Interreg
Baltic Sea Region

Co-funded by
the European Union

SUSTAINABLE WATERS
WaterMan

Water Recycling Toolbox

Water recycling strategy for Braniewo / PL

Braniewo Municipality

Gdańsk University of Technology

GDAŃSK UNIVERSITY OF TECHNOLOGY

WaterMan Kick-off meeting

Kalmar & Västervik, Sweden (14-16/03/2023)

Braniewo Municipality (PP5) &GUT (PP7)

Presented by Magdalena Gajewska

2.4 Local model strategy: Municipal water re-use strategy

T 1.2 Jointly developing a set of methods and tools for elaborating the local model strategies

- **GUT – D.1.2.**
- **Extreme Water Layer – guidelines**
  - ***INTERREG BSR no # R093 "Protecting Baltic Sea from untreated wastewater spillages during flood events in urban area" NOAH- 2019-2021***

1.3 Preparatory surveys for elaborating the local water reuse strategies in the WaterMan model regions

- **Braniewo –**

inventory of rain water drainage network (31.12.2024)

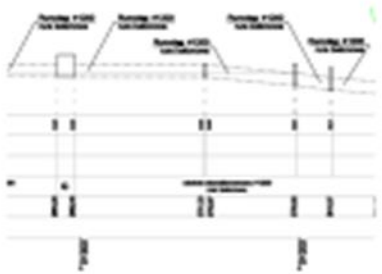
- **GUT – D.1.3.**

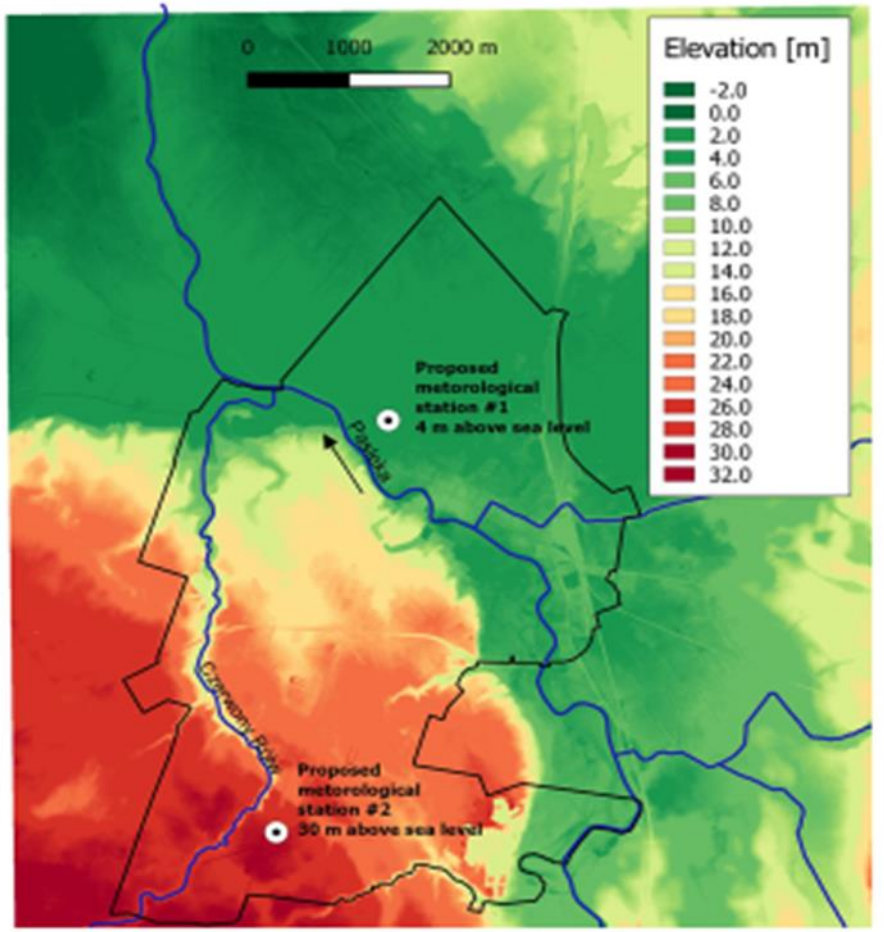
Extreme Water Layer – baseline analysis (31.12.2024)

Modeling of the stormwater runoff drainage system of the City of Braniewo

Preliminary actions:

1. *Inventory of the city's stormwater drainage system*
   - *Elevation*
   - *Martial – roughness*
   - *Facilities*
2. *Establishing the meteorological stations to collect:*
   - *Precipitation depth and duration*
   - *Temperature*
   - *Wind speed and direction*





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- Identification of flood-prone locations
- Definition of flood risk classes

NOAH – CASE STUDY SŁUPSK

EWL enables various types of flood risk visualization

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		0-1	1-10	>10
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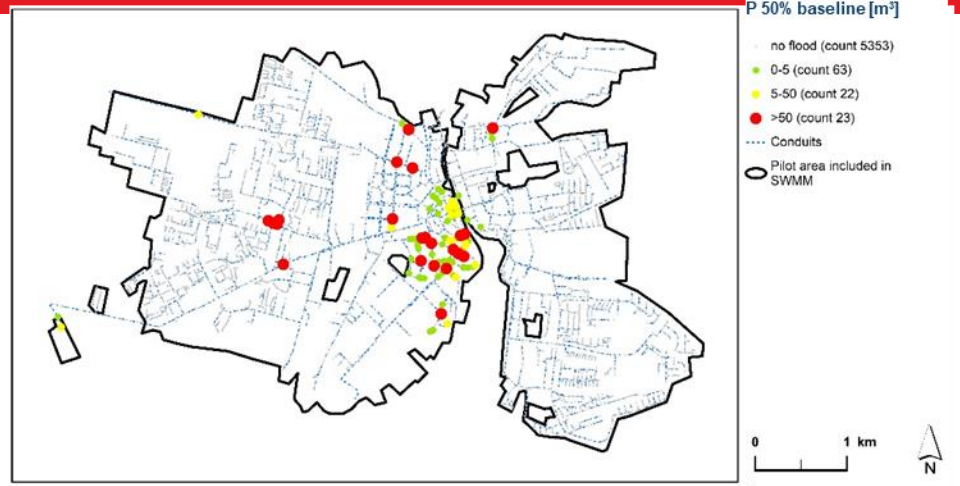

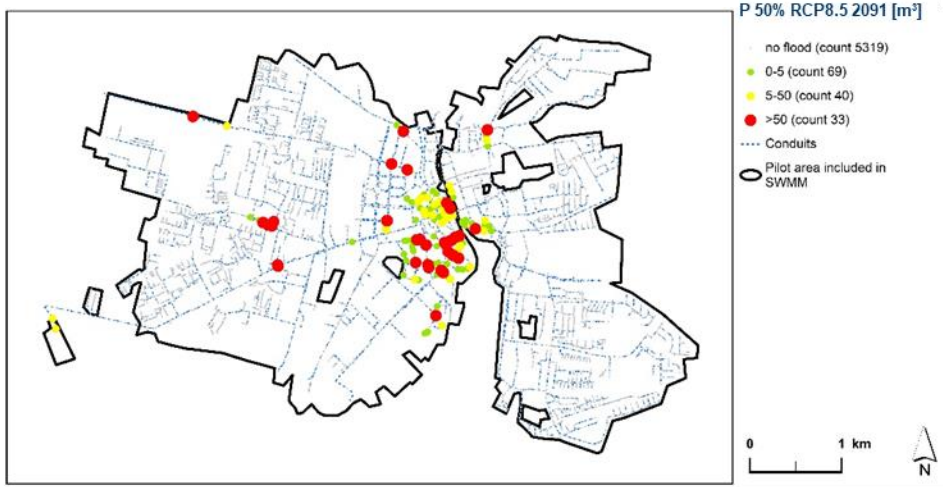

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• What more can we do with the EWL (and the hydraulic model being a part of it)

NOAH – CASE STUDY SŁUPSK

Assessment of effects of the changes in spatial development - Storm water retention scenario base implemented already in Gdańsk*

- 30 mm of runoff retained in place – before the pipe
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Probability	Scenario	Decrease in the flooding volume [%]	
		Total flooding in Słupsk	Overflow to the Słupia River
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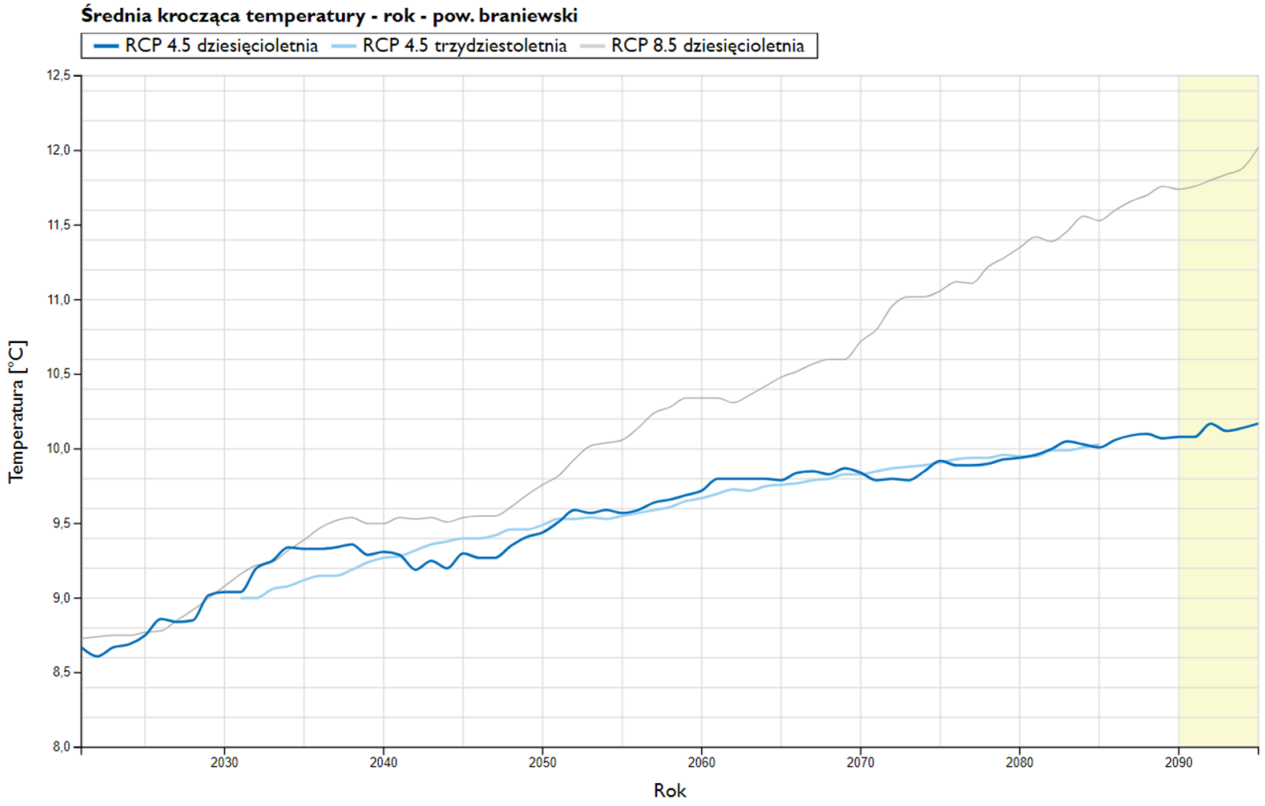
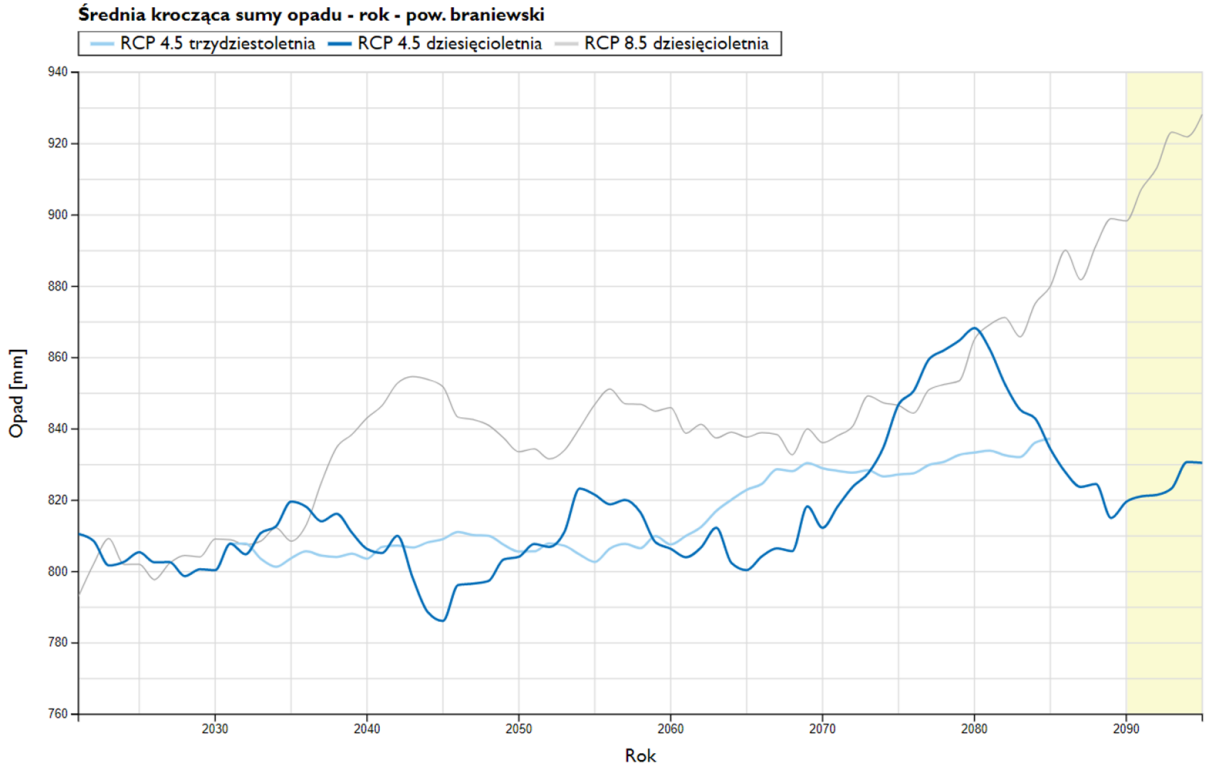
	RCP 8.5 2091-2100	50	60

