

Water Recycling Toolbox

Natural stormwater treatment for use in municipal services

Klaipėda District Municipality

Klaipėda University



Introduction to the pilot measure **Natural stormwater treatment for use in municipal services** Klaipėda District Municipality Klaipėda University

15 March 2023



WaterMan

Promoting water reuse in the Baltic Sea Region through capacity building at local level

Valdas Langas, Vytautas Bernadišius, Jurgita Maračkinaite

Klaipeda University, Marine Research Institute

**Kick-Off-Meeting
Kalmar & Västervik / SE
14-16 March 2023**

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Promoting water reuse in the Baltic Sea Region through capacity building at local level

Klaipeda University, Marine Research Institute:

The **Marine Research Institute** is a subdivision of [Klaipėda University](https://www.klaipeda.lt/), conducting fundamental and applied research on marine and coastal environment and maritime technologies. The Institute aims to facilitate science, study, and business cooperation, based on high-level scientific knowledge.

Research groups:

- Biological Invasions and Environmental Genetics
- Benthic Habitat Ecology
- Plankton
- Aquatic Biogeochemistry and Ecosystem Functioning
- Aquatic Resources, Fisheries and Aquaculture
- Coastal and Marine Management
- Modelling
- Environmental Remote Sensing and Water Quality
- Waterborne Transport and Air Pollution
- Modern Engineering Systems

Recently completed projects:



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Promoting water reuse in the Baltic Sea Region through capacity building at local level

Klaipeda University, Marine Research Institute WaterMan staff

Valdas Langas – overall project management, inputs to project activities, deliverables and outputs

Jurgita Maračkinaite - financial manager

Vytautas Bernadišius – water engineer, with focus on EIA, trans-municipal water reuse strategy, other issues

Mapping, GIS specialist - to be assigned

Sampling and precipitation specialists - to be assigned

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Promoting water reuse in the Baltic Sea Region through capacity building at local level

Two implemented partly related projects



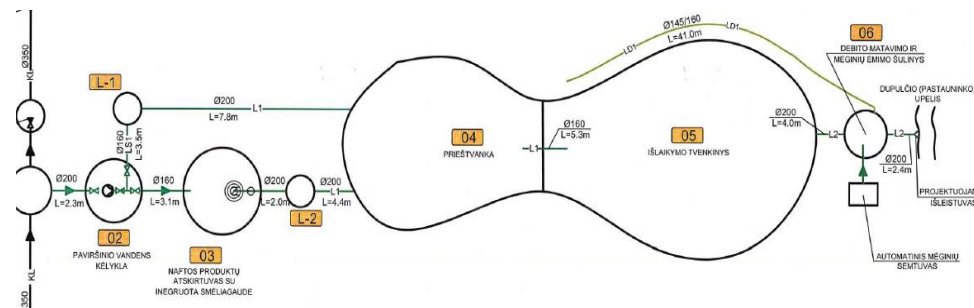
European Regional Development Fund

WISA-Water Innovation System Amplifier, 2019-2022

The aim was to suggest preventive solutions and to develop and test new technologies to reduce pollution by stormwater from sea ports (Klaipeda, Gdynia, Åhus)

MOMENT-UP – Modern water management in SBR – upgrade project, 2010-2013

Ecological adapted stormwater investments in Kretinga town



WaterMan

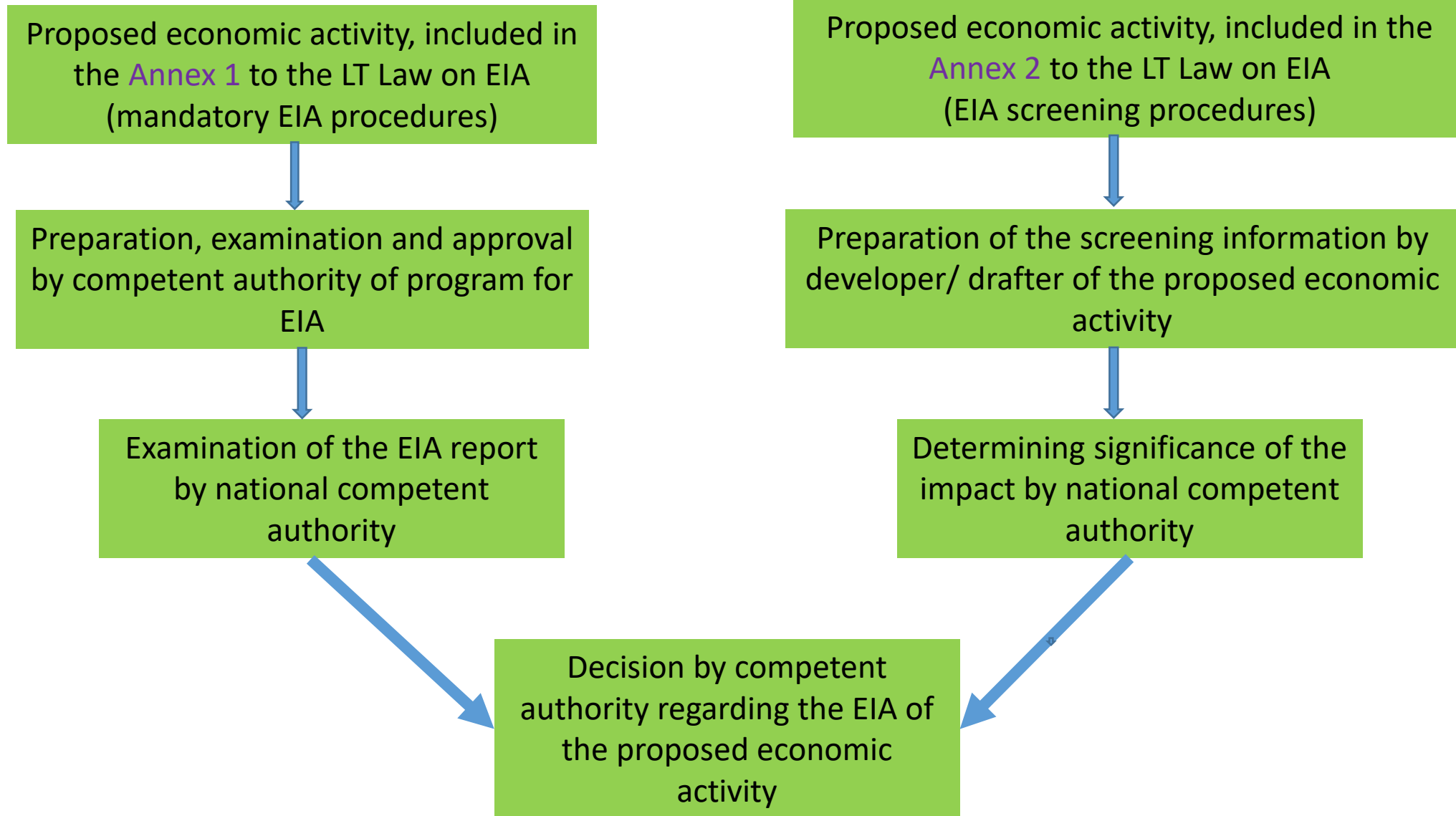
Promoting water reuse in the Baltic Sea Region through capacity building at local level

In WaterMan, LT partners:

- Administration of Klaipeda District Municipality
 - Association of Klaipeda Region
 - Klaipeda University
- will, among other things:

- Implement a pilot measure on recirculation of retained water in Gargždai town (storm water retention ponds in public areas to utilize water for e.g. firefighting or watering of parks & streets);
- Participate in and contribute to the transnational peer learning process;
- Elaboration of the trans-municipal water reuse strategy for Klaipeda Region

For the implement a pilot measure on recirculation of retained water the starting point is to apply
Procedures of Environmental Impact Assessment in Lithuania (simplified version)



Design and construction of stormwater treatment facilities - retention pond with reuse of retained water

The boundaries of the selected 110 ha storm water drainage area in Gargždai town marked in orange, with outfall no. 3



Preparation of the screening information for planned economic activity/LT project:
Design and construction of stormwater treatment facilities - retention pond with reuse of retained water

Screening shall be conducted in respect of the proposed economic activity included in the list of Annex 2 of LT EIA law, e. g. screening shall be initiated if

Run-off water/stormwater treatment plants (designed for the treatment of the run-off water collected by sewage networks from the area of 50 hectares and more)

The purpose of Screening is to determine whether or not an EIA is required for a particular Project listed in Annex 2

Screening information - description of the likely significant effects of the project on the environment resulting from:

- the size, nature of the proposed project, the construction and demolition works;
- the use of natural resources, in particular land, soil, water and biodiversity, with a focus on species and natural habitats – Natura 2000 sites, considering as far as possible the sustainable availability of these resources;
- the emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste;
- the risks to human health, cultural heritage or the environment (for example due to accidents or disasters);
- the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance;
- the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change;
- flood risks;
- the technologies and the substances used, etc.

Design consideration of stormwater treatment facilities - retention pond with reuse of retained water

To keep in mind designs' **functionality, cost, safety, and environmental impact**

There are no clearly formulated national requirements for design of retention or detention ponds

International approach:

HELCOM Recommendation 23/5-Rev.1, 2021 *REDUCTION OF DISCHARGES FROM URBAN AREAS BY THE PROPER MANAGEMENT OF STORM WATER SYSTEMS*

For storm water planning:

- the ecosystem services approach should be applied; this means that storm water should be seen as a resource;
- should be catchment area based;
- designed and dimensioned according to future scenarios of climate change;
- for high intensity storm events, secondary runoff paths should be prepared to divert storm water exceeding the storm water systems capacity where appropriate, however the proportion on water released through the secondary runoff paths should preferably **not exceed 30% of the total estimated annual volume of storm waters**;
- to apply green technologies: to achieve the objectives, different techniques can be used. These techniques are generally categorised under **best management practices (BMPs)** or **sustainable urban drainage systems (SuDS)**, etc.

Design consideration of stormwater treatment facilities - retention pond with reuse of retained water

SuDS are more sustainable than traditional drainage methods because they take account of water quantity (flooding), water quality (pollution) biodiversity (wildlife and plants):

- Manage runoff volumes and flow rates from hard surfaces, reducing the impact of urbanisation on flooding;
- Provide opportunities for using runoff where it falls;
- Protect or enhance water quality (reducing pollution from runoff);
- Protect natural flow regimes in watercourses;
- Are friendly to the environment and the needs of the local community;
- Provide an attractive habitat for wildlife in urban watercourses;
- Provide opportunities for evapotranspiration from vegetation and surface water;
- Encourage natural groundwater/aquifer recharge (where appropriate);
- Create better places to live, work and play.

Design consideration of stormwater treatment facilities - retention pond with reuse of retained water

Retention pond's design approach recommended by **sustainable urban drainage systems (SuDS)**:

Ponds should contain the following zones:

- **sediment forebay** or other form of upstream pre-treatment system to allow sediment to settle from the incoming stormwater runoff before it is delivered to the permanent pool;
- **permanent pool** which will remain wet throughout the year and is the main treatment zone;
- **temporary storage volume** for flood attenuation, created through landscaped banks to the permanent pool;
- **shallow zone or aquatic bench** which is a shallow area along the edge of the permanent pool to support wetland planting, providing ecology, amenity and safety benefits.

