumo klimato kaitai.

Savivaldybė inicijuoja ir organizuoja galimybių studijos, kurios tikslas – nustatyti tinkamiausias vietas dirbtinėms pelkėms įrengti Biržų rajone, parengimą. Siekiant kuo tikslesnio ir išsamesnio rezultato, renkami duomenys apie dirbtinių pelkių įrengimo poreikį, galimybes bei tikslingumą Savivaldybės teritorijoje.

Prašome jūsų iki š. m. liepos 30 d. užpildyti parengtą klausimyną ir išsiųsti el. paštu ieva@environment.lt. Nuoširdžiai dėkojame už pagalbą.

PRIDEDAMA. Klausimynas, 1 lapas.

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NATALIE

Klausimai UAB ,,Biržų vandenys“

- Ar bendrais bruožais yra žinoma kas yra dirbtinės pelkės ir kaip jos veikia ?
- Ar taikytumėte dirbtines pelkes kaip dalį buitinių nuotekų valymo proceso?
- Jeigu taip, dėl kokių priežasčių netaikote? Variantai:
  - Žinių apie dirbtines pelkes trūkumas;
  - Politinio palaikymo stygius;
  - Lėšų trūkumas;
  - Vietos dirbtinėms pelkėms įrengti trūkumas;
  - Kita, įvardinti...
- Ar matote poreikį pagerinti dabartinį buitinių nuotekų valymo procesą?
- Jeigu taip, kuriose vietovėse / valymo įrenginiuose?
- Jeigu būtų suteikiamas finansavimas dirbtinių pelkių įrengimui, ar būtumėte pasirengę atlikti priežiūros darbus iš savo lėšų dirbtinių pelkių eksploatavimo metu? Eksploatavimo laikas gali būti 30-50 metų, o priežiūra susidarytų daugiausia iš augalijos šienavimo, vamzdžių praplovimo ir kt. Jeigu priežiūros darbai būtų galimi tik kai kuriose vietovėse, įvardinkite kuriose.

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NATALIE

Klausimai UAB „Biržų vandenys“

- Ar bendrais bruožais yra žinoma kas yra dirbtinės pelkės ir kaip jos veikia ?

  Taip, turime panašių pavyzdžių Biržų rajone.

- Ar taikytumėte dirbtines pelkes kaip dalį buitinių nuotekų valymo proceso?

  Ne. Šiuo metu turimas dirbtinių pelkių principu veikiančias valyklas yra numatyta rekonstruoti į biologinius nuotekų valymo įrenginius.

- Jeigu taip, dėl kokių priežasčių netaikote? Variantai:
  - Žinių apie dirbtines pelkes trūkumas;
  - Politinio palaikymo stygius;
  - Lėšų trūkumas;
  - Vietos dirbtinėms pelkėms įrengti trūkumas;
  - Kita, įvardinti...

- Ar matote poreikį pagerinti dabartinį buitinių nuotekų valymo procesą?

  Taip, esama infrastruktūra nebeišvalo nuotekų iki Aplinkos ministerijos nustatytų medžiagų išvalymo normų.

- Jeigu taip, kuriose vietovėse / valymo įrenginiuose?

  Rekonstrukcijos praktiškai reikia visuose valdomuose objektuose - Kiršonių, Kirdonių, Mieliūnų, Šukionių, Germaniškio, N. Radviliškio, Anciškių, Skrebiškių, Kvetkų, Kučgalio, Kupreliškio, Ramongalių, Kratiškių, Obelaukių vietovėse.

- Jeigu būtų suteikiamas finansavimas dirbtinių pelkių įrengimui, ar būtumėte pasirengę atlikti priežiūros darbus iš savo lėšų dirbtinių pelkių eksploatavimo metu? Eksploatavimo laikas gali būti 30-50 metų, o priežiūra susidarytų daugiausia iš augalijos šienavimo, vamzdžių praplovimo ir kt. Jeigu priežiūros darbai būtų galimi tik kai kuriose vietovėse, įvardinkite kuriose.

  Ne. Tai yra nepasiteisinusi praktika mūsų rajone. Neturime tiek žmogiškųjų išteklių prižiūrėti tokio tipo valyklas, be to yra išaugęs centralizuotų nuotekų tinklų poreikis, todėl būtų reikalingos daug didesnės teritorijos tokio tipo valykloms įrengti.