*

2.4 LOCAL MODEL STRATEGY: MUNICIPAL WATER RE-USE STRATEGY





2.4 Local model strategy: Municipal water re-use strategy

Strategy for Braniewo based on EWL with climate scenario and quality of rain water with regards to:

-mitigation of flood and droughts problems
-identification of places to keep rain water before gray pipe (moat)
-re- use of rain water and swimming pool water to saving drinking water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SUSTAINABLE WATERS
WaterMan

Initial exchange

Water recycling strategy for Braniewo / PL

Braniewo Municipality

Gdańsk University of Technology

9 November 2023

GDAŃSK UNIVERSITY OF TECHNOLOGY

WaterMan All-partner Meeting
Rønne / DK
9 Nov 2023

Braniewo Municipality (PP5) &GUT (PP7)

Presented by Magdalena Gajewska

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WP- 2

WaterMan pilot actions in Braniewo (Poland)

- **2.4 Elaborating local model strategies for water reuse in dialogue with stakeholders & water consumers**

Responsible Project Partner:

Braniewo Municipality (PP 5)

Gdansk University of Technology (PP7),
Faculty of Civil and Environmental Engineering

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purpose and scope of the strategy.

PURPOSE

- water reuse strategies that include measures for reuse of treated water and recirculation of retained water,
- and are accompanied by actions to promote stakeholder & consumer acceptance.

SCOPE

- Entire municipal territory / storm water & floods /

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City of Braniewo Development Strategy for the Years 2021-2030, 90 p

1. Development Challenges of the City of Braniewo

- Addressing Climate Change-Related Risks and Growing Wealth Disparities
- Enhancing the City's Competitiveness through Infrastructure Development

to Improve Investment Attractiveness and Living Conditions

2. Strategic Goals for City Development and Directions of Planned Actions

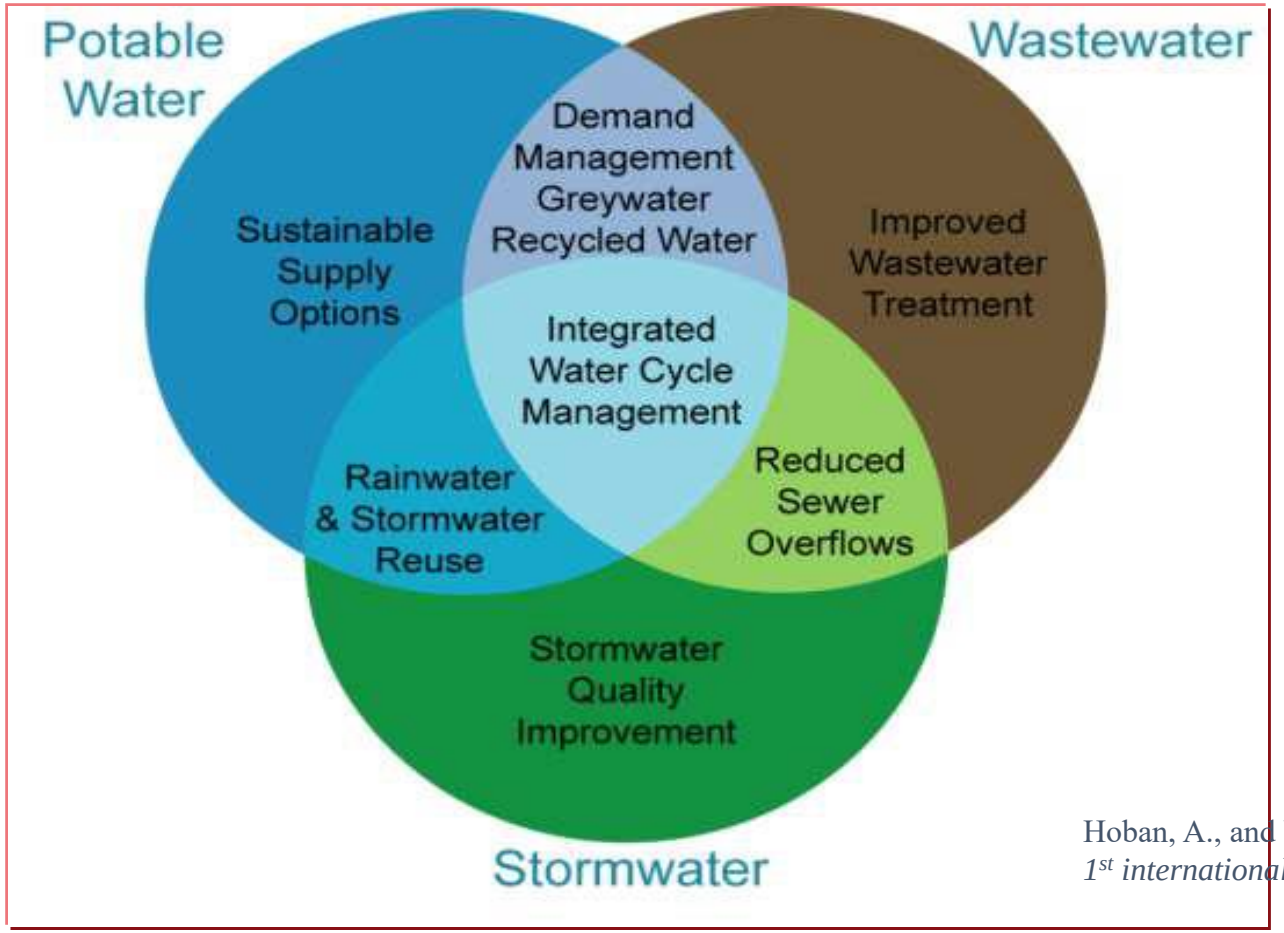
SG I active Residents

SG.II. Attractive and Resident-Friendly Living Space

SG. III. Resilient Green City

SG IV. Competitive economy

Urban Water Integrate Cycle



Hoban, A., and Wong, T.H.F., (2006) "WSUD resilience to Climate Change" *1st international Hydropolis Conference, Perth WA,* October 2006.

Water structure in Braniewo

Yerly consuption :

- **Service & industry 165 000 m3**
- **Citizens 485 000 m3**

- **Register of calls for cleaning stormwater drainage approximately 60 callouts per year**
- **Cleaning and sweeping streets (using a sweeper) - approximately 78,400 liters per year. App 400l/day**
- **Watering - 200,000 liters per year.**
- **Amphitheater - approximately 2,500 cubic meters; water costs: 13,441.22 PLN.**

REUSE

Water Reuse Measures:

- Identify potential sources of water suitable for reuse, such as swimming pool water, wastewater treatment plants.
- Establish guidelines and standards for the quality of water for reuse.
- Promote water recycling in municipal service and needs, industrial, agricultural, and residential sectors.
- Develop infrastructure for water treatment and distribution

30 m³/d

water supply
from the municipal network

wastewater
from showers and toilets

pool water
overflow

filter rinsing ***wastewater***

15 m³/d

4÷5 m³/d

10÷11 m³/d

discharge into the sewage system

For reuse: +/- 15 m³/d

After implementation of
the WaterMan pilot solution:

- ✓ 50% **reduction** in sewage discharge
- ✓ 50% **savings** on tap water for irrigation

STORMWATER

Retained Water Recirculation:

- Implement systems for the retention and recirculation of stormwater.
- Create retention ponds, green infrastructure, or rainwater harvesting systems to capture and store rainwater.
- Design distribution networks for the recirculation of retained water.

Flood Prevention and Stormwater Management:

- Develop flood control infrastructure to mitigate the impact of heavy rainfall.
- Integrate stormwater management into urban planning (LID) and construction practices (EWL).
- Promote permeable surfaces and sustainable landscaping to reduce stormwater runoff.

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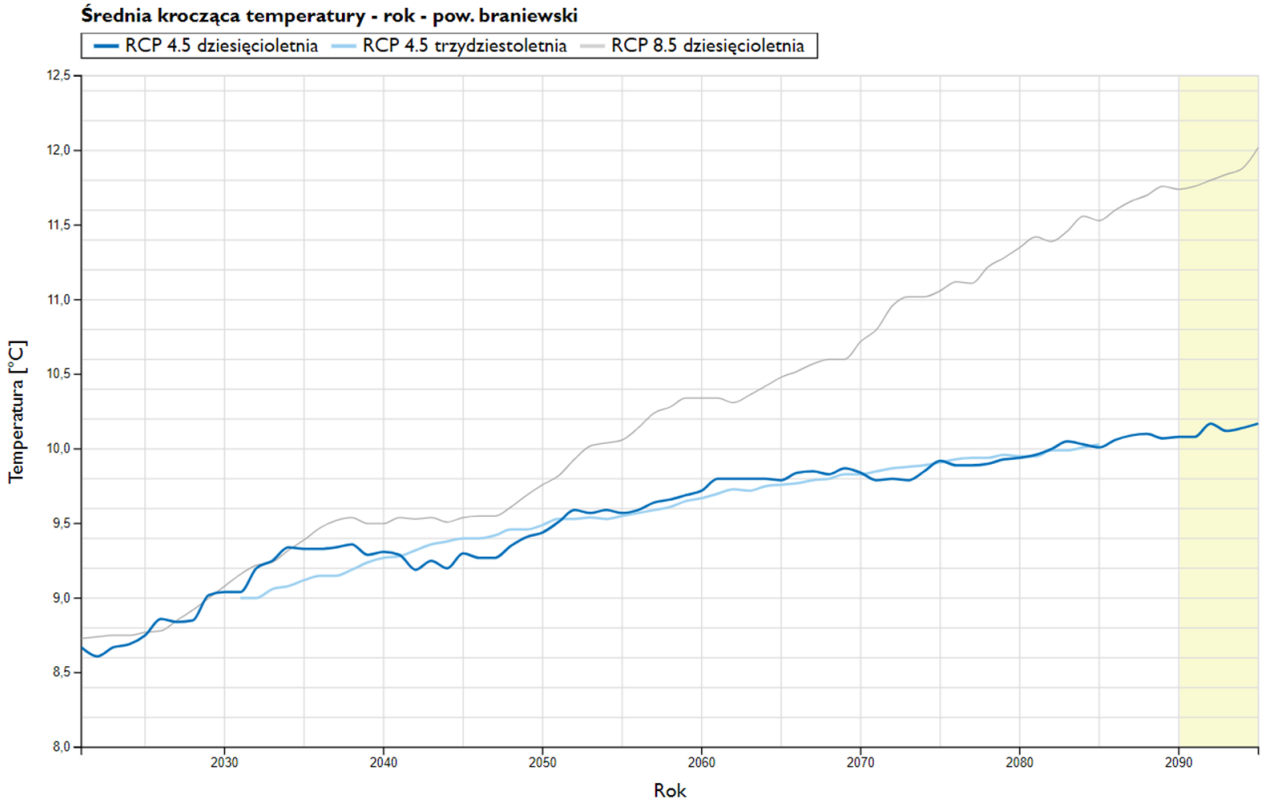