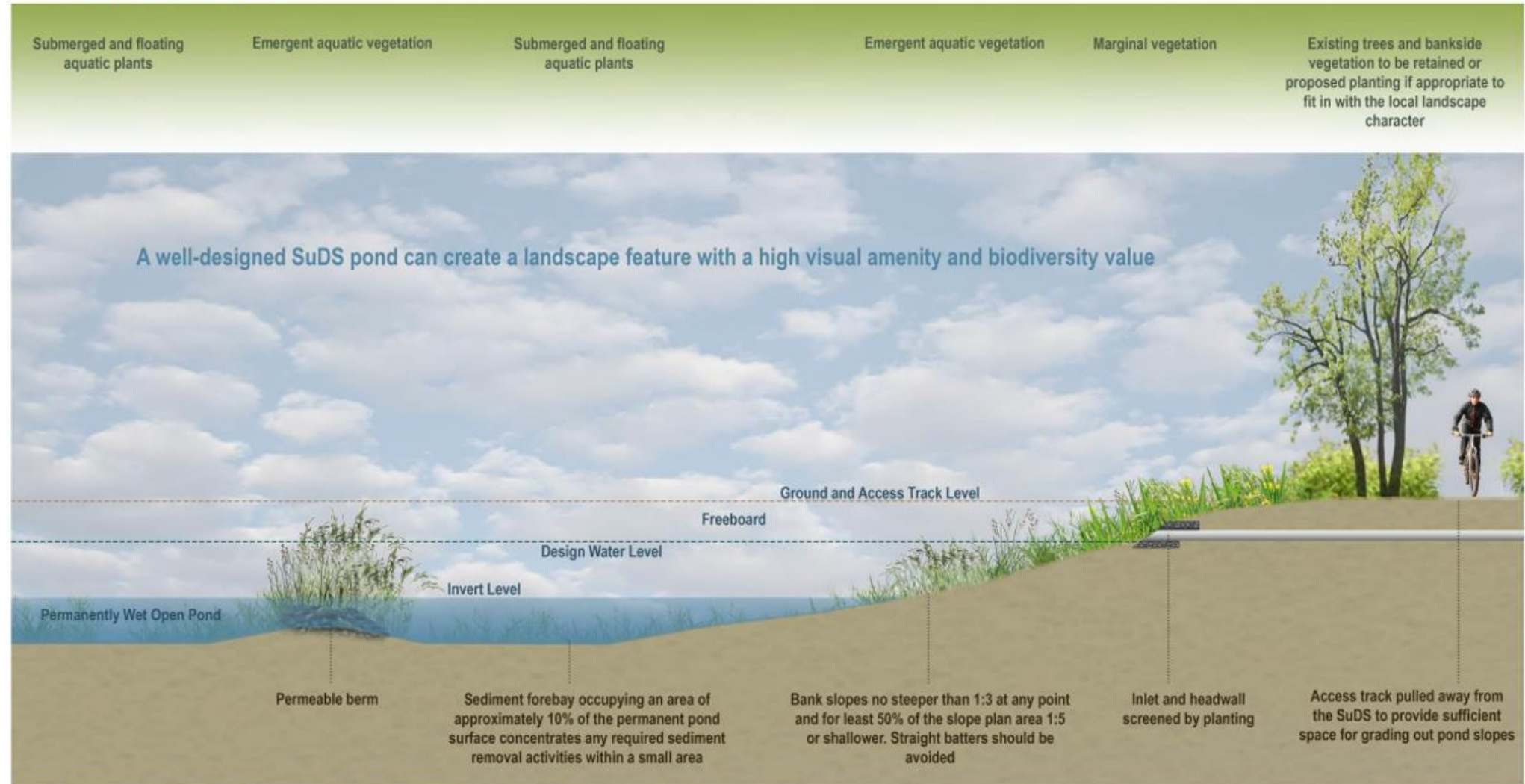
For more info:

<https://www.susdrain.org/>

CIRIA (Construction Industry Research and Information Association), **SuDS Manual** <https://www.ciria.org/>

Retention pond - one of many possible solutions

Figure 4: Retention pond forebay example cross-section



Stormwater sampling

To create stormwater sampling procedures and protocol with the aims to answer the following main questions:

- Selection of sampling site for the assessment of quantitative and qualitative indicators of storm water runoff;
- What kind of rain events can be identified and how do they affect stormwater quality in urban areas;
- How many measurable storm events should be sampled;
- How many samples should be collected per storm event to make statistically accurate estimates;
- Should stormwater runoff be sampled manually (i.e., grab), or composite (automatically);
- Parameters to be tested, etc.

Elaboration of the trans-municipal water reuse strategy for Klaipėda Region

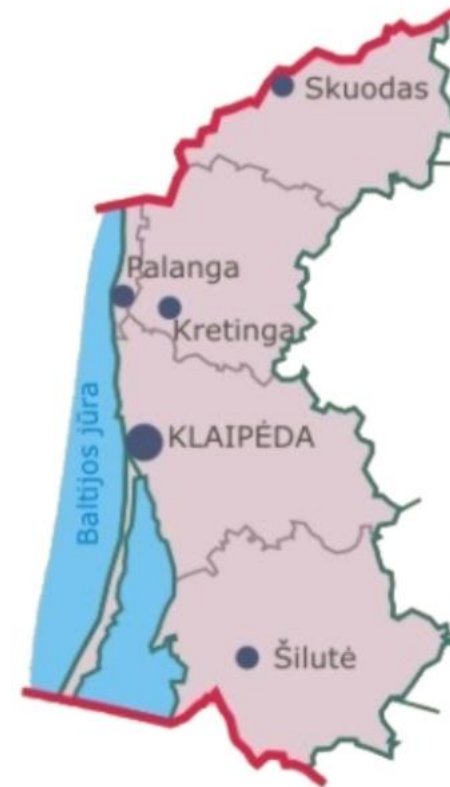
Geographical area: Klaipėda coastal Region with 7 municipalities

Strategy combine three main measures:

- reuse of treated water
- recirculation of retained water
- promoting stakeholder & consumer acceptance for water reuse.

One of the main questions is how to select suitable WWTPs and stormwater management infrastructure facilities for water reuse in this large area?

Project jointly developed methodological guidelines, pilot measures in partners municipalities, external support, etc. will help as to find answers.



Municipal boundaries of Klaipėda County



[Klaipėda City Municipality](#)



[Klaipėda district municipality](#)



[Kretinga district municipality](#)



[Municipality of Neringa](#)



[Municipality of Palanga City](#)



[Skuodas district municipality](#)



[Municipality of Šilutė district](#)



THANK YOU



1st Peer-review session

Natural stormwater treatment for use in municipal services

Klaipėda District Municipality

Klaipėda University

5 Sept 2023



WaterMan

Pilot measure in Gargzdai town / LT

- Recirculation of retained water: Storm water retention ponds in public areas**

Valdas Langas, Vytautas Bernadišius, Nerijus Eidimtas, Raimundas Baublys

Klaipeda University, Marine Research Institute

Partner meeting & on-site visit
Ringsted & Kalundborg / DK
5-6 Sept 2023

Pilot measure in Gargzdai town / LT

Recirculation of retained water: Storm water retention ponds in public areas

Storm water retention pond design and construction Environmental Impact Assessment screening scheme (Annex 2 of EIA regulations)

Organizer of the proposed economic activity or the drafter of EIA documents

Organizer Administration of Klaipeda District Municipality
Drafter – KU. Screening information according to established regulations

Competent authority – LT EPA review the screening information

EPA request for additional information and to coordinate proposed activity with the Protected Areas Service

Supplementary information required from the Public and Entities to perform a screening for EIA. Proposals regarding screening of EIA (10 w/d)

Conclusion whether an EIA is required is greatly influenced by the opinion of the public, which it can express in the proposals. Proposals from public and entities of EIA (state institutions responsible for health protection, fire protection, cultural property protection, municipal executive authority) and the public) can be submitted within 10 w/d from the publication of the screening information on the Agency's website.

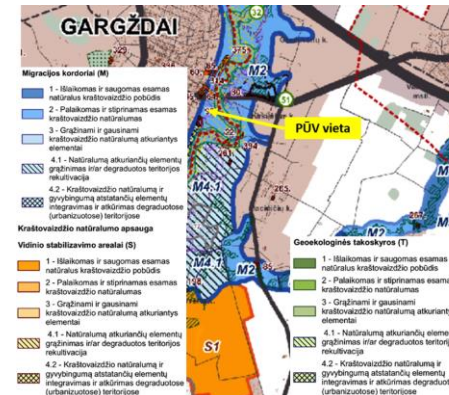
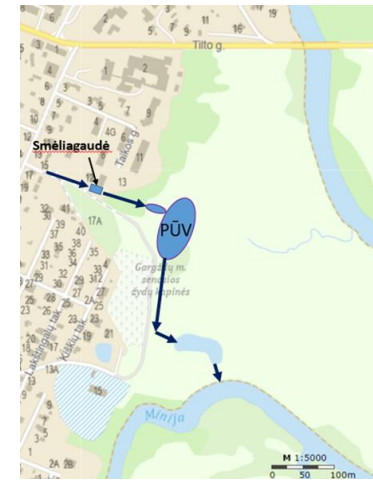
The final revised and supplemented information regarding the EIA screening was placed on the EPAs website on 08.21.2023

LT EPA

Screening conclusion on whether an EIA is obligatory or not is made within 10 working days. **On August 31, the EPA concluded that full EIA is not obligatory.**

SUMMARY OF INFORMATION FOR THE SCREENING FOR ENVIRONMENTAL IMPACT ASSESSMENT

- description of the proposed activity (incl. description of technology to be used, related infrastructure, changes in traffic flows, etc.);
- scale of the proposed activity (e.g. area, size, production capacity, water, raw material and energy use, generation of waste);
- Information on the location (e.g. physical-geographical, socio-economic characteristics, with maps, drawings with a clear indication of the distance to the sensitive areas, e. g. “Natura 2000” and other protected sites, objects and sites of cultural heritage, residential areas, etc.);
- Information on expected environmental impacts and proposed mitigation measures: emissions into the atmosphere, discharges into the water, waste generation, noise, soil, climate, landscape human health and safety, flora and fauna, etc. Probability, duration, frequency and reversibility of the impacts, number of affected people, impacts on areas of special environmental value, etc.):
- information on possible cumulation of impacts, including impacts of other existing, approved and/or proposed activities;
- measures to prevent, eliminate, reduce or compensate for negative environmental impacts.



LT stormwater sampling regulations

Testing parameters for WaterMan project

According to Lithuanian legislation, economic entities/operators discharging effluents into the surface water bodies and having an IPPC (Integrated Pollution Prevention and Control Permit) or Pollution Permit must monitor the wastewater/stormwater quality.

The aim of the self-monitoring is to assess whether the pollution parameters/indicators discharged from pollution sources do not exceed the established limits and/or standards. Usually stormwater samples are taken and tested by private contract laboratories that must be accredited or licensed.

Self-monitoring frequency. Normally, operators must take grab stormwater effluent samples four times per year (once per quarter) during the storm event. Samples should be taken not earlier than 15 minutes after the rainfall begins. Only one grab sample is required.

EPA also implement compliance monitoring programs and pursue enforcement is provided through local environmental inspectors. Compliance monitoring procedures necessary to determine compliance and non-compliance with permit conditions.

Compliance monitoring – in accordance with the EPA's annual compliance monitoring plans, or as needed.

Parameters

Pollution Permits, in principle follow the Lt regulations:

- mandatory parameters SS, petroleum products and recently - BOD have been set;
- phosphorus, nitrogen, salts, metals, and other pollutants for activity-specific companies;

During the implementation of the WaterMan project, the following parameters are tested:

Selected 110 ha drainage area does not have a IPPC or Pollution Permit, therefore monitoring of discharged stormwater is not carried out.

One grab sampling taken for EIA purposes and these parameters, coordinated with LT EPA, were tested in the laboratory:

pH, Suspended solids, BOD₇, COD, Petroleum hydrocarbons, N_{total}, P_{total}, Sulfates, Chlorides

Stormwater monitoring approach

In 2017, a committee was created by the National Academies of Sciences, Engineering, and Medicine through support by the USA Environmental Protection Agency to address several concerns related to the stormwater monitoring in the Multi-Sector General Permit (MSGP). The committee 2019 report, **Improving the EPA Multi-Sector General Permit for Industrial Stormwater Discharges**, recommends several ways that EPA can strengthen the MSGP program to provide its intended environmental protection while balancing the overall burden of monitoring on industry.

The report highlights that *the volume-weighted (or flow-weighted) pollutant concentration, also called the event mean concentration (EMC), provides the most consistent and comprehensive assessment of stormwater pollutant discharges and loads. Pollutant loads are important for understanding longer-term water-body impairments and toxicity concerns,*

For stormwater monitoring the report recommend **to allow and promote the use of composite sampling for benchmark monitoring for all pollutants**. Multiple composite sampling techniques should be used that provide more consistent and reliable quantification of stormwater pollutant discharges compared to a single grab sample. EPA

see <https://doi.org/10.17226/25355>

In order to obtain reliable stormwater qualitative and quantitative data, it was decided to apply the following monitoring methods:

- **To use time-weighted composite sampling instead grab sampling;**
- **Flow measurements perform using flow meter, instead calculated by universally used formula:**

$Wf = 10 \times Hf \times ps \times F \times K$, m³ / year, where:

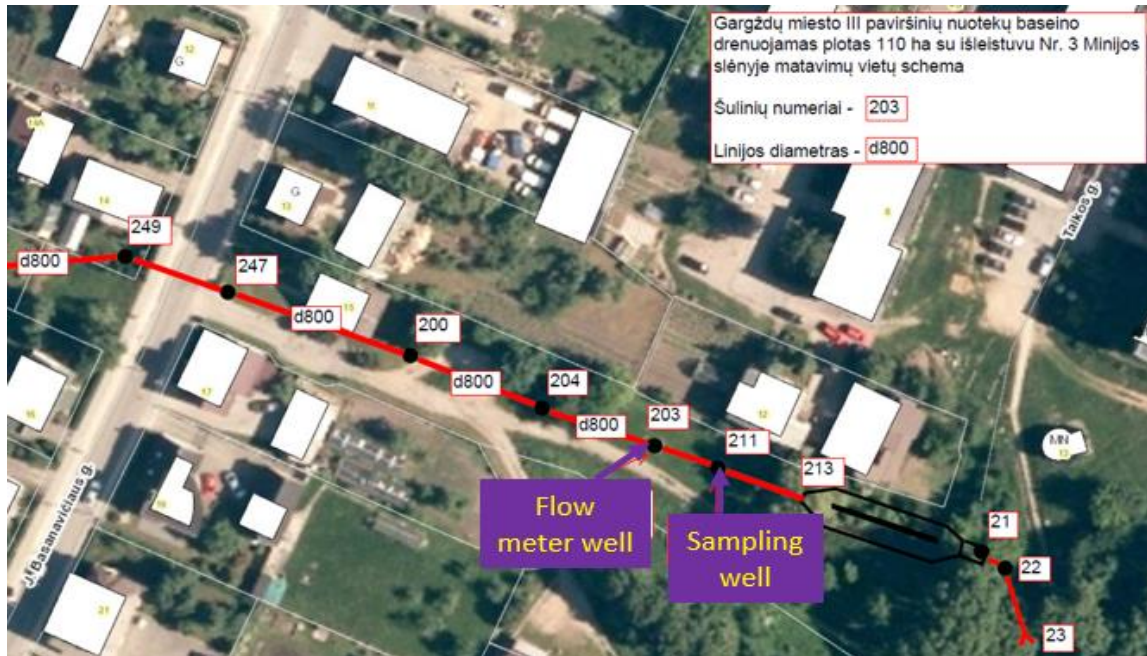
Hf - actual annual rainfall (mm) (according to the Lithuanian Hydrometeorological Service data);

ps - runoff coefficient reflects the surface characteristics (various pervious and impervious surfaces) of the contributing runoff basin. The range of runoff coefficient values varies from 0.2 to 0.85:

F - runoff basin area (ha);

K coefficient reflects snow removal from the drainage basin. If snow is removed, $K = 0.85$ if not removed ($K = 1$).

Monitoring sites



Stormwater sampling equipment

Transportable sampler Avalanche, ISCO

- 950 ml (x14) bottle kit
- 7.5 m vinyl suction hose with protection
- Wheels for transportation
- 12 VDC, 75 Ah battery with charger
- Cooling from rechargeable battery
- Additional rechargeable battery



Stormwater sampling

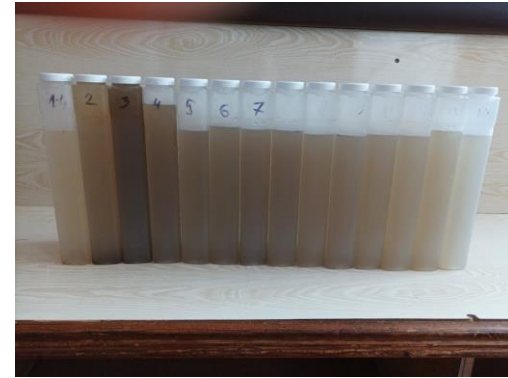
Sampling considerations

The sample should be collected where the wastewater is well mixed. Therefore, the sample should be collected near the center of the sampling well/manhole, at approximately 40 to 60 percent of the water depth, where the turbulence is at a maximum and the possibility of solids settling is minimized.

The sampler programmed to collect aliquots at a 15 minutes frequency after 15 minutes from the start of rain. So far, two composite sampling campaigns have been conducted with an automatic sampler 14 aliquots/ bottles were collected.



First sampling campaign:
2023-07-18
14 aliquots/ bottles poured into 7 containers (due to lack of water in one bottle for chemical analysis)



Second sampling campaign:
2023-08-17
14 aliquots/ bottles poured into 1 containers.



LT stormwater quality limit values and results of the analysis

Stormwater permissible concentrations

	Endorsed by Stormwater Management Regulations, mg/l				Endorsed by Wastewater Management Regulations, mg/l								
	Suspended solids	BOD ₇ ¹	BOD ₇	Petroleum hydrocarbons	N _{total}	P _{total}	Zn	Pb	Cd	Cu	Hg	As	Cr
Maximum allowable concentration	50	34	10	7	-	-	-	-	-	-	-	-	-
Average annual concentration	30	23	-	5	30	4	0,4	0,1	0,04	0,5	0,002	0,05	0,5

1 BOD parameter must be specified and monitored in stormwater effluents contaminated with organic substances (e.g. agricultural processing, food industry, organic waste management facilities, etc.). In other cases, the maximum allowable concentration of BOD₇ is 10 mg O₂/l, the average annual concentration is not determined.

Tested results

	pH	Suspended solids	BOD ₇	COD	Petroleum hydrocarbons	N _{total}	P _{total}	Sulfates	Chlorides
Grab sampling 2023-04-25 for EIA	7,9	27	10,4	54	0,14	1,51	0,18	46	60
First composite sampling (average) 2023-07-18 8:10 – 10:10		5,7	9,9	45,3	0,23	10,2	0,3	21,1	60
Second composite sampling 2023-08-17 10:30 – 14:00 h	7,88	158	34,0	120	0,32	18,0	1,3	20	26

Results of the analysis

First composite sampling protocol, sample taken 2023-07-18



KLAIPĖDOS VANDUO

Laboratorija

TYRIMŲ PROTOKOLAS Nr. 23-472
2023-07-26

Užsakovas, adresas Klaipėdos universiteto Jūros tyrimų institutas, Manto 84, Klaipėda
Mėginio paėmimo vieta Gargždų m. Taikos g. 12, Šul. Nr. 203
Mėginio pavadinimas paviršinės nuotekos
Mėginio paėmimo data nenurodyta
Mėginio pristatymo į lab. data ir laikas 2023-07-19 8:35 val.
Mėginius pristatė A. Skripkauskas

Analitės	Rezultatas							
Mėginio Nr.	1-2	3-4	5-6	7-8	9-10	11-12	13-14	Normatyvinis dokumentas, pagal kurį atliktas tyrimas
Mėginio registracijos Nr.	N23.1638_01	N23.1638_02	N23.1638_03	N23.1638_04	N23.1638_05	N23.1638_06	N23.1638_07	
Skendinčios medž., mg/l	4,2	4,5	4,9	2,8	8,0	12,0	3,3	LAND 46-2007
Biocheminis deguonies suvartojimas (BDS7), mg/lO2	6,6			6,8	10	24	14	LST EN ISO 5815-1:2019,
Biocheminis deguonies suvartojimas (BDS7), mg/lO2		3,6	4,2					LAND 47-2:2007
Cheminis deguonies suvartojimas (ChDSCr), mg/lO2	26	13	19	28	56	93	82	ISO 15705:2002
Chloridai, mg/l	61	58	61	65	56	58	61	LAND 63-2004
Sulfatai, mg/l	16	18	22	25	25	21	21	UM*, 50-52 psl.
Bendrasis azotas, mg/l	8,28	8,28	8,34	9,76	11,6	12,8	12,3	LAND 59-2003
Bendrasis fosforas, mg/l	0,128	0,162	0,160	0,212	0,466	0,606	0,352	LAND 58-2003
Naftos angliavandenilių indeksas C10-C40, mg/l	0,29	0,33	0,32	0,18	0,11	0,16	0,24	LAND 61-2003

Vyresnioji chemijos specialistė



L. Minajeva

Už mėginių paėmimą nuotekų tyrimo laboratorija neatsako.

Tyrimų rezultatai galioja tik pateiktam mėginiui.

Be raštiško laboratorijos leidimo draudžiama kopijuoti atskiras protokolų dalis.

AB „Klaipėdos vanduo“

Removal efficiency

The report *Natural Water Retention Measures* provides the following information **on average pollutant removal efficiency in retention ponds:**

- Suspended solids: 55%
- Total phosphorus: 32%
- Total nitrogen: 34%
- Metals: 26-65%

Retention ponds can be effective at pollutant removal, particularly as a result of settling of particulate pollutants. However, retention ponds, with permanent water, are likely to be less effective for removal of oils that stay on the water surface,

[http://nwrn.eu/sites/default/files/nwrn_ressources/u11 -
_retention_ponds.pdf](http://nwrn.eu/sites/default/files/nwrn_ressources/u11_-_retention_ponds.pdf)

Flow Meter

NIVUS Type PCM flow measurement

A measurement system for portable flow measurements basically consists of a transmitter Type PCM for power supply, data entry, indication and data storage plus a sensor for the recording of measurement data. The portable Type PCM units are designed for use in part filled and full channels, pipes and flumes with various shapes and dimensions.

Flow cannot be measured directly

Q: average flow velocity and the flow cross section.

This leads to the general formula below:

$$Q = v(\text{average}) \cdot A$$

The flow cross section A is investigated by continuously measuring the filling level considering the channel shape. The flow velocity is detected via the velocity of the particles..

The particle velocity is measured by using ultrasound. The flow changes as soon as the velocity changes.



Instruction Manual for
portable Flow Meter PCM 4
(Original Instruction Manual – German)