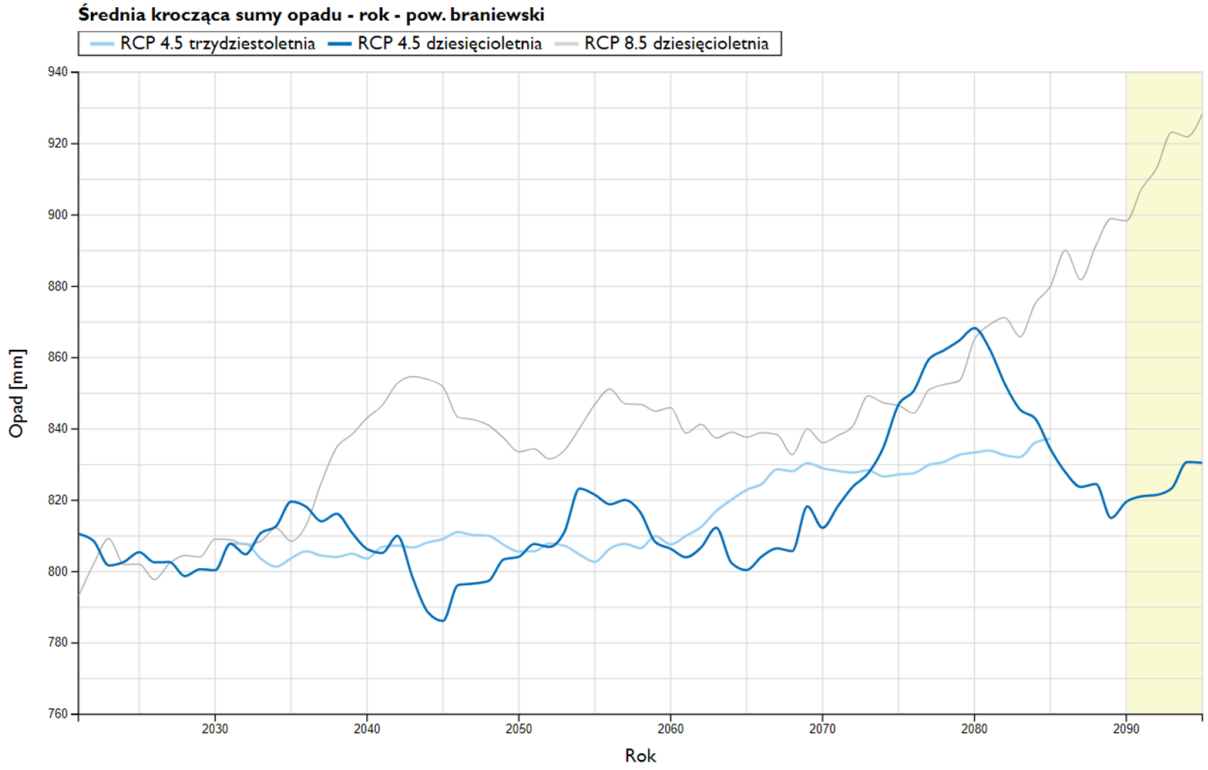

2.2 Pilot measure / recirculation of retained water: Urban raingarden at public swimming pool

JAGGED CURBS

2.2 Pilot measure / recirculation of retained water: Urban raingarden at public swimming pool

GUTTER

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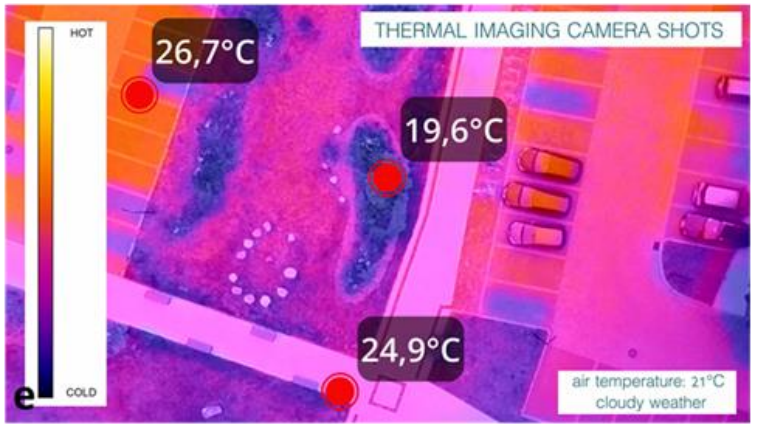
CONTENT AND TOOLS

Rain gardens



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NOAH

Implementation of EWL – The Słupsk case study

- Identification of flood-prone locations
- Definition of flood risk classes

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➢ An example of manholes and flood risk classes based of the flooding flow rate

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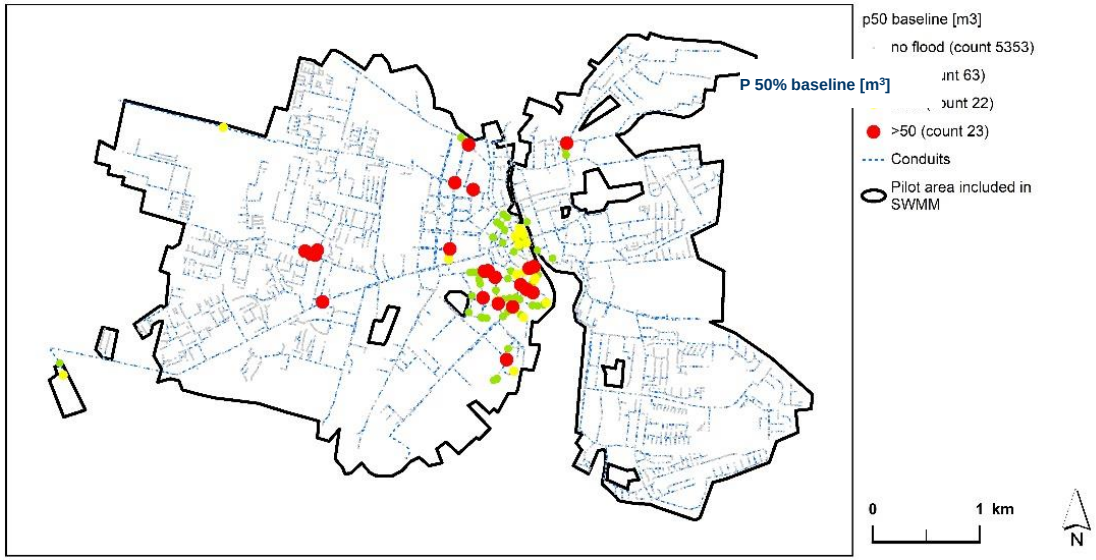

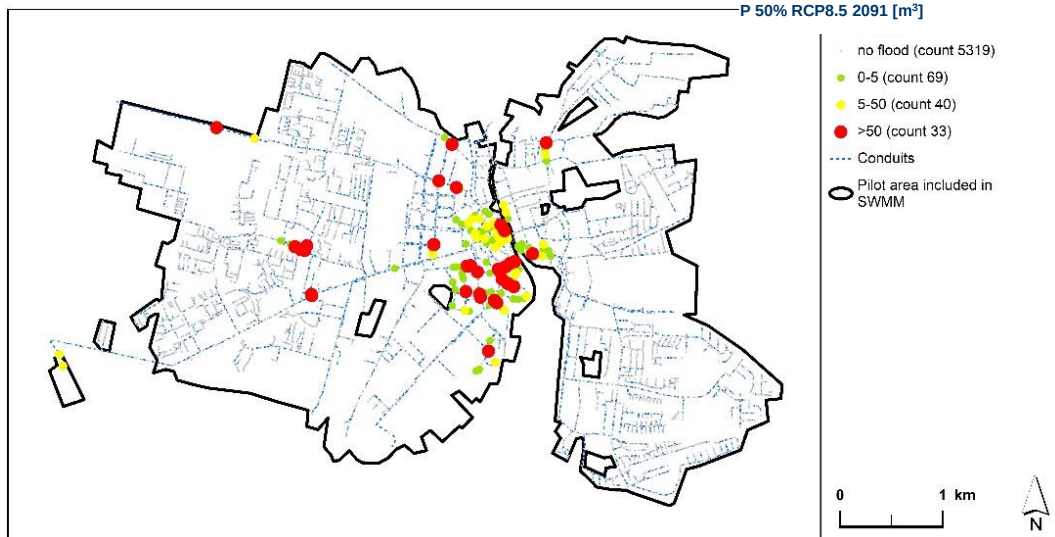

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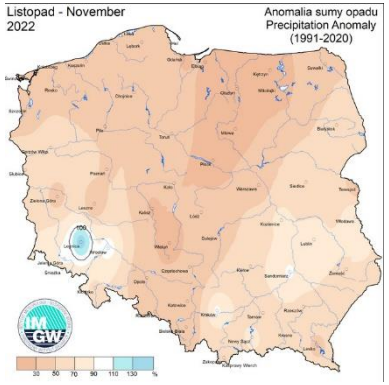
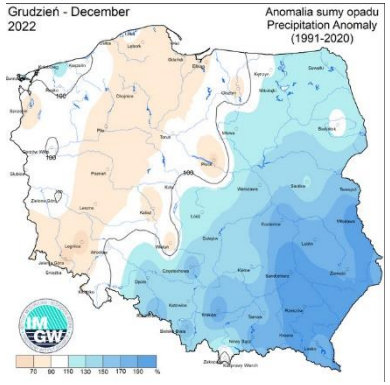
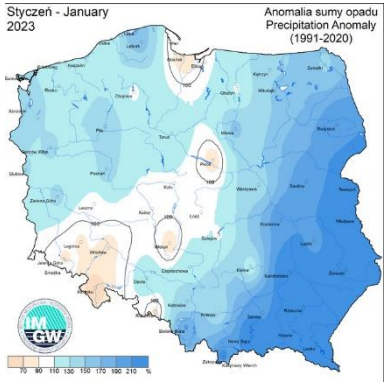
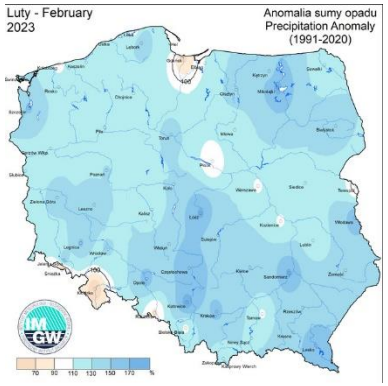
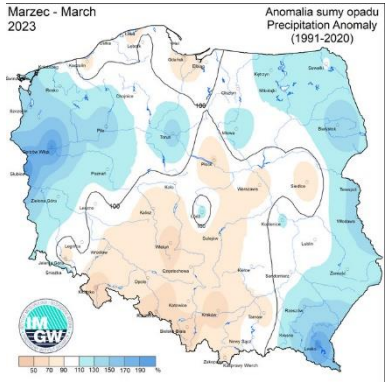
Precipitation data November 2022 – April 2023