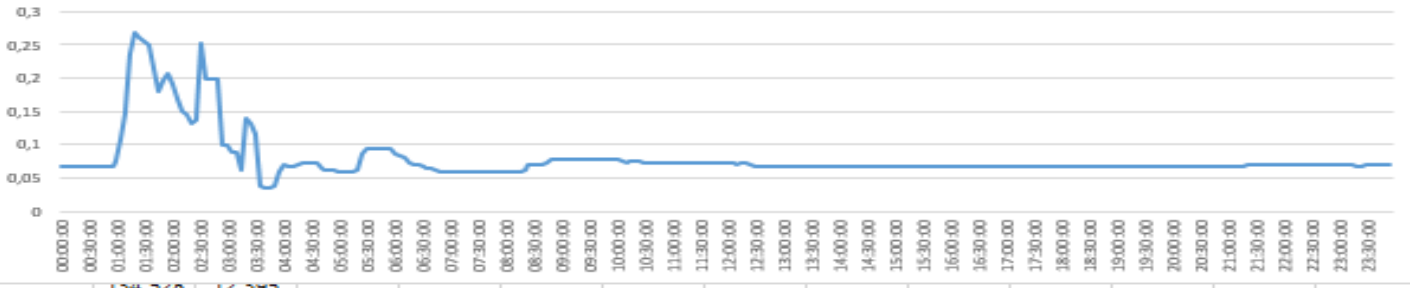


Stormwater flow measurement

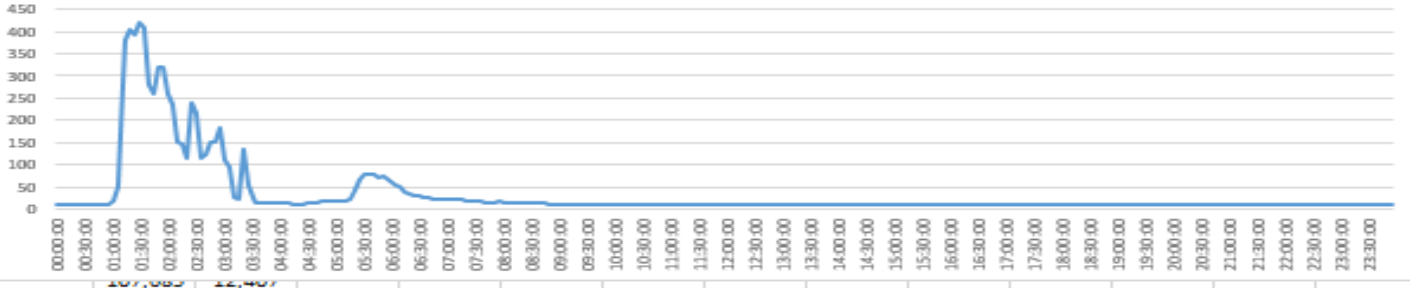
July 25th 2023 flow data

B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
Laikas	svamzdyje	greitis (m/s)	skuto kiekis	T [°C]	ADC_2 [mA]	ADC_3 [V]												
00:00:00	0,067	0,414	8,339	13,4	128,646	12,405												
00:05:00	0,067	0,412	8,307	13,6														
00:10:00	0,067	0,418	8,429	13,6														
00:15:00	0,067	0,429	8,642	13,5														
00:20:00	0,067	0,422	8,507	13,5														
00:25:00	0,067	0,42	8,455	13,6														
00:30:00	0,067	0,41	8,268	13,6														
00:35:00	0,067	0,413	8,326	13,5														
00:40:00	0,067	0,42	8,455	13,5														
00:45:00	0,067	0,42	8,475	13,5														
00:50:00	0,067	0,419	8,436	13,6														
00:55:00	0,067	0,481	9,907	13,6														
01:00:00	0,075	0,664	19,314	14,8														
01:05:00	0,108	1,121	51,737	15,1														
01:10:00	0,149	2,786	273,771	18														
01:15:00	0,237	2,805	380,587	18,5	134,328	12,395												
01:20:00	0,268	2,698	402,558	18,6														
01:25:00	0,261	2,833	392,837	19,1														
01:30:00	0,254	3,136	420,837	19,1														
01:35:00	0,25	3,061	408,558	19,1														
01:40:00	0,216	3,24	278,603	19,1														
01:45:00	0,181	2,956	258,212	19,3														
01:50:00	0,197	3,091	320,956	19,4														
01:55:00	0,207	3,123	317,795	19,4														
02:00:00	0,19	3,257	260,565	19,1														
02:05:00	0,169	3,15	233,544	19,1														
02:10:00	0,15	2,405	149,423	19,1														
02:15:00	0,144	2,417	145,774	19,1														
02:20:00	0,131	2,423	114,578	19,1														
02:25:00	0,136	2,399	237,416	19,1														
02:30:00	0,252	2,42	216,626	18,9	107,085	12,407												
02:35:00	0,2	2,221	116,376	18,9														
02:40:00	0,2	2,034	122,199	18,7														
02:45:00	0,2	1,892	151,103	18,7														
02:50:00	0,2	1,893	151,489	18,5														
02:55:00	0,1	1,761	180,974	18,5														
03:00:00	0,1	1,612	111,877	18,1														
03:05:00	0,09	1,608	96,253	18,1														
03:10:00	0,09	1,51	26,508	17,8														
03:15:00	0,061	1,34	23,512	17,8														
03:20:00	0,139	1,282	133,159	17,6														
03:25:00	0,132	1,356	53,542	17,6														
03:30:00	0,116	1,222	27,938	17,3														
03:35:00	0,038	1,019	15,762	17,3														
03:40:00	0,036	0,989	15,304	17,2														
03:45:00	0,036	0,92	14,613	17,2	125,734	12,4												
03:50:00	0,037	0,777	12,331	16,8	125,896	12,402												
03:55:00	0,06	0,765	14,747	16,8	143,113	12,398												

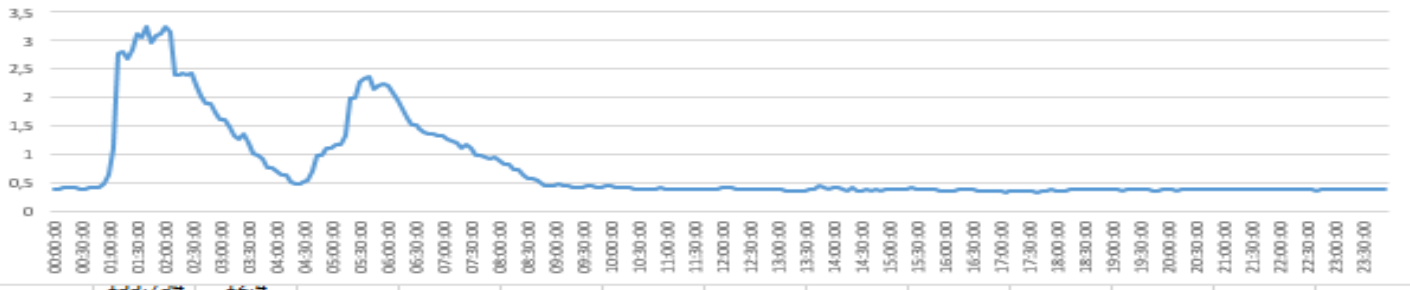
Water level in the pipe (m)



Flow (l/s)



Velocity (m/s)



Rain gauge

Operating Instruction
Precipitation Sensors (15189) + (15189 H)

LAMBRECHT
METEOROLOGICAL INSTRUMENTS GERMANY

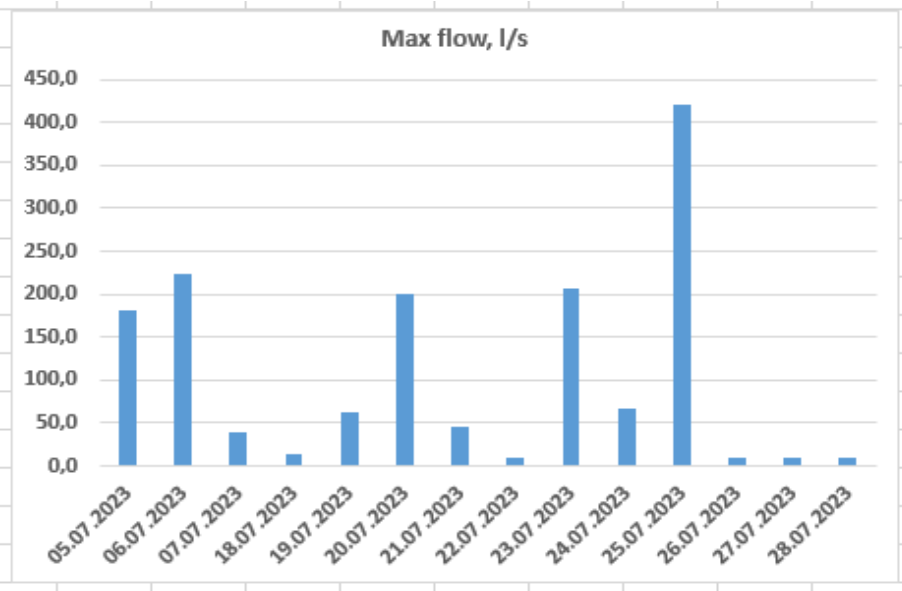
Features

- Precipitation Sensor for automatic weather stations
- Exchangeable, weighing tipping bucket system
- 2 cm³ (2g water) tipping bucket for precise precipitation measuring in regions with normal rain falls
- 4 cm³ (4g water) tipping bucket for precise precipitation measuring in regions with heavy rain falls/ tropical rain
- Connectable to external data logger
- Winter-fit model (15189 H) with electronically controlled 2-circuit heating
- Weatherproof materials (anodized aluminium, stainless steel) guarantee a long durability
- Funnel according to the WMO Standard No. 8



Flow data

Data	Hr, min	Max flow, l/s
05.07.2023	11:41	182,3
06.07.2023	08:40	222,8
07.07.2023	09:36	39,0
18.07.2023	08:35	13,0
19.07.2023	06:00	61,8
20.07.2023	19:27	199,9
21.07.2023	03:55	45,7
22.07.2023	19:50	9,0
23.07.2023	12:50	207,5
24.07.2023	05:20	67,1
25.07.2023	01:30	420,8
26.07.2023	10:55	9,2
27.07.2023	16:30	10,4
28.07.2023	09:05	9,0



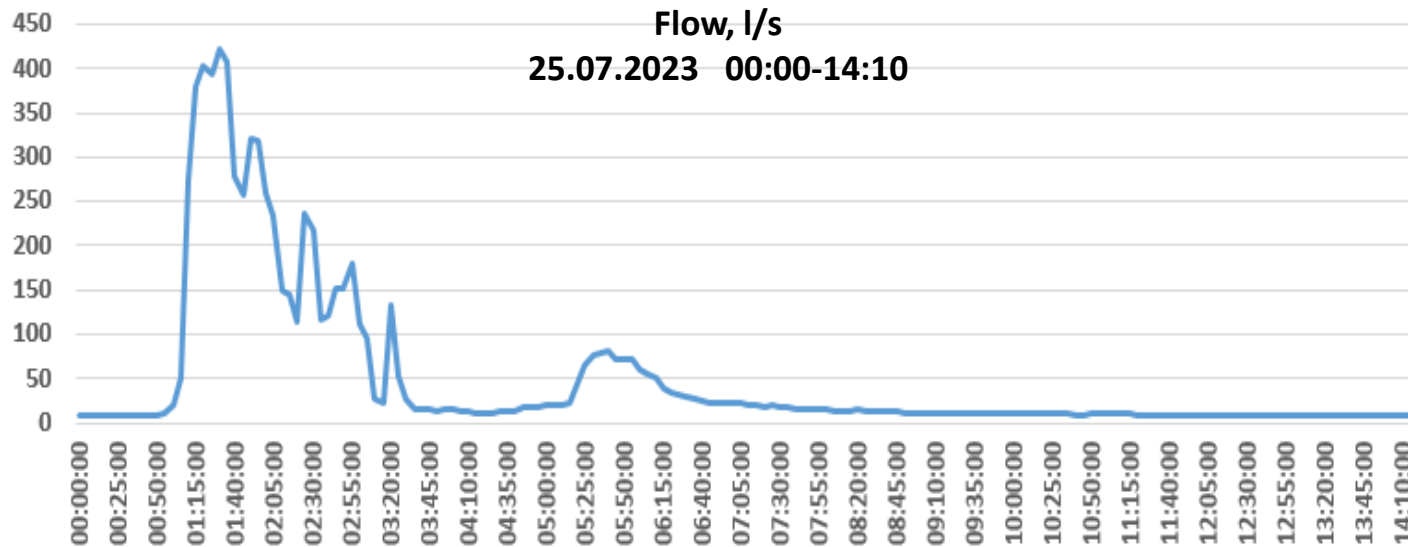
Average flow (l/s)	
25.07.2023	32,8

Base flow without rain ~ 7,8 - 8 l/s

Calculated max flow 500 l/s

Based on rainfall/flow measurements:

- flow data l/s and m3/d will be used for design purposes, and
- for the prediction of rainfall/runoff trends due to climate change



Thank you

1st Peer & expert review session: Recommendations & conclusions

- Not only the incoming water, but also the design of the pond can determine the water quality at its outlet (e.g. if your design attracts birds then there is unwanted “additional input” into the water, also the retention period influences the water quality). It is therefore important to determine in the beginning the water quality that is aimed for at the outlet and needed for the intended reuse (e.g. municipal irrigation, water for firefighting), and to choose the design of the retention pond accordingly
- Even though there may be no legal requirements for your use of retained water thus far in Lithuania, you can choose and refer to an existing quality norm, e.g. bathing water quality as in Västervik, other European Regulations (> have a look into the slides of the workshop in Schweinfurt) or Class A/B/C according to the Water Reuse Regulation 2020/741).
- In order to design the pond in an optimum way, it will be necessary to have a deeper look into and to measure some additional parameters of the storm water to be retained:
 - It may not be sufficient to measure suspended solids in general, but also their composition. Reason: Mineral suspended solids are in general no big problem since they settle faster. But if there are organic suspended solids, this may make it difficult or even prevent to use the water for irrigation. So it is advisable to survey organic suspended solids in addition. Also micro granular analysis could be conducted.
 - Consider testing in different weather conditions & seasons. For example during the melting of the snow, the composition of suspended solids can be very different than in the summer.
- As it is considered to use the retained water for municipal irrigation, it will be important to test also E. coli, Enterococci, and Legionella (in the summer period). Getting more in-depth knowledge on these water parameters enables to design the pond more accurately according to needs, and to optimise the ‘low-cost’ treatment process that takes place while the water is collected & retained:
 - Depending on the type of suspended solids, you can calculate the optimum retention time. In general, longer retention time increases treatment efficiency (except if you have “additional input” e.g. from birds). But too long retention time (e.g. 7 days) may be counterproductive, because you then reduce also nutrients (e.g. phosphorus).
 - If you select a design with long sedimentation time, consider a bypass for heavy rainfall & high intensity storm events that could disturb the sedimentation and degradation by mixing new rainwater with the retained one. 30% of the total estimated annual volume of storm waters could be discharged with this bypass.
- Consider also other functions of the ponds when elaborating and choosing the design (e.g. walking paths, creating a recreational area with it). This may be important for gaining / increasing the acceptance for the ponds by the population.
- Gdańsk University of Technology offers further assistance in adjusting the preparatory analyses and elaborating the design of the ponds.