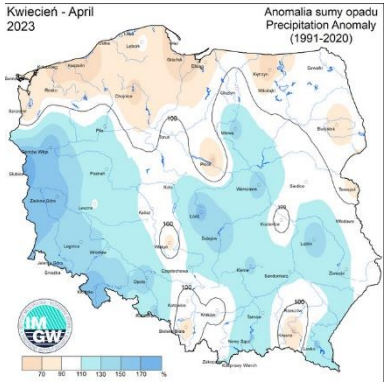


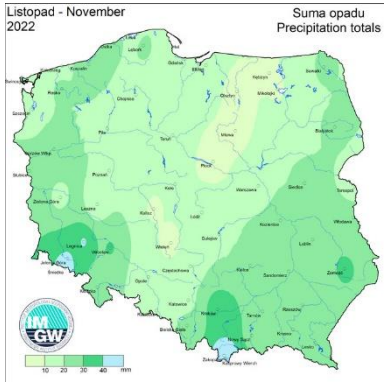


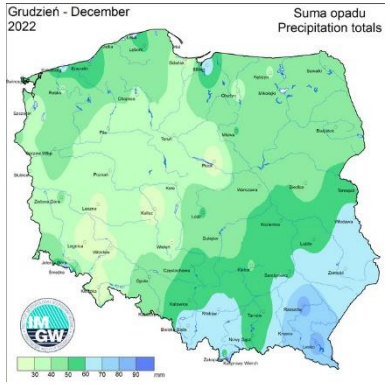


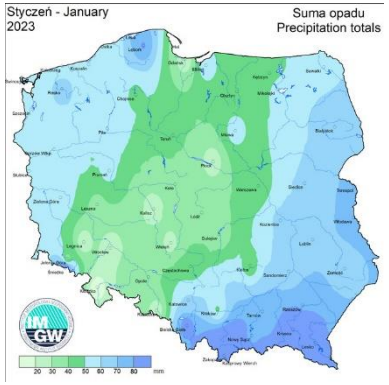


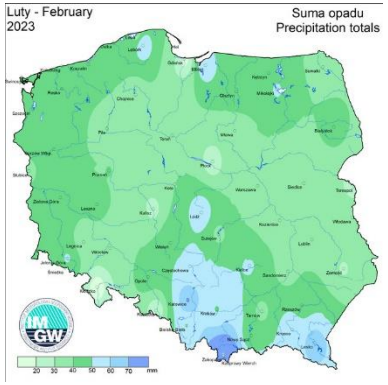


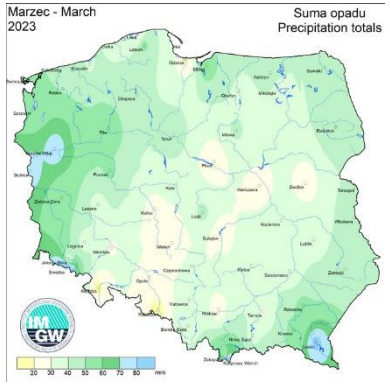


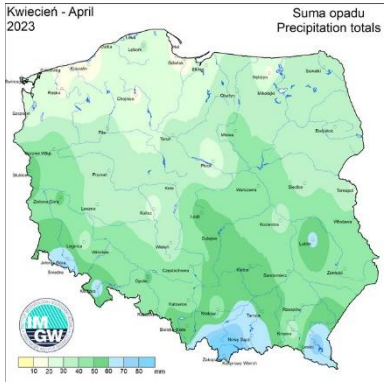




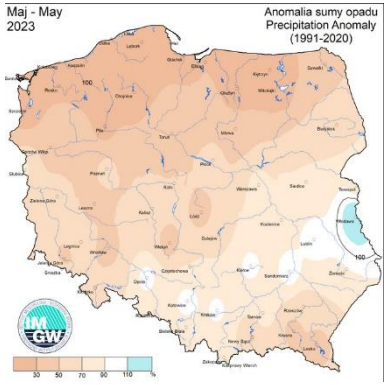


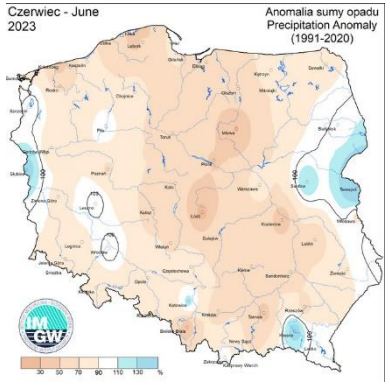


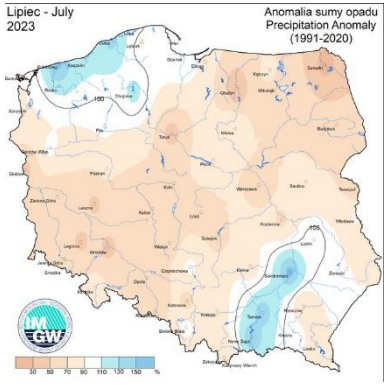


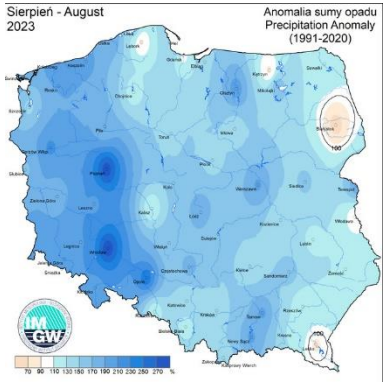


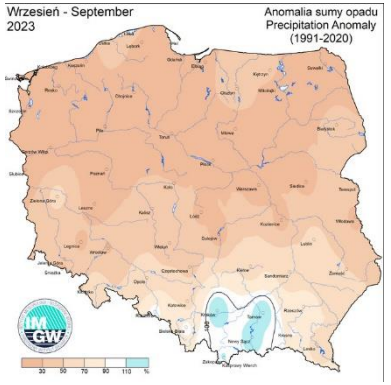
Precipitation data May 2023 – October 2023

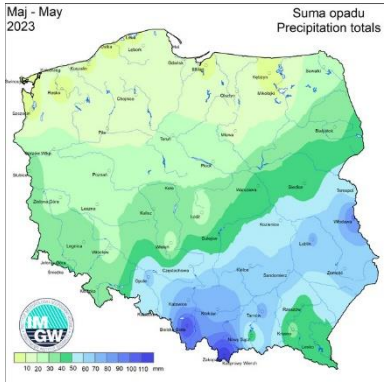


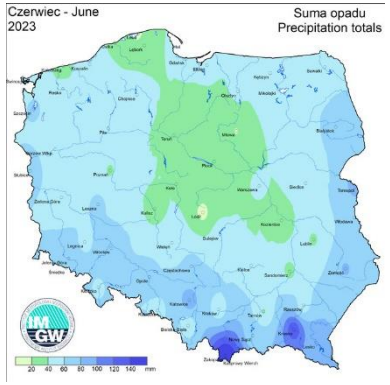


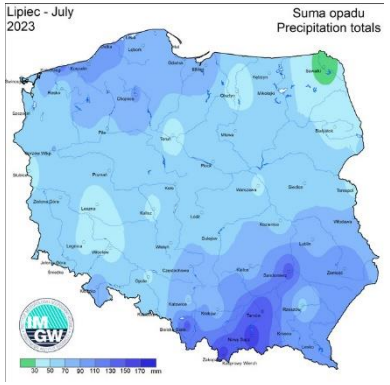


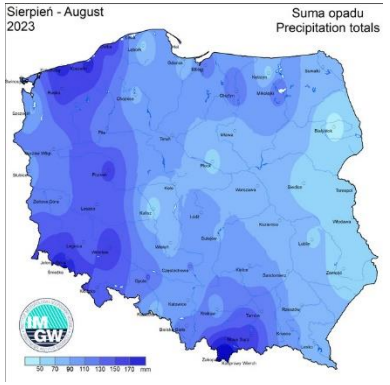


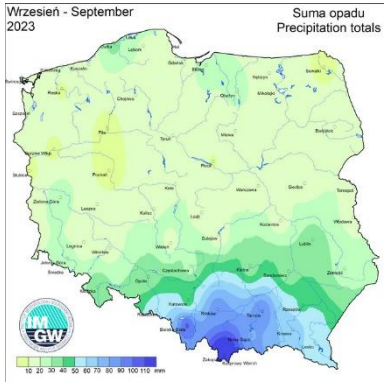


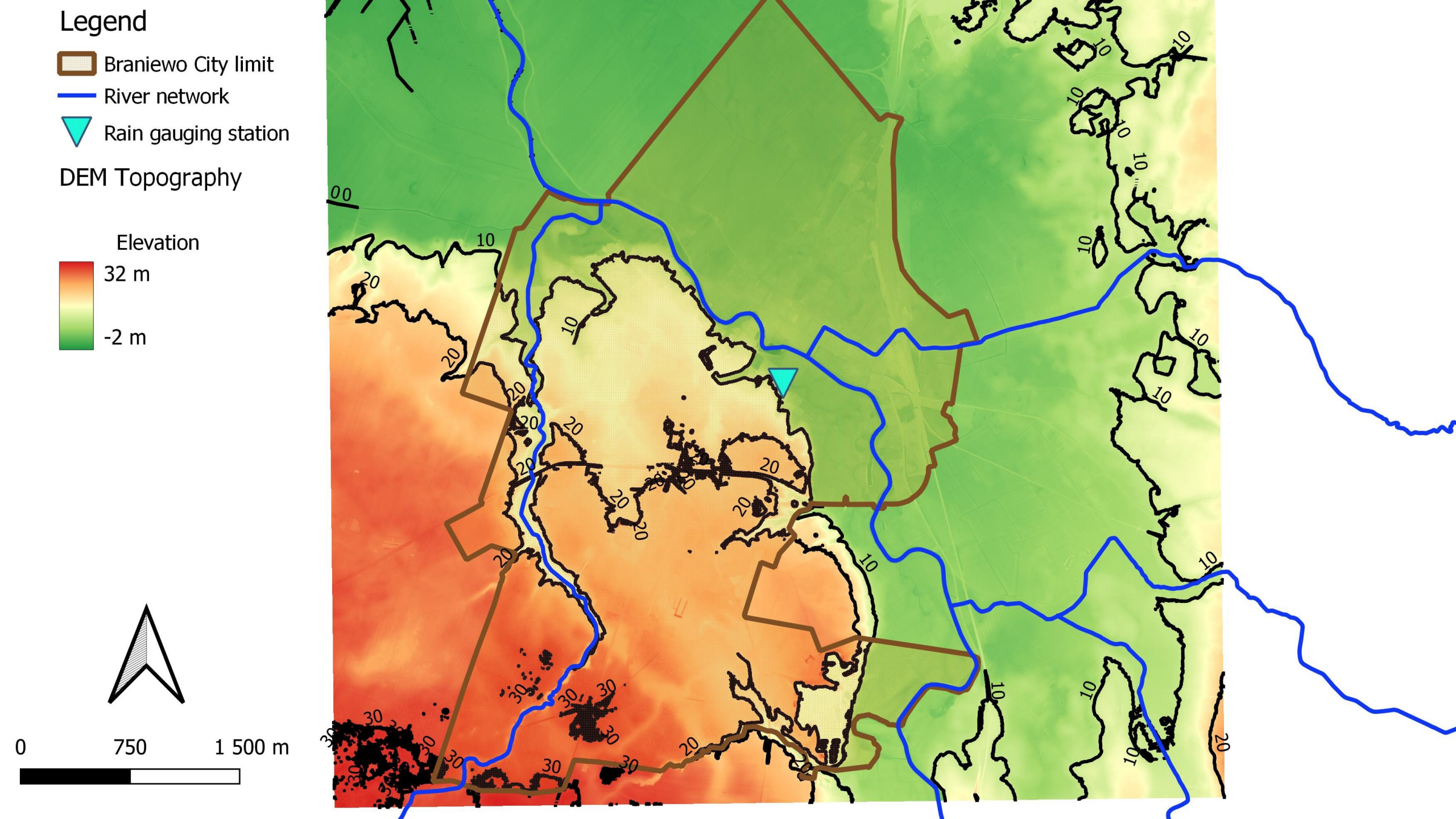











Legend
Braniewo City limit
River network
Rain gauging station
DEM Topography
Elevation
32 m
-2 m
0
750
1 500 m

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-re- use of rain water and swimming pool water to saving drinking water

Stakeholder & Consumer Acceptance:

- Conduct public awareness campaigns to educate residents and stakeholders about the benefits of water reuse and recirculation.
- Encourage stakeholder participation through workshops, seminars, and public consultations.
- Provide incentives for industries and consumers to adopt water-efficient technologies.

Monitoring and Regulation:

- Establish monitoring mechanisms to ensure the quality and safety of reused water.
- Implement regulatory frameworks to oversee water reuse practices.
- Collaborate with local, regional, and national authorities to align with relevant regulations.


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Ministry of Science
and Higher Education

1st Peer & expert review session: Recommendations & conclusions

Comments from the peer & expert review:

- Consider who could be the change leaders for gaining stakeholder acceptance & awareness rising. Mayor, scientists? Strong local activists? How do you approach them?
- Addressing citizens:
  - Have in mind that surveys are one-way. And the answers could be biased (e.g. no-one will like to have the WWTP reuse if it rises the water prices).
  - Could be good to make a distinction between different kinds of water reuse: waste water, rain water, internal (in-house) water cycle? Maybe the acceptance is bigger for one than for the other.
- Consider involving one company from local as a frontrunner in water reuse.

Related project examples:

- Adapt my city tool: https://www.catch-tool.com
- *This website aims to help in developing climate resilient cities: sustainable, liveable and profitable on the long term. How? We have developed a set of decision support tools and good practice examples that will support midsize cities to determine long term climate adaptation strategies.*
- AQUARES: https://www.interregeurope.eu/find-policy-solutions/stories/aquares-the-potentials-of-water-reuse
  - Pilot: Closed-cycled water overflow in "Sports Bay": https://www.interregeurope.eu/good-practices/closed-cycled-water-overflow-in-sports-bay
- WaterCoGovernance: https://northsearegion.eu/watercog/
  - Pilot: Climate Resilient Cities - Climate Atlas https://northsearegion.eu/watercog/pilot-projects/climate-resilient-cities-nl/

Elaboration on local model strategy: Braniewo Municipality/ PL

Interreg
Baltic Sea Region

Co-funded by
the European Union

SUSTAINABLE WATERS
WaterMan

2nd Peer-review session

Water recycling strategy for Braniewo / PL

Braniewo Municipality

Gdańsk University of Technology

3 April 2025

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Further elaborated approach of the local water reuse strategy for Braniewo Municipality

Braniewo Municipality (PP5), APCEB(PP6) &GUT (PP7)

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WP- 2 WaterMan pilot actions in Braniewo (Poland)

- **2.4 Elaborating local model strategies for water reuse in dialogue with stakeholders & water consumers**

Responsible Project Partner:

Braniewo Municipality (PP5)

Association of Polish Communes Euroregion Baltic (PP6)

Gdansk University of Technology (PP7),
Faculty of Civil and Environmental Engineering

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Purpose and scope of the strategy

PURPOSE & GOALS

- water reuse strategies that include measures for reuse of treated water and recirculation of retained water,
- accompanied by actions to promote stakeholder & consumer acceptance,
- set up the goals for reuse and flood mitigation.

SCOPE

- entire municipal territory/stormwater & floods / retained water & reuse of urban waters for different purposes

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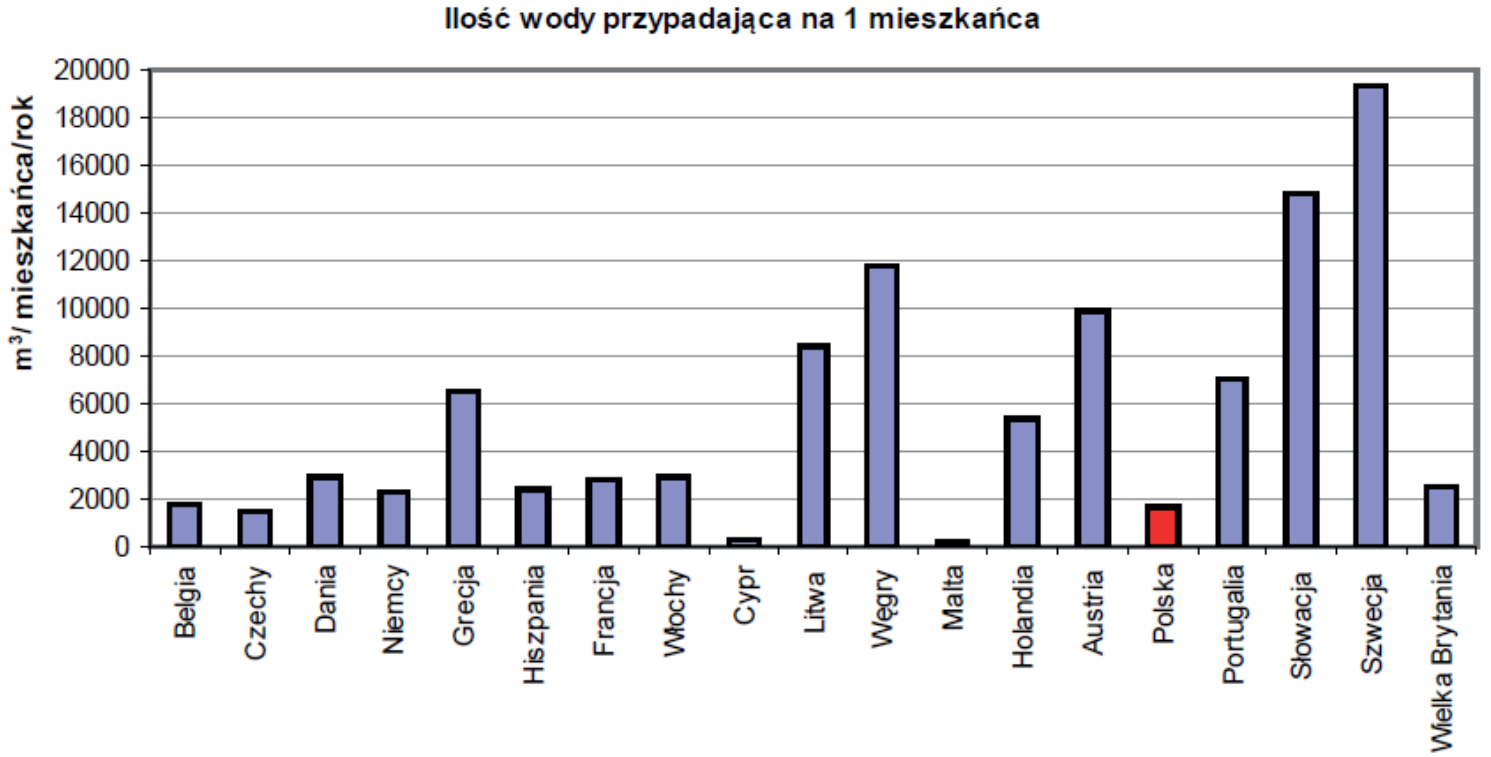
Scarcity of water in Poland



Rys. 1.2. Ilość wody przypadająca na jednego mieszkańca w wybranych państwach Unii Europejskiej; opracowanie własne na podstawie danych Eurostat (2014)

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PLAN OF THE DOCUMENT - SCOPE

1. INTRODUCTION - what the document is and what it serves (introduction, reference to the project, reference to Braniewo policy and objectives of the document - inspiration, support, initiation of dialogue, lobbying)

2. MAPPING OF EU LEGAL AND STRATEGIC FRAMEWORK incl national, local guidelines and legislation - by showing the basis (what it refers to - strategies, legislation, legal standards it is in line with)

3. CURRENT PROJECT ACTIVITIES AND EXISTING DEVELOPMENTS AND FUTURE PLANS, what are its goals (short- and long-term, i.e. what is to be served and contributed to by the undertaken activities in Braniewo

3.1 Pilots
3.2 Tools to support EWL- supporting tools for local authorities (e.g. Extreme Weather Layer, what it is, where it is located and what it is used for, plus these weather stations, plus info on pilots - to encourage similar activities,
3.3 Awareness raising measures

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PLAN OF THE DOCUMENT - SCOPE

4. FUTURE PLANS (with reference to our wish list) Combination of soft and social measures to build commitment and awareness- proposals for further infrastructure and soft measures (i.e. the full set of our wish list)- short summary

5. EXAMPLES FROM OTHER COUNTRIES WITH WATERMAN (long hanging fruit)

6. POSSIBLE SOURCES OF FUNDING AND WHERE TO LOOK FOR SUPPORT
   (maybe also a mention of DUT call application as a continuation of the WaterMan project in will be accepted)

7. SUMMARY

8. CONTACT LIST

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Legal acts related to strategy – European level

FRAMEWORK WATER DIRECTIVE
Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

DRINKING WATER DIRECTIVE (optional) (DWD) IS THE EU'S MAIN LAW REALTED TO THE TOPIC
DIRECTIVE (EU) 2020/2184 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL OF 16 DECEMBER 2020 ON THE QUALITY OF WATER INTENDED FOR HUMAN CONSUMPTION (RECAST)

MINIMUM REQUIREMENTS FOR WATER REUSE.
The EU Regulation 2020/741 of the European Parliament and of the Council on minimum requirements for water reuse entered into force on 26 June 2020 and applies in all EU member states since 26 June 2023.

URBAN WASTEWATER TREATMENT
Directive (EU) 2024/3019 of the European Parliament and of the Council of 27 November 2024 concerning urban wastewater treatment

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Policies related to strategy – European level

- European Union Strategy for the Baltic Sea Region (EUSBSR) – 2009, commission of the European communities
- National Energy and Climate Plans - 2019, Regulation on the governance of the energy union and climate action (EU)2018/1999
- National Water and Environmental Programme (NWEP) - NWEP was first drafted back in 2008 and approved in 2010 in line with the Water Law
- Floods Directive (Directive 2007/60/EC - Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007
- Environmental Quality Standards Directive (EQSD) - Directive 2008/105/EC of the European Parliament - 16 December 2008 , European Parliament

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Policies related to strategy– national level

- National Environmental Policy 2030 - development strategy in the field of environment and water management – Warsaw 16 July 2019, Ministry of Environment
- ACT of 11 July 2014 amending the Act - Environmental Protection Law and certain other acts - In the Act of 27 April 2001. - Environmental Protection Law (Journal of Laws 2013, item 1232, as amended
- Strategic Adaptation Plan for Climate Vulnerable Sectors and Areas to 2020 with an Outlook to 2030 - 29 October 2013, the Council of Ministers
- Poland's National Energy and Climate Plan 2019 - Submitted to the European Commission on December 30, 2019
- "Development of climate change adaptation plans in cities with more than 100,000 inhabitants„ - Project start date: 12 January 2017, Ministry of Climate and Environment, Project funded by the European Union from the Cohesion Fund and the state budget. Project value: PLN 29,950,000
- Regulation of the Minister of Infrastructure of 15 July 2021 on the adoption of the Drought Plan - 15 July 2021, PL Ministry of Infrastructure of republic of Poland
- Adaptation Manual for Cities. Guidelines for preparing a Municipal Climate Change Adaptation Plan, Updated 2023 - The manual was developed by the Ministry of the Environment on the basis of an expert opinion prepared by the Institute for Ecology of Industrial Areas in Katowice within the framework of the project entitled 'Guidelines for the preparation of an urban adaptation strategy', carried out on behalf of the Ministry of the Environment in 2014 with funds from the National Fund for Environmental Protection and Water Management

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Policies related to strategy – regional level

- **WARMIŃSKO-MAZURSKIE 2030. SOCIO-ECONOMIC DEVELOPMENT STRATEGY - Olsztyn, 18 lutego 2020 r, Regional W-M Government**
- **Development Strategy Pomorskie Voivodeship 2030 Regional Strategic Programme in terms of environmental and energy security environmental and energy security - Gdańsk 2012, Regional Pomeranian Government**
- **WARMIA-MAZURY REGIONAL SPECIALIZATION - Olsztyn, 18 lutego 2020 r, Regional W-M Government**
- **The Programme for Environmental Protection of the Warminsko-Mazurskie Voivodeship until 2030 - Resolution No. XXIV/382/21 of the Sejmik of the Warmińsko-Mazurskie Voivodeship of 16 February 2021 on adopting the Environmental Protection Programme of the Warmińsko-Mazurskie Voivodeship until 2030**

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Policies related to strategy – local level

- **CITY OF BRANIEWO DEVELOPMENT STRATEGY 2021-2030 - Resolution-Nr-XXXVI-355-22- on the adoption of Strategy for the development of the Municipality of Braniewo for the years 2021-2030**

The project activities are in line with the following: lines of action for the strategic and operational objectives.
SO I. Active citizens
SO II. Attractive and friendly space for living
SO III. Resilient green city
SO IV. Competitive economy

Identify LIMITATION OF THREATS RELATED TO CLIMATE CHANGE AND GROWING PROSPERITY DISTRIBUTION

Legal acts related to strategy – local level

- **Environmental Impact Assessment for the Development Strategy of the City of Braniewo 2021-2030 - Resolution-Nr-XXXVI-355-22-on the adoption of Strategy for the development of the Municipality of Braniewo for the years 2021-2030**

It contains: information on the content, the main objectives of the draft document and its relationship to other documents; information on the methods used to prepare the forecast; proposals concerning the methods foreseen for analysing the effects of the implementation of the provisions of the draft document and the frequency with which they are to be carried out; information on the possible transboundary impact on the environment;

- Assessment of the existing state of the environment, taking into account legally protected areas

- assessment of the existing state of the environment in the areas predicted to have a significant impact

- potential changes in the state of the environment in the case of non-implementation of the draft strategy

- existing environmental problems relevant for the implementation of the draft strategy.

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Legal acts related to strategy – local level

- **Environmental Protection Programme for the Municipality of Braniewo for the years 2018 - 2021 with an outlook for 2022-2025 - Resolution No. XLVI/328/18 of the Braniewo City Council together with the Environmental Impact Assessment;**

The obligation to implement the Environmental Protection Programme results from the Act of 27 April 2001. Environmental Protection Law (Journal of Laws of 2022, item 2556, as amended). According to the provisions of the Act, the environmental protection policy - i.e. a set of activities aimed at creating the conditions necessary for the implementation of environmental protection in accordance with the principle of sustainable development - is carried out, inter alia, by means of provincial, district and communal environmental protection programmes.

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The environmental policy of the City of Braniewo

The environmental policy of the City of Braniewo is aimed primarily at issues concerning:

- air protection, noise protection - ensuring high air quality,
- reducing gas and dust emissions, minimising noise nuisance,
- **water protection - ensuring proper quality of usable water, rationalisation of water consumption, proper water and sewage management,**
- soil and land surface protection - ensuring appropriate usable quality of soils,
- protection against degradation,
- **rational use of natural resources - reducing the consumption of energy, raw materials and materials, increasing the proportion of renewable resources used, protecting fossil resources**,
- **protection of natural resources - preservation of natural resources taking into account their diversity and development of forest resources, rational use of forests**,
- improvement and rationalisation of the waste management system - reduction of the amount of waste produced, increasing levels of recovery,
- developing cooperation with Communes - joint actions for environmental protection,
- **carrying out an effective educational campaign - activities aimed at increasing the ecological awareness of the inhabitants, guaranteeing successful implementation of the above mentioned activities.**

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Water structure in Braniewo

Yearly consumption :

- **Service & industry** **165 000 m^3**
- **Citizens** **485 000 m^3 what corresponds to 30.3 m^3 /PE A and 83l/day PE**

- **Register of calls for cleaning stormwater drainage approx. 60 callouts per year.**
- **Cleaning and sweeping streets (using a sweeper) – approx. 78 400 liters annually. App 400l/day (only for working days)**
- **Watering – 200.000 liters annually.**
- **Amphitheater – approx. 2,500 m^3; water costs: 13,441.22 PLN.**

REUSE

Water Reuse Measures:

- Identify potential sources of water suitable for reuse, such as swimming pool water, and wastewater treatment plants.
- Establish guidelines and standards for the quality of water for reuse.
- Promote water recycling and needs in municipal service, industrial, agricultural, and residential sectors.
- Develop infrastructure for water treatment and distribution.