Absorption report

Natural stormwater treatment for use in municipal services

Klaipėda District Municipality

Klaipėda University

07 November 2023



WaterMan

Pilot measure in Gargzdai town / LT

- **Recirculation of retained water: Storm water retention pond in public areas**

Uptake of recommendations & adjustments of the concept after the 1st peer & expert review session

**Klaipeda University, Marine Research Institute
Klaipėda District Municipality
Association “Klaipėda Region”**

Dialogue Forum & All-partner Meeting
Rønne / DK
7-9 Nov 2023

LT position on the implementation of EU Regulation 2020/741

EU Regulation 2020/741:

Article 2

Scope

1. This Regulation applies whenever treated urban waste water is reused, in accordance with Article 12(1) of Directive 91/271/EEC, for agricultural irrigation as specified in Section 1 of Annex I to this Regulation.

2. A Member State may decide that it is not appropriate to reuse water for agricultural irrigation in one or more of its river basin districts or parts thereof, taking into account the following criteria:

- (a) the geographic and climatic conditions of the district or parts thereof;
- (b) the pressures on and the status of other water resources, including the quantitative status of groundwater bodies as referred to in Directive 2000/60/EC;
- (c) the pressures on and the status of the surface water bodies in which treated urban waste water is discharged;
- (d) the environmental and resource costs of reclaimed water and of other water resources.

LT position

- The LT Minister for the Environment by 2022-10-11 order determined that, taking into account the criteria set out in Article 2, paragraph 2 of EU Regulation 2020/741, wastewater collected by centralized wastewater collection systems is not reused in agriculture for the purpose of irrigation, as specified in Section 1 of Annex I of Regulation (EU) 2020/741;
- The decision above must be reviewed according to the criteria set out in Article 2, paragraph 2 of EU Regulation 2020/741 at least every 6 years from the entry into force of this order.
- To authorize the Environmental Protection Agency, at the request of the responsible authorities of the member states, to perform the cooperation functions established in Article 8 of EU Regulation 2020/741 on the use of wastewater collected by centralized wastewater collection systems in agriculture for the purpose of irrigation (cross-border water reuse relevance)

1st peer & expert review session comment:

Choose and refer to an existing quality norm, e.g. bathing water quality other European Regulations

Important to test also E. coli, Enterococci, and Legionella (in the summer period)

refer to an existing quality norm, e.g. bathing water quality as in Västervik, other European Regulations (> have a look into the slides of the workshop in Schweinfurt)

		Escherichia coli CFU/100 ml	Intestinal enterococci, CFU/100 ml	Legionella, CFU/L	Remarks
Composite sampling, 2023-09-14		2419,6	23	Not detected	
EU regulation 2020/741	Reclaimed water quality class, indicative technology, crop category				
	A Secondary treatment, filtration, and disinfection. Food crops	≤ 10		Legionella spp.: < 1 000 cfu/l where there is a risk of aerosolisation Intestinal nematodes (helminth eggs): ≤ 1 egg/l for irrigation of pastures or forage	
	B Secondary treatment and disinfection. Food crops	≤ 100			
	D Secondary treatment and disinfection. Food crops	≤ 1 000			
	D Secondary treatment and disinfection. Industrial, energy and seeded crops *	≤ 10 000			
LT hygiene norm HN 92:2018 "Beaches and their bathing water quality"	Limit values (Surface water bodies (lakes, rivers))	≤ 1 000	≤ 100 400??		
Directive 2006/7/EC management of bathing water quality, Annex 1	Bathing waters classification				
	B. Excellent quality	500 ⁽¹⁾	200 ⁽¹⁾		
	C. Good quality	1 000 ⁽¹⁾	400 ⁽¹⁾		
	D. Sufficient	900 ⁽²⁾	330 ⁽²⁾		
	(¹) Based upon a 95-percentile evaluation. (²) Based upon a 90-percentile evaluation.				

For now, we cannot say what the CFU-colony forming units will be in outfall
Discussions with LT responsible health care institutions have started.

Summer sampling campaign completed
(1 grab and 4 composite sampling with automatic sampler 950 ml (x14) bottle kit

Fourth composite sampling

Changes in substances concentrations can be highly variable and depend on factors such as the intensity and duration of the storm, land use, land management practices, and the specific substances in question.

14 bottle kit	pH	SS	BOD ₇	COD	N _{total}	P _{total}	Sulfates	Chlorides
Bottle No. 1	8.19	2,33	9,3	14	13,6	0,05	29	71
Bottle No. 2	8,21	4,3	4,1	14	14,8	0,07	36	69
Bottle No. 3	8,03	44	12	49	11,2	0,31	27	62
Bottle No. 4	7,9	38	12	71	9,8	0,35	20	54
Bottle No. 5	7,93	52	12	58	8,28	0,42	26	44
Bottle No. 6	7,84	59	11	57	7,58	0,31	18	44
Bottle No. 7	7,76	48	13	55	8,42	0,26	14	21
Bottle No. 8	7,72	38	13	52	7,28	0,22	13	19
Bottle No. 9	7,77	34	9,2	66	7,46	0,15	11	19
Bottle No. 10	7,75	27	9,1	65	7,27	0,16	12	19
Bottle No. 11	7,78	17	6,5	98	7,73	0,13	17	19
Bottle No. 12	7,79	19	6,6	31	8,18	0,10	17	20
Bottle No. 13	7,79	11	6,3	27	8,11	0,11	13	21
Bottle No. 14	7,77	7,3	6,2	27	7,96	0,09	11	20
Average	7,29	28,64	9,31	48,86	9,12	0,20	18,86	35,86
LT limit values	6,5-8,5	30	23		25	4	300	1000

2,33 lowest concentration
59 highest concentration

1st peer & expert review session comment:

If there are organic suspended solids, this may make it difficult or even prevent to use the water for irrigation. So it is advisable to survey organic suspended solids and micro granular analysis could be conducted.

Gdańsk University of Technology offers further assistance in adjusting the preparatory analyses and elaborating the design of the ponds.

For now no response from PL colleagues concerning methods for micro granular and organic suspended solids analysis.

KU suggested methods

Organic suspended solids:

The determination of suspended organic matter in surface runoff water can be achieved through a combination of methods. These methods involve collecting suspended matter on glass fiber filters (GF/F) with a nominal pore size of 0.7 μm . The collected matter is then dried at either 105 °C or 60 °C ?? for several hours to obtain the total amount of suspended matter per liter. By subsequently burning the collected matter at 55 °C, we can calculate the weight difference to estimate the amount of organic matter.

Micro granular analysis:

Particle size can be determined by collecting precipitating particles from the water column and analyzing them using a laser analyzer. This analyzer allows for the distinction of different size fractions and provides information on the grain sizes of the media.

Can these methods proposed by KU be applied??

Average COD concentration of 5 samples (1 grab, 4 composite) - 62 mg/l meanwhile, for discharges from urban waste water treatment plants the limit values must not exceed 125 mg/l. COD indicates nearly all-organic substances found in water. Low concentration means a low amount of oxidizable organic matter.

1st peer & expert review session comment:

The design of the pond can determine the water quality at its outlet. It is therefore important to determine in the beginning the water quality that is aimed for at the outlet and needed for the intended reuse (e.g. municipal irrigation, water for firefighting), and to choose the design of the retention pond accordingly

Consider testing in different weather conditions & seasons. For example during the melting of the snow, the composition of suspended solids can be very different than in the summer.

Additional stormwater sampling for: chemical substances analysis

Suspended solids

BOD₇

COD

Petroleum hydrocarbons? (summer sampling average 0,21 mg/l)

N_{total}

P_{total}

Sulfates

Chlorides

and pathogens

Escherichia coli

Intestinal enterococci

Legionella

is planned during the upcoming winter time

The design technical specification also stipulate that a **monitoring program must be prepared**, not limited to chemical and pathogen tests to manage the contamination risks, but also for regular retention pond operation and maintenance purposes:

- Inspect for sediment and debris accumulation in pre-treatment sediment forebay for removal purposes;
- Inspect inlets, outlets and overflows, banksides, structures, for evidence of physical damage;
- Cutting grass, manage plants, etc.

1st peer & expert review session comment:

Depending on the type of suspended solids, you can calculate the optimum retention time. In general, longer retention time increases treatment efficiency (except if you have “additional input” e.g. from birds). But too long retention time (e.g. 7 days) may be counterproductive, because you then reduce also nutrients (e.g. phosphorus).

The volume ratio between the sediment forebay and the permanent pool in a retention pond can vary depending on the specific design and intended function of the pond. However, a common guideline is to size the sediment forebay to be a certain percentage of the permanent pool volume. This percentage can vary based on regulatory requirements, local design standards, and the pond's intended purpose. **A typical range is between 10% to 20% of the permanent pool volume, but it can be higher or lower depending on specific factors, with the available space .**

A wet pond is a constructed basin designed to retain a permanent pool of stormwater with limited biological treatment. Wet ponds aid in peak flow reduction and promote sedimentation. **If stormwater enters through a pipe, it should pass through a forebay, allowing initial sedimentation and velocity reduction. Once water reaches the permanent pool storage, additional sediment settling and biological uptake occur as stormwater is slowly released over 24-72 hours.**

A pond can deliver high aesthetic values to the site and host a large variety of vegetation and wildlife. However, it requires regular maintenance and the need for this is increased by the complexity of the design.

A 2-day retention is currently planned (for maximum daily flow, in other cases, there will be a much longer retention), this figure may vary slightly after rainfall-runoff measurement data analysis is completed

1st peer & expert review session comment:

* If you select a design with long sedimentation time, consider a bypass for heavy rainfall & high intensity storm events that could disturb the sedimentation and degradation by mixing new rainwater with the retained one. 30% of the total estimated annual volume of storm waters could be discharged with this bypass.

** Consider also other functions of the ponds when elaborating and choosing the design (e.g. walking paths, creating a recreational area with it). This may be important for gaining / increasing the acceptance for the ponds by the population.

The following technical requirements are listed in the design tender documentation:

- * for high intensity storm events, secondary runoff paths/bypass system without treatment should be designed;
- to design the retained/treated water flow measurement, sampling, water abstraction for reuse and emergency outlet closure technical appliances;
- ** prepare a landscaping/planting plan with recreational infrastructure elements, footpaths, etc to increase amenity value;
- taking into account the properties of the soil, the pond embankment slopes should be designed to be stable. If necessary, anti-erosion protection means should be provided against heavy rains, ice, etc. effects (different liners materials could be used-clay, geomembrane ...);
- the pond operation, maintenance and monitoring/surveillance plan should be prepared;
- to proposed location of the pond in such a way that it does not fall within the boundaries of the "Natura 2000" territory and the high-probability flood zone;
- to design the lighting of the area;
- it is recommended to use other provisions specified in the Sustainable Drainage Systems Manual (SuDS Manual)

1st peer & expert review session comment:

Consider testing in different weather conditions & seasons. For example during the melting of the snow, the composition of suspended solids can be very different than in the summer.

Main planned activities:

- Winter sampling (grab);
- Cooperation with Klaipėda District Municipality on design issues (assistance during the tendering process and in the preparation of project design solutions);

- Rainfall-runoff measurement data analysis;

Calculated flow values	m ³ /year	Max m ³ /day	Max m ³ /hour	I/sec.		
	41150	4100	600	500		
Measured flow values		Cumulative flow, m ³ /d	Flow rate, l/s and m ³ /s	Base flow, l/s and m ³ /s	Direct/storm flow, m ³ /s	Runoff Coefficient

- Activities related to preparation of trans-municipal water reuse strategy for Klaipėda Region;
- In cooperation with Association “Klaipėda Region” to prepare an article/information focusing more on the partners' pilot measures and their implementation solutions (preliminary idea).
- Development of a questionnaire, meetings/discussions with municipalities, water companies, farmers to raise awareness and collect information on drought affected agricultural crops in Klaipėda region and to find out the needs and possibilities of water reuse in the seven municipalities of the region.
- Together with LT partners organize meeting with Klaipėda region and national stakeholders with pilot site visit in Gargždai.

2nd Peer-review session

Natural stormwater treatment for use in municipal services

Klaipėda District Municipality

Klaipėda University

7 November 2024



**WaterMan
All-partner Meeting
Berlin & Potsdam / DE
5-7 Nov 2024**

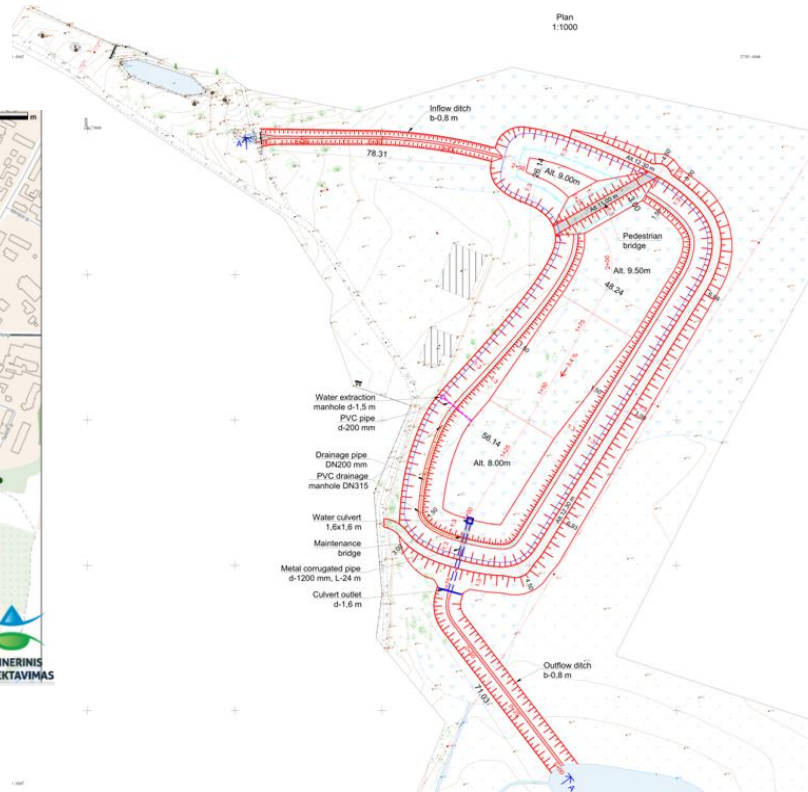
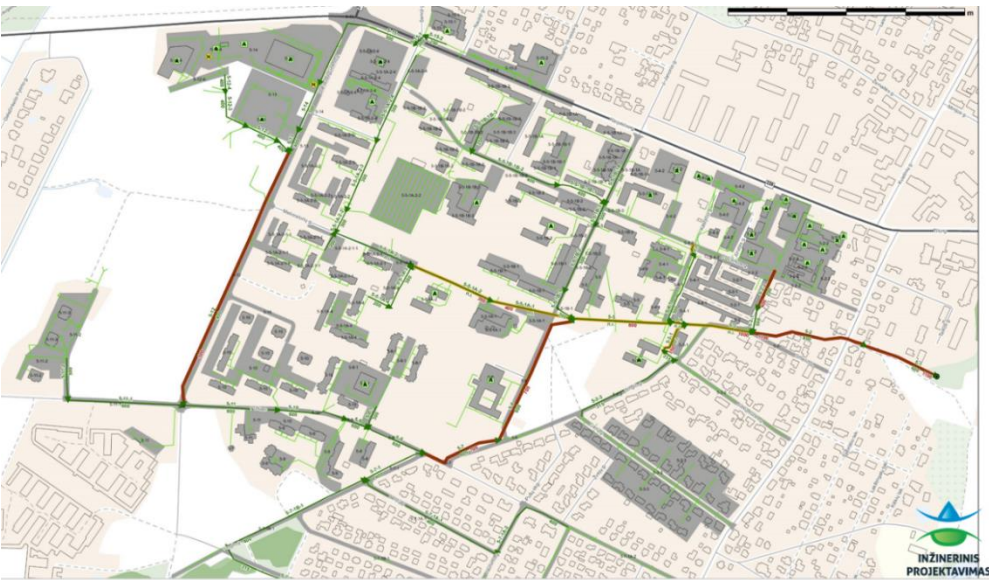
**Users & utilisations for the recycled stormwater of the WaterMan pilot
measure in Gargzdai / LT**

**Klaipėda University
Administration of Klaipėda District Municipality**



WaterMan pilot measure - Retention pond in Gargždai town, LT

Designer: UAB "Inžinerinis projektavimas" (Engineering Design Ltd.)



Storm water catchment area – **110 hectares**;
Forebay (upstream) area – **1040 m²**, volume – **1666 m³**;
Main pond area – **7043 m²**, volume – **17400 m³**;
Planned duration of wastewater retention and treatment – **2 days**;



The envisaged user of the recycled stormwater

During the summer season, the marked in green central part of Gargždai is irrigated with drinking water

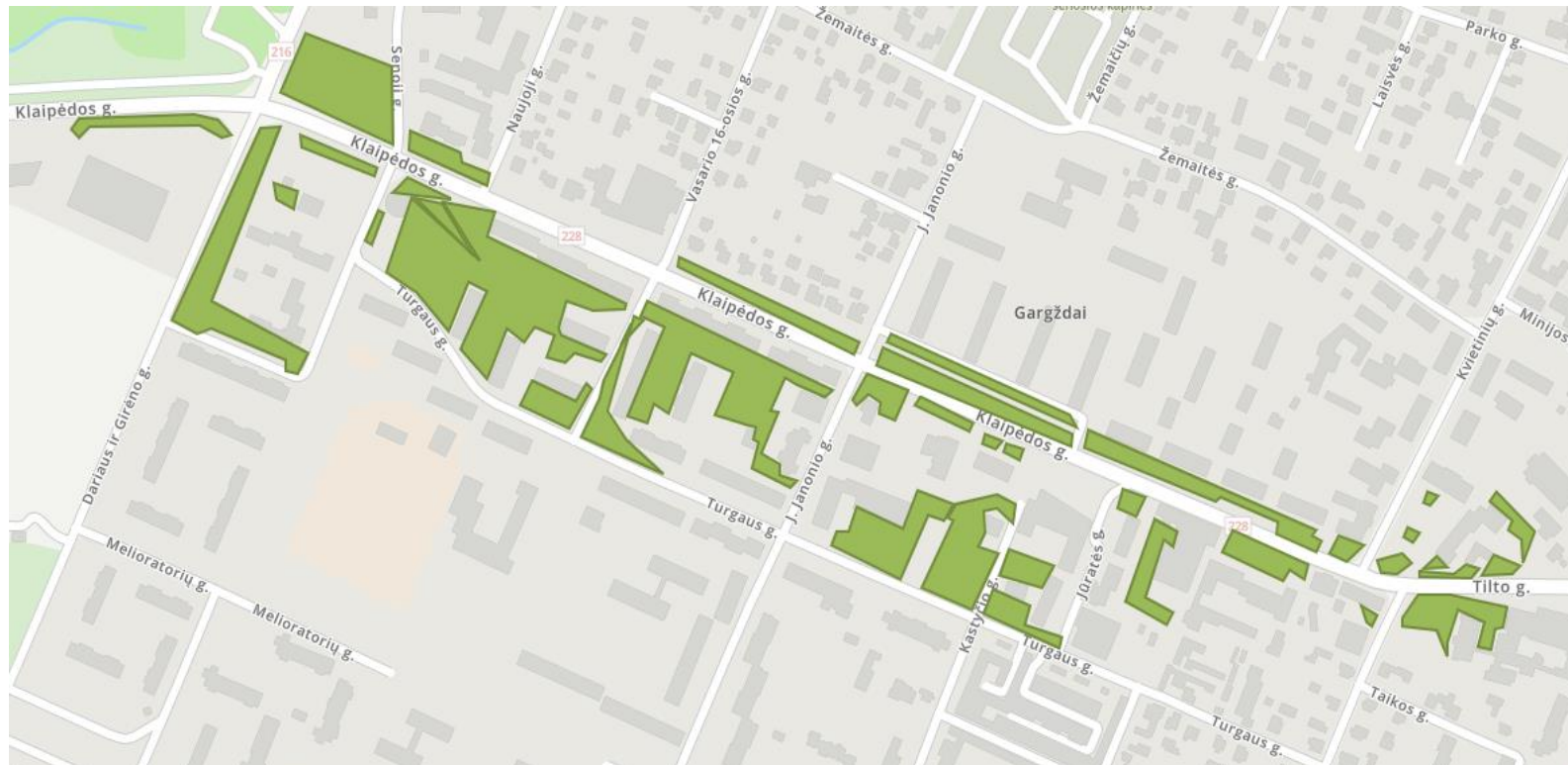
Approximately 50,000 - 60,000 square meters of irrigated green area



The envisaged user of the recycled stormwater

Responsible for irrigation is the Gargždai Town Eldership (smaller municipal administrative unit) of the municipality.

300 cubic meters of drinking water consumed per year/summer season



The methods for evaluating the utilisation of the stormwater

- **2023 stormwater sampling campaign completed:
(2 grab and 4 composite samples)**

For chemicals

- Suspended solids
- BOD7
- COD
- Petroleum hydrocarbons
- Ntotal
- Ptotal
- Sulfates
- Chlorides

And 1 grab and 1 composite sample for pathogens

- Escherichia coli
- Intestinal enterococci
- Legionella



Methods for evaluating the use of stormwater

Sampling and analysis of stormwater runoff in 2023

Chemicals, mg/l

	pH	SS	BOD ₇	COD	Petroleum hydrocarbons	N _{total}	P _{total}	Sulfates	Chlorides
LT Average	7,7	64,2	11,1	50,9	0,27	9,2	0,39	29,3	86,8
Regulation 2020/741		A ≤ 10 B-D 35	A ≤ 10 B-D 25						

Microbiological tests (Legionella not detected in both samples)

E. coli (number/100 ml)				Intestinal Enterococci (number/100 ml)		
Regulation 2020/741	LT summer sample	LT winter sample (snowmelt water)	LT hygiene norm HN 92:2018 "Beaches and their bathing water quality"	LT summer sample	LT winter sample (snowmelt water)	LT hygiene norm HN 92:2018 "Beaches and their bathing water quality"
A ≤ 10	2 419,6	913,9	Excellent - 500* Good - 1 000* Sufficient - 900**	23	780	Excellent - 200* Good - 400* Sufficient - 330**
B ≤ 100						
C ≤ 1 000						
D ≤ 10 000						

* Based on 95th percentile estimate.

** Based on 90th percentile estimate.



Methods for evaluating the use of stormwater

Post-construction stormwater runoff sampling and analysis

Two options for sampling and analysis are available:

- 1. shortly after the completion of the retention pond, i.e. at the end of 2025**
- 2. sampling before the irrigation season in 2026**

The first option is questionable because the pond ecosystem is not yet formed (the vegetation is not yet well established) and may give slightly biased results.

Therefore, the second option would be more acceptable.



Involving and motivating use groups to use recycled stormwater

After further testing, a final decision will be made by the municipality:

- Turn off the drinking water taps and replace the drinking water currently used for irrigation in this green marked area with pond water and determine irrigation methods based on test results



- Other potential pond water user groups to be further considered:
 - Irrigation of other urban green spaces,
 - Irrigation of newly planted trees and other plants,
 - Industrial processes - cooling water, car washes,
 - Fire suppression systems



Retention pond construction progress update

Environmental impact screening conducted - EPA conclusion that full EIA is not required	August 2023
Public procurement documents for design prepared and tender announced	September 2023
Design contract signed	November 2023
Project appraisal/expertize completed	October 2024
Project approval is planned	December 2024
Construction tender documents prepared and tender scheduled	Jan-Feb 2025
Construction scheduled for completion	Aug-Sept 2025



Thank you for your attention

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2nd Peer & expert review session: Recommendations & conclusions

- The presented project schedule doesn't include testing of users' perception. This is an important aspect that must be included.
- How do you distribute the water from the pond to the green areas?: mobile tanks (truck).
- How far is the distance between the pond and the irrigated area: several hundred meters.
- Responsibility for irrigation: Gargzdai municipality. Another institution will make investments into the mobile tanks, and infrastructure (pipes). If we want to expand irrigation area, we will need mobile units anyway.
- Think about how to enable water for other user groups of pond water in the future (to extend the user groups after project lifetime): for example there could be tanks/reservoirs placed somewhere else.
- Do you pick-up the water directly from the pond? No, similar to Västervik – we will have a tap point. It's part of the design.
- How much water can you use per day, considering that you have these 2 days retention time? Think about it, calculate it – to determine the potential for reuse and for extension of user groups after project lifetime. Difficult to say. About 7000 m³ per year?
- User acceptance: Consider to irrigate at night time (no movement of people).
- Consider if there are any possible problems with permissions to use it for irrigation of the green area? For this Gargzdai plans to have additional discussion with hygiene authorities.
- Consider risk assessment & management during monitoring of operation of the pond.
- We have to decide about the kind of method that could be used for irrigation (depending on the volumes of contaminants in the water, the KWB prepared a programme / algorithm what irrigation method to use).
- One very safe use case for Gargzdai to be considered: flushing the sanitary network (canalisation). Probably no permission needed.
- If you do not have one safe utilisation that is realised, evaluated and adjusted within the project lifetime, then you have failed formally. This can result in severe consequences from the Programme, including the obligation to pay back the whole amount already spent.