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Technically possible to take over wastewater stream

30 m³/d

water supply from the municipal network

After implementation of the WaterMan pilot solution:

Reuse of treated wastewater:

- *flushing the sewer system in Braniewo: ap. 3 m³/d (all year round)*
- *watering urban greenery (vegetation period)*
- *watering of plants by residents (vegetation period)*
- *…… (in the process of arrangements)*

wastewater *from showers and toilets*

pool water ***overflow***

filter rinsing ***wastewater***

15 m³/d

4÷5 m³/d

4÷6 m³/d

4÷5 m³/d

discharge into the sewage system

- ✓ 40-50% **reduction** in filter rinsing wastewater
- ✓ 15% **reduction** in sewage discharge
- ✓ **5m3/d savings** on tap water for different purposes

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List of potential users of wastewater and swimming pool water

- **Identification of potential USERS for reuse – quality and quantity needs**
- **Elaboration of tools for reuse - developing incentives, facilities, and benefits (maybe some limits in case if not …)**
- **Awareness raising campaign – FRONT RUNNER (at least one)**

TARGET GROUPS OF RECYCLED WATER, C.A 10m³ IN THE TANK & STRATEGY

INSTITUTIONAL RECIPIENTS

A) Municipal Waterworks: flushing of the sanitary network;

b) Municipal Services Department: for street sweepers, street sprinkling during heat waves, and watering shrub and perennial flower beds;
c) Municipal Waste company (the company responsible for waste collection and transport): washing of tanks, containers, and operational equipment;
d) Municipal Sports Center: watering of park green areas (May-August);
e) of football station – after the warranty period expires (since 2027)

f) Concrete Plant: production of liquid concrete and concrete products;
g) Military Equipment Wash Station;

INDIVIDUAL RECIPIENTS

A1) Allotment Gardeners."

Users of pilot water during the project's lifetime – up to 10m3/d

Potential further users of the pilot water after the project's lifetime

C

Potential users of recycled water from other sources in the WaterMan model regions

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2.3 Pilot measure / reuse of treated water:
Reuse of public swimming pool water

- **Justification**:
  - Ensures water usage during the project lifetime.
  - Provides tangible benefits to the municipal services department.
  - Operationally feasible, reliable, and can be monitored effectively.
- **Implementation schedule**:
  - **Testing phase** VII-IX 2025.
  - **Data collection** - Real-time monitoring of water volumes used and quality.
  - **User feedback collection** - Surveys with municipal workers and supervisors.

Importance:
-Ensures that reclaimed water is actively used.
-Allows for **user acceptance testing** and feedback within the project timeframe.

Key opportunity:
-Incorporates broader, long-term users who benefit from reduced potable water consumption and cost savings.
-Supports development of a **local water reuse model strategy**.

Strategic role:
-Demonstrates scalability of the Braniewo pilot for **industrial applications**.
-Encourages replication across other WaterMan model regions.

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STORMWATER

Retained water recirculation:

- Implement systems for the retention and recirculation of stormwater.
- Create retention ponds, green infrastructure, or rainwater harvesting systems to capture and store rainwater.
- Design distribution networks for the recirculation of retained water.

Flood prevention and stormwater management:

- Develop flood control infrastructure to mitigate the impact of heavy rainfall.
- Integrate stormwater management into urban planning (LID) and construction practices (EWL).
- Promote permeable surfaces and sustainable landscaping to reduce stormwater runoff.

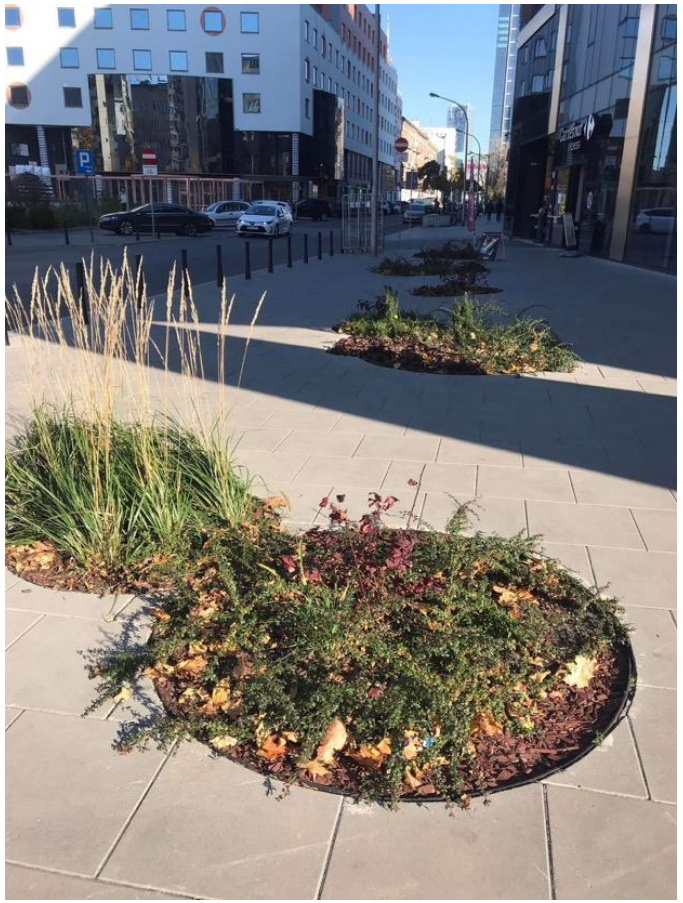
INSPIRATIONS for harvesting and reuse

- Both single houses and in the city for municipal buildings
- As a single reservoir or in series to increase the capacity and direct reuse for greenery watering
- Awareness raising campaign
- Front runners like city hall building (leading by example), schools, shops
- TOOLS and subsidies

Flood prevention and stormwater management

Retention of the precipitation as close as possible to the place of origin
JAGGED CURBS

Flood prevention and stormwater management



Flood prevention and stormwater management

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MEASURES, roads and retention in greenery

Flood prevention and stormwater management

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2.4 Local model strategy: Municipal water reuse strategy

Strategy for Braniewo based on EWL with climate scenario and quality of rainwater with regards to:

- **mitigation of flood and drought problems**
- **identification of places to keep rainwater before gray pipe (moat)**
- **reuse of rainwater and swimming pool water to save drinking water**

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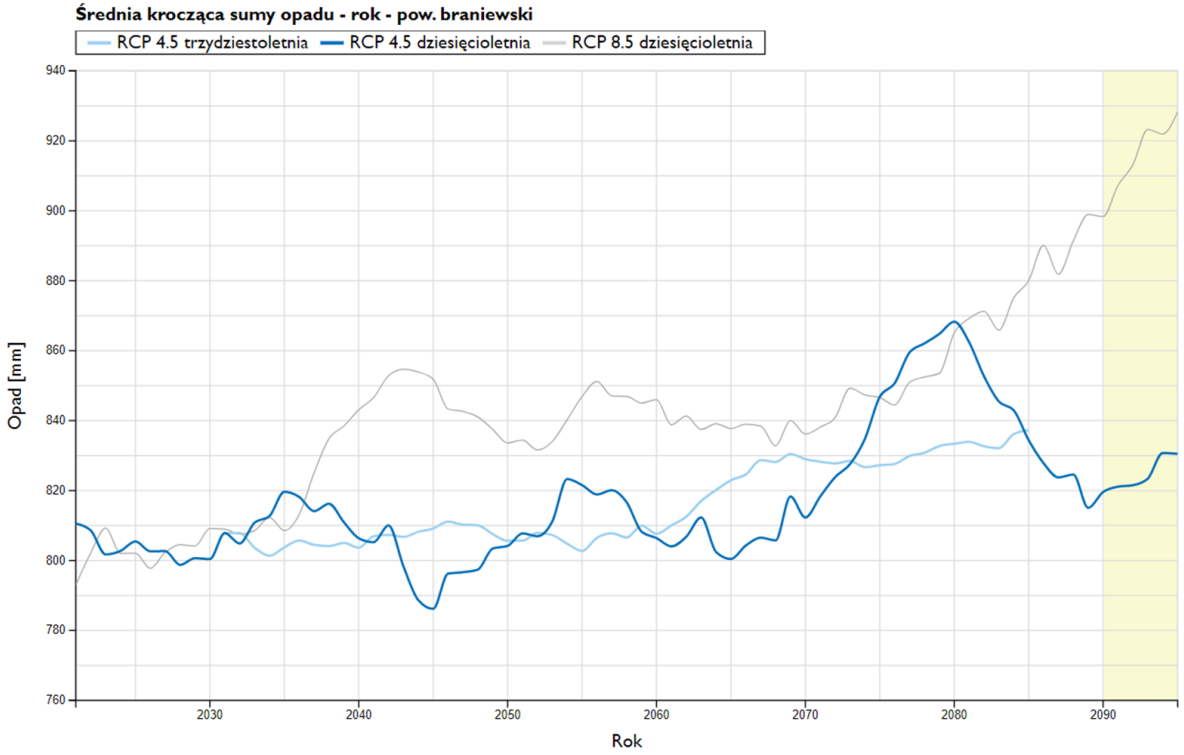
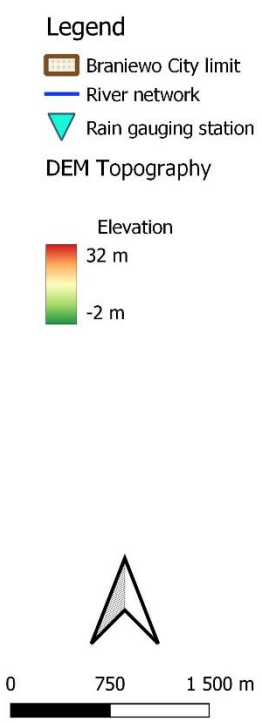
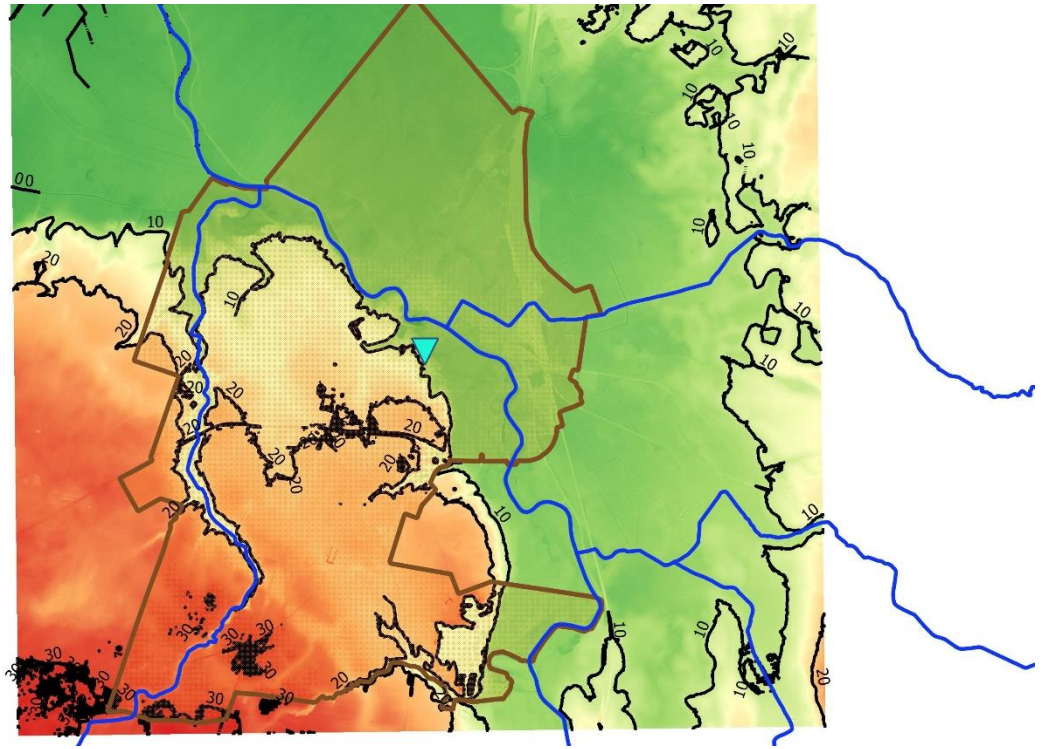
Strategy for Braniewo based on EWL with climate scenario and local threats

2.4 Local model strategy: Municipal water reuse strategy supported by the hydroulic model of the drenage system and EWL tool







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2.4 Local model strategy: Municipal water reuse strategy supported by the hydroulic model of the drainage system and EWL tool

- The model-based spatial planning tool -Extreme Weather Layer – EWL demonstrated the capability of supporting urban spatial planning by including the aspect of climate change-driven risks posed to the urban drainage systems in the decision-making process. The tool proved useful for estimating current and future flood risk which will increase considerably, taking into account even the least severe climate change scenarios. The tool, combined with the runoff quality measurements, also allowed us to estimate the load of pollution discharged during the current and forecasted rainfall events in the form of spillages (urban flooding) and combined sewer overflows and discharge from drained systems to surface waters.