Final review

Natural stormwater treatment for use in municipal services

Klaipėda District Municipality

Klaipėda University

24 September 2025



The Challenge: A New Water Reality in Gargždai

- **The Local Problem: A Dual Challenge for Klaipėda District**
 - **Excess Stormwater:** Due to climate change, heavy rainfall overwhelms our insufficient, Soviet-era infrastructure, leading to localized flooding.
 - **Wasted Drinking Water:** During the summer, the municipality uses approximately **300 m³ of high-quality drinking water** annually just to irrigate 50,000–60,000 square meters of green spaces in central Gargždai.
- **The Need for a New Solution:** The current situation is unsustainable. We need a modern, climate-resilient approach that turns our stormwater problem into a valuable resource.
- **The Opportunity: The Stormwater Pond**
 - By creating a stormwater retention pond, we can naturally treat runoff and reuse it for municipal needs, saving precious drinking water.
 - This aligns with our strategic goals for sustainable infrastructure.



Impact and Systemic Causes

- **Who is Affected?**
 - **Local Authorities & Water Companies:** They are the key actors responsible for water supply and climate change adaptation, but for most, water reuse is still a novelty.
 - **Water Consumers:** Citizens, farmers, and industries are directly affected by water shortages. Their acceptance is crucial for the successful adoption of water reuse practices.
 - **The Baltic Sea Environment:** The sea suffers from nutrient and hazardous substance runoff. Retaining and reusing water on land helps reduce these outflows.
- **Underlying Causes:**
 - **Environmental Driver: Climate Change** – The primary driver, which alters precipitation patterns and causes more frequent and intense droughts and rainfall events.
 - **Systemic Barriers:**
 - **Lack of Awareness and Capacity:** Local authorities lack knowledge about the potential of water reuse.
 - **Outdated Infrastructure:** Our pilot project addresses a specific problem—**insufficient and outdated Soviet-era infrastructure** that cannot cope with current weather events.
 - **Mindsets and Acceptance Barriers:** Shifting away from using drinking water for all purposes requires a fundamental change in thinking from both consumers and the water industry. Gaining consumer and stakeholder acceptance can be more challenging than the technical aspects.



Objectives of the Gargždai Pilot Project

- **Primary Goal: Test and Validate a Nature-Based Solution**
 - The pilot aims to implement, test, and validate a **stormwater retention pond** as a practical and replicable solution for water reuse in the Baltic Sea Region (BSR).
 - It is designed to be a "blueprint" that can be easily transferred to other municipalities facing similar challenges.
- **Prove Technical Feasibility & Usefulness**
 - A key objective is to demonstrate the **technical feasibility and usefulness** of recirculating retained stormwater for municipal services.
 - The project will test the pond's effectiveness as a natural purification system and its ability to supply water for:
 - **Irrigating parks and streets** in Gargždai.
- **Achieve Water Savings & Increase Climate Resilience**
 - The project intends to prove that reusing stormwater can significantly **reduce the use of drinking water**, aiming for an estimated saving of **300 m³ annually**.
 - This contributes to the broader objective of making our local water supply more **climate-resilient** by diversifying water sources.



Broader Objectives: Fostering Acceptance and Regional Strategy

- **Test and Promote Social & Stakeholder Acceptance**
 - A critical aim of the overall WaterMan project, and our pilot, is to address and promote **consumer and stakeholder acceptance** for water reuse.
 - Experience from other European regions shows that gaining acceptance can be more challenging than the technical implementation.
 - We will engage local users and stakeholders through meetings and a media campaign to build awareness.
- **Contribute to a Trans-Municipal Strategy**
 - Our local pilot is not an isolated project; it's a key component of a larger regional effort. We aim to contribute experiences and data to the development of a **trans-municipal water reuse strategy** for the entire Klaipėda Region, in cooperation with the Association "Klaipėda Region" and Klaipėda University.
- **Create a Multi-functional Public Space**
 - Beyond its technical function, the project aims to improve the local environment by transforming an underutilized area.
 - The plan includes creating a **new recreational area** with walking paths and enhancing local biodiversity by planting native species, thereby increasing the site's public and ecological value.



Context: Why Gargždai?

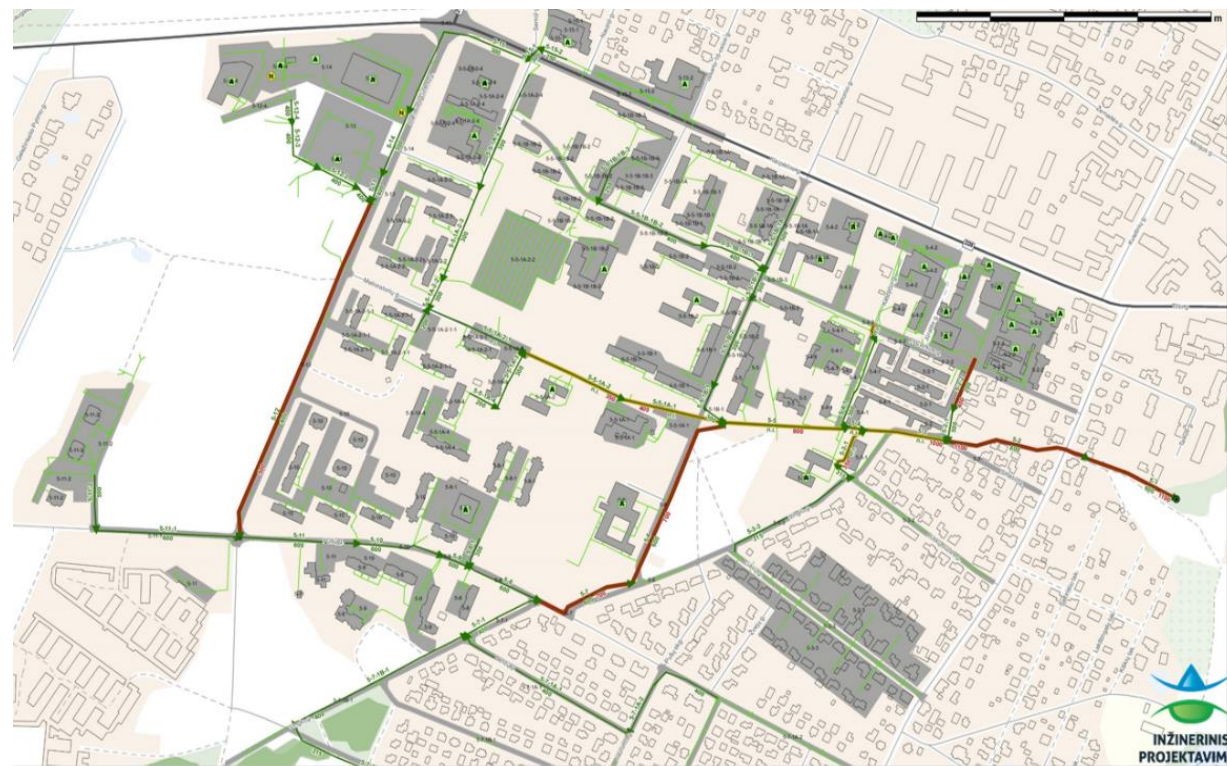
- **Specific Location:** The pond is being built in Gargždai town, near Taikos St. 11 & 12, in the Minija river valley.
- **Targeting an Existing Problem:** The site was chosen because it is the discharge point for a **110-hectare urban drainage basin**. This area includes multi-story residential buildings, public buildings, and some private homes.
- **Infrastructure Challenge:** Currently, stormwater from this large area flows through an existing, but non-operational, sand trap and is discharged untreated into the Minija river valley via an open ditch.
- **High-Impact Opportunity:** The central part of Gargždai uses approximately **300 m³ of drinking water annually** just for irrigating 50,000-60,000 square meters of green spaces. The pond is strategically located to capture runoff that can be reused for this very purpose, creating a direct and measurable benefit.
- **Land Availability:** The project is planned on state-owned land that is not yet formally designated, which facilitates its development for public infrastructure.



During the summer season, the marked in green central part of Gargždai is irrigated with drinking water
Approximately 50,000 - 60,000 square meters of irrigated green area



Stormwater catchment area – 110 hectares



Policy & Strategic Alignment

- **EU Policy Driver:** The project aligns with the EU's focus on climate resilience and sustainable water management. It directly contributes to the **EU Strategy on Adaptation to Climate Change** and supports the **EU Regulation 2020/741 on Water Reuse**.
- **Baltic Sea Region Strategy:** The WaterMan project contributes to the **EU Strategy for the Baltic Sea Region (EUSBSR)**, specifically Policy Area Nutri. By retaining and reusing stormwater, we **reduce the outflow of nutrients and hazardous substances** into the Minija River and ultimately the Baltic Sea.
- **Local & Regional Strategy:** The pilot is a core part of Klaipėda District Municipality's strategic development goal for **sustainable infrastructure**. It also serves as a practical component for a **trans-municipal water reuse strategy** being developed by the Association "Klaipėda Region" and Klaipėda University.
- **Conditions & Environment:**
 - **Environmental:** The primary driver is **climate change**, causing more frequent extreme weather events.
 - **Institutional:** The project is a collaborative effort between the **Klaipėda District Municipality** (implementer), **Klaipėda University** (provides scientific expertise), and the **Association "Klaipėda Region"** (coordinates the strategy).
 - **Economic:** The pilot project has a budget of **€272,195**, co-financed by the Interreg Baltic Sea Region Programme (ERDF).



Our Key Stakeholders & Their Roles

- **Core Project Partners (Local Implementation Team):**
 - **Klaipėda District Municipality (KDM):** As the lead implementer, we are responsible for the practical execution of the Gargždai pilot, including procurement, construction, and overall management of the retention pond project.
 - **Klaipėda University (KU):** Our scientific partner, providing essential technical and methodological expertise, including stormwater modeling and water quality analysis.
 - **Association "Klaipėda Region" (AKR):** This association unites seven local authorities. Their role is to ensure our pilot project contributes to a broader **trans-municipal water reuse strategy** and to help raise awareness among local politicians and stakeholders.
- **Local End-Users & Operational Partners:**
 - **Gargždai Town Eldership:** The primary envisaged user of the recycled water for irrigating the town's central green spaces.
 - **UAB "Klaipėdos rajono energija":** An operational partner who has agreed to use the recycled water for pipeline flushing, serving as a safe alternative use case.
 - **AB "Klaipėdos vanduo":** The regional water utility, involved in stakeholder meetings to ensure alignment with broader water management practices.



Engaging Stakeholders Throughout the Process

- **Transnational Peer Learning & Co-creation:**
 - We actively participate in a structured international dialogue with partners from six countries. This involves **regular peer review sessions** where our pilot plans are commented on by partners and external experts, ensuring we benefit from a wide range of experiences.
 - We also engage in international **study trips and conferences** to "import" knowledge on best practices from regions where water reuse is more advanced, such as Spain.
- **Local & Regional Engagement:**
 - **Direct Meetings:** We are holding targeted meetings with key local users and partners—specifically the **Gargždai eldership, AB „Klaipėdos vanduo“,** and **UAB „Klaipėdos rajono energija“**—to align on practical implementation and gather feedback.
 - **Strategic Dialogue:** The Association "Klaipėda Region" involves local politicians and stakeholders in international dialogues and study trips to raise their awareness and inspire new solutions based on international experiences.
- **Public Awareness & Acceptance Building:**
 - Recognizing that stakeholder and consumer acceptance is critical, we are planning a **media campaign** involving articles, social media updates, and local press coverage to inform the public about the project.