- EWL is a tool for optimizing urban stormwater and wastewater systems, as well as spatial planning with green infrastructure for stormwater management at source and re-use. Tools such as EWL could be useful for the implementation of different NBS as a smart tool for the creation of climate-resilient cities.

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2.4 Local model strategy: Municipal water reuse strategy supported by the hydroulic model of the dranage system and EWL tool

- **Weather scenarios for the EWL**

6-hour and 24-hour rainfall events with a return period of 10 and 50 years (probability p=10% and p=2%):

1. Present status (baseline),
2. RCP 4.5 scenario, two horizons:
   2051-2060,
   2091-2100
3. RCP 8.5 scenario, two horizons:
   2051-2060,
   2091-2100

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2.4 Local model strategy: Municipal water reuse strategy supported by the hydroulic model of the dranage system and EWL tool

- **Climate change scenarios (RCP 4.5 & 8.5)**

1. **Clausius-Clapeyron relations**

characterizes the slope of the saturation vapor pressure curve on a pressure-temperature diagram. In the simplified way: vapor pressure e_{sat} in Pascals, as being dependent only on air temperature, T_a in degrees Celsius

2. **Modified rainfall intensity curves based on climate change projections**

Main source of the inputs used for the preparation of projected rainfall events for Braniewo was the Klimada 2.0 project

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2.4 Local model strategy: Municipal water reuse strategy supported by the hydroulic model of the dranage system and EWL tool

Precipitation probability		2% (1 / 50 y.)		10% (1 / 10 y.)	
Baseline 6-h (PMAXTP, 2022)		55.19		38.56	
Forecasts 6-h		RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
Clausius-Clapeyron method	2051-2060	58.85	59.89	41.12	41.84
	2091-2100	61.23	68.20	42.78	47.65
Klimada 2.0 precipitation histogram-based method	2051-2060	51.07	70.46	35.37	46,31
	2091-2100	57.59	73.65	41.16	46.31
Baseline 24-h (PMAXTP, 2022)		81.03		55.12	
Forecasts 24-h		RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
Clausius-Clapeyron method	2051-2060	86.40	87.93	58.77	59.91
	2091-2100	89.89	100.14	61.15	68.12
Klimada 2.0 precipitation histogram-based method	2051-2060	74.28	102.42	50.53	69.05
	2091-2100	83.73	107.04	59.71	69.05

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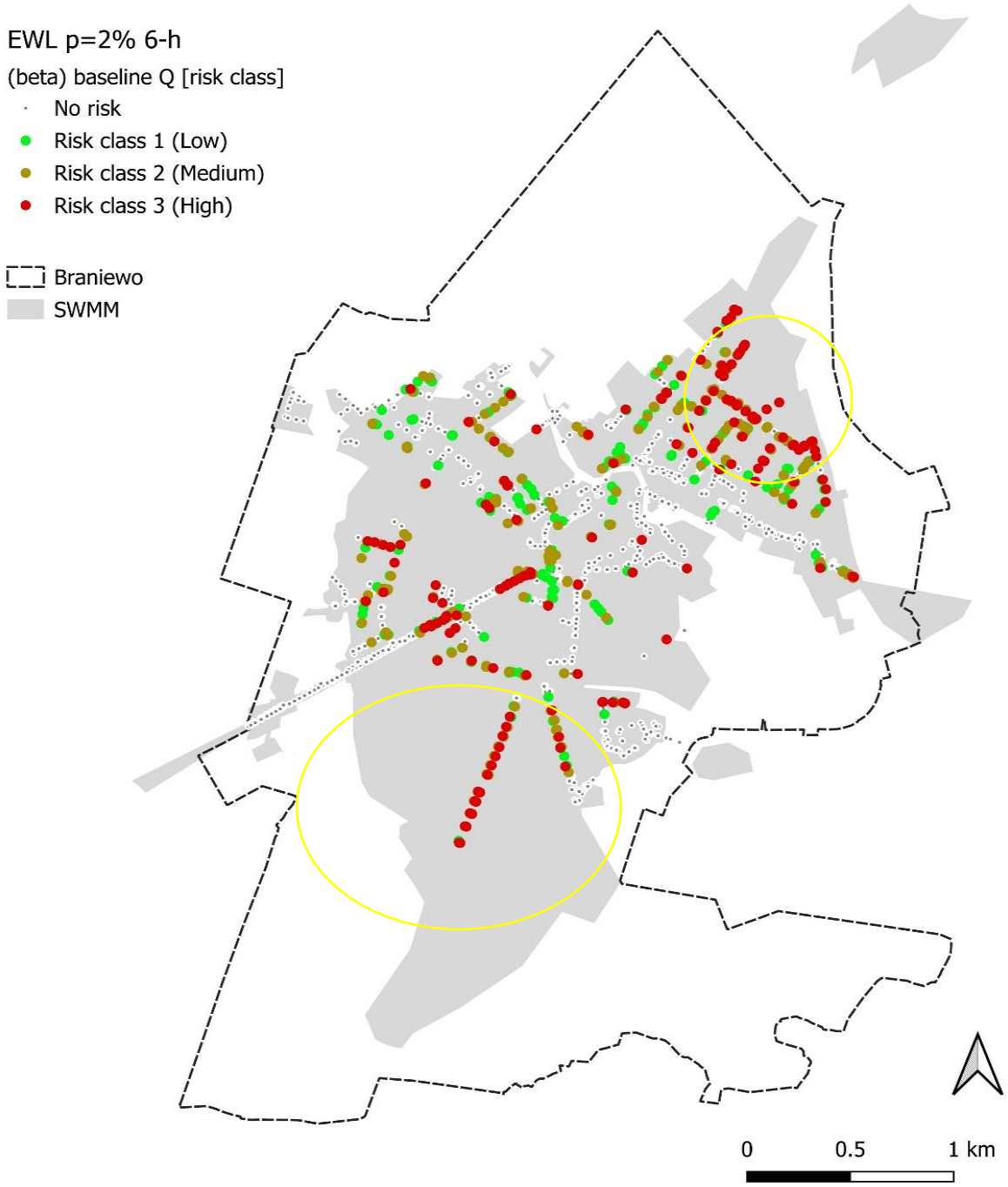
Baseline scenario beta distribution,

classes based on discharge

400 of 2000 manholes



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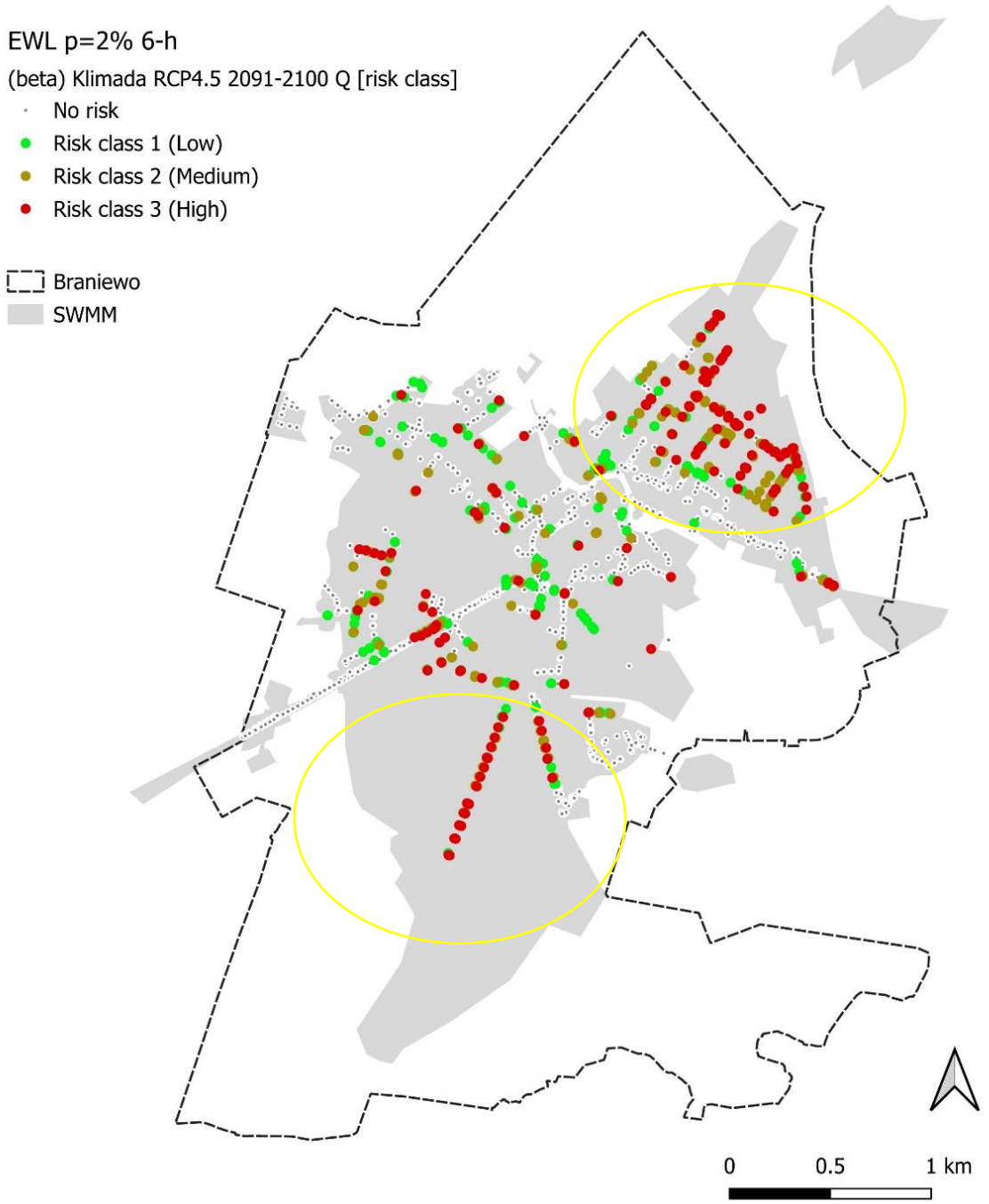
- **RCP 4.5**
  Klimada
  horizon 2091-2100



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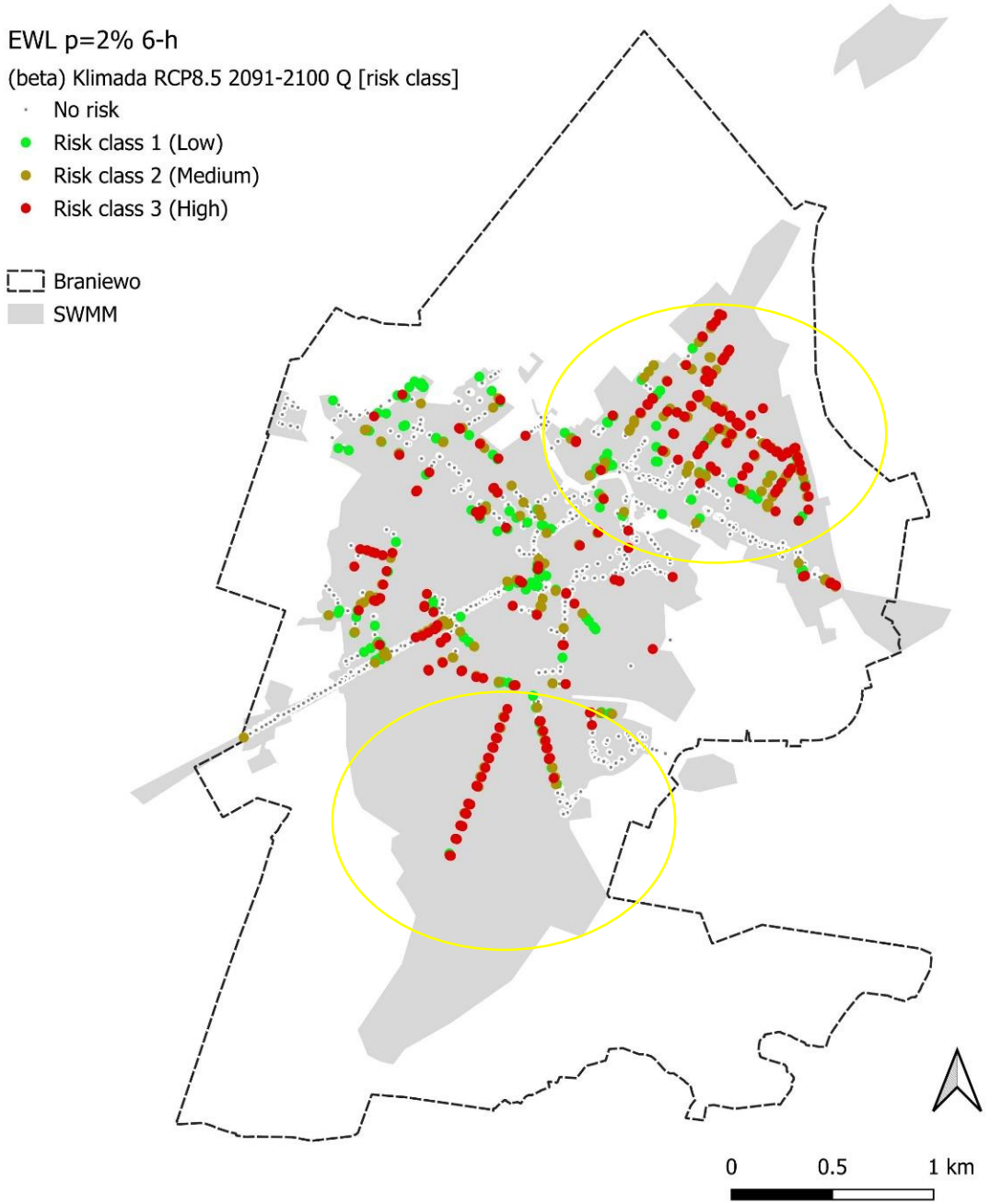
- **RCP 8.5 Klimada horizon 2091-2100**