The Solution: A Nature-Based Approach for Stormwater Reuse

- **Technical Solution:** A **stormwater retention pond** was designed and is being constructed in Gargždai town.
 - This solution replaces insufficient Soviet-era infrastructure with a modern, eco-efficient system designed according to sustainable urban drainage principles (SuDS).
 - The pond is a **nature-based solution** that uses natural processes like sedimentation and biodegradation for purification, avoiding the need for additional technical equipment or chemicals.
- **Organizational Solution:** The project is a collaborative effort led by the Klaipėda District Municipality.
 - It is one of ten pilot measures within the international **Interreg BSR WaterMan project**.
 - **Klaipėda University** provides scientific and technical support.
 - **Association "Klaipėda Region"** integrates the local pilot into a broader, **trans-municipal water reuse strategy** for seven municipalities.
 - Operational users like the **Gargždai Town Eldership** and **UAB "Klaipėdos rajono energija"** are key partners for the final use of the recycled water.



Development Process & Methods

- **Process of Development: Transnational Co-creation**
 - Our local pilot is part of a structured international process involving municipalities, water companies, and research institutions from six countries.
 - The core method is a **transnational peer learning and co-creation arena**. This involves:
 - **Regular Peer Reviews:** We present our pilot plans in sessions where partners from other countries and an international expert panel provide feedback and recommendations.
 - **"Importing" Knowledge:** We participate in study trips and conferences to learn from best practices in regions where water reuse is more advanced, such as Spain.
- **Process of Testing:**
 - The solution will be tested under **real-world conditions** to demonstrate its feasibility and usefulness.
 - Water reuse testing is scheduled for **September–November 2025**, following the completion of construction works.
 - Klaipėda University (KU) will conduct post-construction sampling and analysis, likely before the 2026 irrigation season, to allow the pond's ecosystem to stabilize



Tools, Technologies & Timeline

- **Technology: Nature-Based Solution (SuDS)**
 - The core technology is a **stormwater retention pond**.
 - It uses natural purification processes like **sedimentation and biodegradation** in a two-stage system (forebay (1040 m², 1666 m³) and main pond (7043 m², 17400 m³).
 - The system includes an intake point for collecting the treated water into mobile transport vehicles.
- **Methods for Planning & Analysis:**
 - **Preparatory Surveys (Baseline Analysis):** Before design, we conducted surveys to create a knowledge base.
 - **Stormwater Sampling and Analysis:** Klaipėda University conducted a comprehensive sampling campaign in 2023 to determine the runoff's chemical and microbiological characteristics.
- **Project Timeline & Milestones:**
 - **Phase 1: Preparation & Design (2023–2024):** Project appraisal completed in **October 2024**.
 - **Phase 2: Construction (2025):** Construction works are completed in **September 2025**.
 - **Phase 3: Testing & Evaluation (End of 2025):** Water reuse testing is planned for **September–November 2025**.

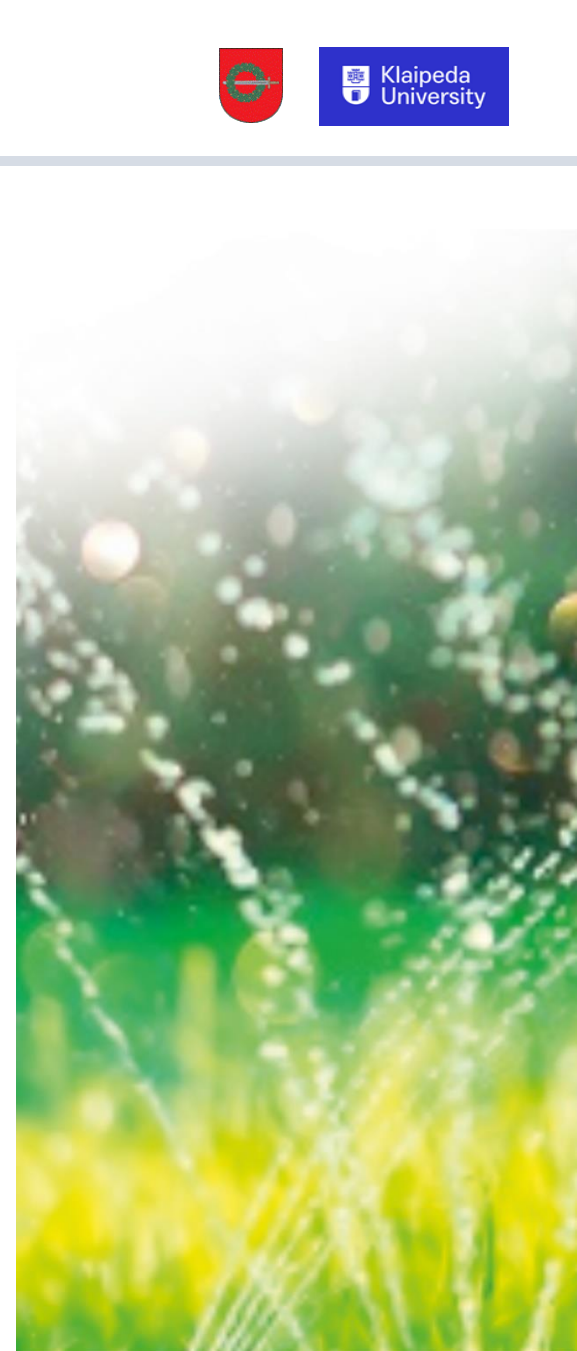




Photo credit: Laura Jankutė

Lessons Learned: What Didn't Go as Planned & Adjustments

- **Initial Concept vs. Practical Reality: Pipeline Installation**
 - **What didn't go as planned?** An intuitive idea for distributing the recycled water would be a permanent pipeline system.
 - **What needed adjustment?** A feasibility assessment showed this was not a rational approach for our specific site. The retention pond is located in the Minija river valley at a lower elevation than the town's green spaces.
 - **Lesson:** Pumping water up a 30-meter height difference over challenging terrain would be inefficient and costly. The plan was adjusted to use **mobile transport vehicles** to collect and distribute water, which is a more practical and flexible solution for this location.
- **Risk Mitigation: Construction Delays**
 - **What was identified as a potential problem?** The primary risk to the pilot's success within the WaterMan project timeline is a delay in construction works.
 - **Lesson:** We have proactively planned for potential delays by extending the pilot's internal timeline to December 2025, ensuring that even with setbacks, the project goals can be met.



Key Takeaways for Future Implementations

- **Lesson 1: Proactive Planning for Water Quality is Crucial**
 - **Takeaway:** A comprehensive **pre-construction sampling campaign**, like the one Klaipėda University conducted in 2023, is essential. This data is critical for the engineering design and for setting realistic expectations.
 - **Recommendation:** Always secure a scientific partner early. Also, plan for post-construction sampling before the main usage season (e.g., before the 2026 irrigation season) to allow the pond's natural ecosystem to stabilize.
- **Lesson 2: Secure a "Safe" Alternative Use Case from the Start**
 - **Takeaway:** The primary goal is irrigating green spaces, but it's vital to have a backup plan.
 - **Recommendation:** We secured an agreement with the local energy company, UAB "Klaipėdos rajono energija," to use the water for **pipeline flushing**. This provides a valuable, non-public-contact use case, ensuring the pilot's recycled water has a purpose regardless of initial testing outcomes and de-risks the investment.
- **Lesson 3: Don't Reinvent the Wheel – "Import" Knowledge**
 - **Takeaway:** Water reuse is a novelty for most municipalities in our region, but it's a well-established practice elsewhere. The WaterMan project's structure taught us the immense value of not starting from scratch.
 - **Recommendation:** Actively participate in transnational learning. Through **study trips to advanced regions like Spain** and regular peer reviews, we can "import" field-tested solutions and adapt them to our local Baltic Sea Region conditions



The water usage for pipeline flushing



Video credit: UAB „Klaipėdos rajono vandenys“

Before

After



Photo credit: UAB „Klaipėdos rajono vandenys“

Scalability: From a Local Pilot to a Regional Blueprint

- **Can the Measure be Scaled Up? Yes, it is designed for it.**
 - The Gargždai pilot project is explicitly designed to be a **replicable blueprint** for other municipalities, not just a one-off solution.
 - The knowledge and results are processed into a "**BSR Water Reuse Toolbox**" which gives other local authorities concrete guidance on how to replicate these measures.
- **Scaling Up within the Klaipėda Region:**
 - The project is a cornerstone for a **trans-municipal water reuse strategy** being developed for all seven member municipalities of the Association "Klaipėda Region".
 - The experience from Gargždai will directly inform and enable similar projects in neighboring municipalities.
- **Scaling Up Across the Baltic Sea Region:**
 - The entire WaterMan project is structured as a **transnational peer learning and co-creation process**, ensuring that the lessons learned in Lithuania are shared and validated with partners.



Financial Viability of Scaling Up

- **Financial Sustainability:**
 - **Reduced Operational Costs:** The primary financial benefit is long-term savings from **reducing the use of high-quality, expensive drinking water**. Our Gargždai pilot is estimated to save **300 m³ of drinking water annually**.
 - **Nature-Based Solution:** The retention pond is an **eco-efficient solution** that relies on natural purification. This avoids the high operational and maintenance costs associated with more complex technologies.
- **Financial Viability (Funding):**
 - **Leveraging Transnational Funding:** The Gargždai pilot is made possible by co-financing from the **Interreg Baltic Sea Region Programme**, which covers 80% of the costs.
 - **Blueprint for Future Funding Applications:** The successful implementation of the Gargždai pilot and the creation of the "**BSR Water Reuse Toolbox**" provide a proven concept and strong justification for future funding applications.



Transferability of the Solution and Preconditions for Success

- **How can the solution be adapted to other regions?**
 - The core method for transfer is the "**BSR Water Reuse Toolbox**". This online catalogue will contain "**replication blueprints**" that present the solution in an easy-to-understand way, allowing other municipalities to adapt the most suitable solutions.
 - The project's **transnational peer learning and co-creation arena** is a key process for adapting solutions, including "importing" knowledge from more advanced regions like Spain.
- **Preconditions for Successful Replication:**
 - **1. Local Need & Political Will:** There must be a recognized local challenge, such as water scarcity or flooding, and strong support from local authorities.
 - **2. A Structured, Data-Driven Planning Process:** This requires **preparatory surveys (baseline analysis)**, including site-specific analysis and water quality assessment.
 - **3. Stakeholder Engagement and Acceptance:** **Early and continuous dialogue with stakeholders** and a strategic plan to build public acceptance are critical.
 - **4. Collaborative Partnerships:** A strong partnership between the implementing municipality and a **scientific/research institution** is essential.



Final Reflections & Our Wish for the Future

- **Our primary wish is for our pilot to become a true catalyst for change.**
 - We hope it serves as a tangible, trusted **blueprint that is actively replicated** by other municipalities across Lithuania and the wider Baltic Sea Region.
 - Ultimately, we wish for a fundamental **shift in mindset**—where both the public and the water industry see recycled stormwater not as waste, but as a valuable and essential resource for building a climate-resilient future. Our pond, with its integrated recreational paths and enhanced biodiversity, is designed to be a living demonstration of that new way of thinking.





Photo credit: Vytautas Valantinas



Photo credit: Vytautas Valantinas

Final review, 24 September 2025



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The „BSR Water Recycling Toolbox” was elaborated as part of the WaterMan project, which is co-financed by the European Union (European Regional Development Fund) and implemented within the Interreg Baltic Sea Region Programme. More information:

eurobalt.org/WaterRecyclingToolbox

interreg-baltic.eu/project/waterman

WaterMan promotes a Baltic Sea Region-specific approach to water recycling, which makes use of the alternation of too much and too little water that has become typical for humid areas in the EU to strengthen the resilience of local water supply. Building on this approach, the project supports municipalities and water companies in adapting their water supply strategies.

The contents of „BSR Water Recycling Toolbox” are the sole responsibility of the authors and can in no way be taken to reflect the views of the European Union, the Managing Authority or the Joint Secretariat of the Interreg Baltic Sea Region Programme.