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A summary of EWL risk classes

Scenario	RCP	Decade	Flooding volume [m^3]	EWL risk class			
				Flooding flow rate [m^3/s]			
				Class 1: Low	Class 2: Medium	Class 3: High	All manholes at risk
Beta disaggregation method							
Bas.	0	0	130	185	182	157	524
CC	45	2051	162	174	157	169	500
		2091	171	181	162	176	519
	85	2051	166	178	163	171	512
		2091	199	173	166	212	551
KL	45	2051	132	169	161	137	467
		2091	157	179	158	162	499
	85	2051	209	177	171	216	564
		2091	222	171	173	218	562
DVWK disaggregation method							
Bas.	0	0	130	185	182	157	524
CC	45	2051	143	187	186	165	538
		2091	152	191	191	177	559
	85	2051	147	180	190	174	544
		2091	177	187	212	213	612
KL	45	2051	116	176	173	141	490
		2091	139	181	186	162	529
	85	2051	185	187	213	226	626
		2091	197	78	175	236	489

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EWL+ NBS = smart tool for direct and indirect water reuse

Combining the EWL and Nature Based Solutions like treatment wetlands, green walls, rain gardens, green roof etc. ARE SUPER TOOL in creation Urban Water Cycle (re-use) and Adapt Cities for Climate Change

This tool could suport the decision makers to meet the criteria like:

- ✓ **Closing and reconnecting loop**
- ✓ **Resilient, robust and flexible as well as attractive operation**
- ✓ **Treatment in place with as many as possible ecosystem service**

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CONTENT AND TOOLS & SCHEDUL E

Stakeholder & consumer acceptance:

- Conduct public awareness campaigns to educate residents and stakeholders about water reuse and recirculation benefits.
- Encourage stakeholder participation through workshops, seminars, and public consultations.
- Provide incentives for industries and consumers to adopt water-efficient technologies.

Monitoring and regulation:

- Establish monitoring mechanisms to ensure the quality and safety of reused water.
- Implement regulatory frameworks to oversee water reuse practices.
- Collaborate with local, regional, and national authorities to align with relevant regulations.

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SOFT ACTIVITIES FOR STRATEGY PROPOSE

- To implement the strategy, it is also necessary to introduce so-called soft activities, which raise public awareness and encourage the reuse of water.
- After analyzing the conditions and available tools, a catalog of soft activities was proposed

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RESEARCH UNIVERSITY EXCELLENCE INITIATIVE

Completion of education and information activities as part of the Braniewo model strategy

- **April-May 2025 -** Practical workshops for children and young people - SFERA LAB (own event in Elbląg Technological Park) based on research experiences for schoolchildren.
  A series of practical workshops to build audience acceptance of water reuse and water use for the youth of Braniewo from three primary schools 3,5,6 titled ‘Saving water and reuse and know your water footprint’
  Who is responsible: STG ERB (technical) and Braniewo (participation of schools, administration)
  Participants: youth citizens c.a. 100 participants

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RESEARCH UNIVERSITY EXCELLENCE INITIATIVE

Completion of education and information activities as part of the Braniewo model strategy

- **22 - 24 May 2025 -** Baltic Science Festival at Gdansk University of Technology
  Trip of representatives and participation in thematic activities of young people from three primary schools No. 3,5,6 from Braniewo (workshops, visit to the rain garden'
  Who is responsible: GUT cooperation, Braniewo
  Who covers: GUT (substantive), Braniewo (access)
  Participants: youth citizens c.a. 40 participants

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RESEARCH UNIVERSITY EXCELLENCE INITIATIVE

Completion of education and information activities as part of the Braniewo model strategy

- **9 June 2025 (alternatively between 09-11.06.2025) –** Open Public Conference&workshop for practitioners dedicated to local authorities and local beneficiaries “practical and theoretical dimension of NBS case studies” in Braniewo - presentation of case studies of international projects.
  - Local pilot dissemination event for local authorities (follower communities), policy makers, companies and other interested practitioners"
  - Awareness raising campaign focused on target groups"
  - Synergic event organized by multiple projects: Nice, Cone, WaterMan, Nursecoast II for municipalities and external projects - showcasing the project result (pilot) and promoting water reuse and NBS. Presentation of the project and its pilots.

Who is responsible: STG ERB, GUT cooperation, Braniewo and involvement of synergy projects**.**

Who covers: STG ERB, Braniewo and project consortium (shared cost)

Participants: local authorities (follower communities), policymakers, companies, and other interested practitioners c.a. 40

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RESEARCH UNIVERSITY EXCELLENCE INITIATIVE

Completion of education and information activities as part of the Braniewo model strategy

- **Beginning of the September (exact date to be decided) –** APC ERB Board meeting in Braniewo and presentation of the project pilot to the authorities of the largest cities in northern Poland

Who is responsible: Braniewo, APC ERB (promotion among municipalities)

Who covers: APC ERB (scenario, description, implementation), Braniewo (implementation)

Participants: Project Partners (GUT, ABraniewo, APC ERB) Polish stakeholders of aPC ERB: local authorities and policymakers, c.a. 15 participants

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RESEARCH UNIVERSITY EXCELLENCE INITIATIVE

Completion of education and information activities as part of the Braniewo model strategy

- **24-26 September 2025 -** ‘WaterMan on tour’ in Braniewo (back-to-back with All-partner Meeting and PL conference in Braniewo**.**
  - Study visit and demonstration of the [functioning] WaterMan pilot facility’ (here: rain garden, reuse of pool water), which should primarily target to present project partners ’Site visit and demonstration’
  - Public open event - external stakeholder conference for Polish stakeholders as a party WaterMan of Tour dedicated to other municipalities and water supply companies, regional and national authorities)
  - Conference for Polish local and regional audiences

Who is responsible: Gdansk University of Technology, Braniewo, STG ERB (promotion among municipalities)

Who covers: GUT (scenario, description), Braniewo (implementation)

Participants: Project Partners (30) and Polish stakeholders: local authorities (follower communities), policymakers, companies, and other interested practitioners c.a. 20 participants

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Completion of education and information activities as part of the Braniewo model strategy

- **August - October 2025** - Education and information trail of water reuse (information boards and posters)

Elements of an information path available to residents presenting the pilots and encouraging actions promoting water reuse

Visit of schoolchildren to the pilot site and the created path and presentation of the designed solutions.

Who is responsible: Gdansk University of Technology, Braniewo

Who covers: GUT (scenario, description), Braniewo (implementation)

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CATALOG OF OTHER POSSIBLE SOFT ACTIVITIES FOR STRATEGY PROPOSE

Action for water re-use promotion:

- "Citizen and urban activity days" – practical urban actions in the form of a living lab
- A series of workshops: “Water-sensitive city – co-creating a long-term vision and planning support areas in braniewo”
- Program "Water and environmental education in preschool"
- Educational program ‚Panta Rhei’ for the school children
- Art contest for residents: 'Water in the life of Braniewo
- Annual partnership program for non-formal education for schools: 'Outdoor lessons’
- Educational game 'Climate mosaic – water in our lives'

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Other activities

- **Participation / creation of regional cooperation platforms in the field of water resources and their management - it is possible to use the existing open network 'Elbląg Network for Water Specialization and Economy')**

- **Construction, expansion, adaptation, renovation, furnishing, and equipping of facilities for water ecological education in Braniewo.**

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Elements of small infrastructure

- **Educational pathway at the Swimming Pool**
  - **Information boards**
  - **Educational Water Park – modern solutions for urban space organization, where children can learn about retention issues.**
  - **Experimentarium – an educational and training room**
  - **Educational Room**
- **Promotional Elements for Tap Water Usage**
  - **Mobile water dispensers**
  - **tap water collection points in the city**
  - **Mobile Exhibition Stand – used to promote tap water at municipal and international events.**

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Benefits of the activities implementation

For local government:

- **Development of innovation and local specialization based on the central theme of water resource reuse and efficient, innovative water resource management,**
- **Implementation of national and regional strategies based on the “water” smart specialization of the Braniewo subregion,**
- **Dissemination of knowledge in the fields of climate, environmental protection, and sustainable development,**
- **Fostering pro-environmental behaviors in society,**
- **Social activation – fostering a civil society focused on climate, environmental protection, and sustainable development,**
- **Education and training of public administration personnel in pro-ecological activities.**

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Benefits of the activities implementation

For the younger generation:

- **Gaining broad knowledge on ecology, especially regarding water,**
- **Engaging students, parents, school staff, and the local community in efforts to keep rivers, lakes, and other water bodies clean (e.g., through cleanup campaigns),**
- **Acquiring knowledge about the role of water in human life and the environment, including understanding water-related risks like floods and droughts,**
- **Participating in demonstrations or training on water reuse**
- **Learning how to use water responsibly and care for it, while developing eco-friendly habits,**
- **Opportunities for visiting hydrotechnical facilities managed by the municipality and gaining insight into their operations,**
- **Taking part in field-based educational activities and classroom sessions led by specialists/experts.**

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RELATED INSTITUTIONS & AUTHORITIES WHICH ARE WORTHY OF BEING INVOLVED OR INFORMED

Central:

- **Gospodarstwo Wody Polskie (National Water Agency)**
- **Ministry of Environment**
- **General Directorate for Environmental Protection (GDOŚ)**
- **Chief Inspectorate for Environmental Protection (GIOŚ)**

Regional:

- **Voivodeship Departments (Department of Environment and Agriculture);**
- **Regional Water Management Boards**
- **Regional Inspectorates for Environmental Protection carry out monitoring of water quality**
- **Voivodship Fund for Environmental Protection and Water Management in Olsztyn.**

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RELATED INSTITUTIONS & AUTHORITIES WHICH ARE WORTHY OF BEING INVOLVED OR INFORMED

County level:

- **Counties (powiats): Poviat Environmental Protection and Water Management Fund (PFOŚiGW); District Sanitary and Epidemiological Station in Olsztyn**
- **Poviat Environmental Protection and Water Management Fund (PFOŚiGW); Poviat Sanitary and Epidemiological Station in Elbląg**
- **County Office in Braniewo (Poviat Starosty in Braniewo)**

Local:

- **Municipalities and towns in local area (legal bodies and politicians, municipal councils, environmental protection departments and the department of investments, municipal affairs and the environment, municipal economy enterprises).**

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and Higher Education

2nd Peer & expert review session: Recommendations & conclusions

- Consider to concentrate the strategy measures and cooperate with the companies & the people living in the flooded areas of Braniewo Municipality. Then you can get a broader awareness, and could also think of using some financing incentives for them.
- Think on what you want to achieve with this strategy document in the end: guidelines / handbook for specialists, municipal services. Involve the specialists (target groups) into elaboration of the strategy. There are several ways: e.g. involve them into workshops for developing the solution, or involve open-minded representatives of them to become “ambassadors”.
- To talk to politicians the arguments can be to use/communicate the insurance data to restore the damages in the south of Poland. This can be a wake-up call for municipality authorities and a good argument to make them think about anti-flood solutions.

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WaterMan

Final review

Water recycling strategy for Braniewo / PL

Braniewo Municipality

Gdańsk University of Technology

26 April 2025

LOCAL ACTION PLAN AND STRATEGY FOR PROMOTING WATER USE FOR THE MUNICIPALITY OF BRANIEWO

Contents

5.3.2 Smart Retention for Flood Protection and Water Reuse

Mathematical modeling confirmed that water retention is the most effective way to reduce the risk of rainfall floods.

The model compared two retention strategies:

- General retention, applied evenly throughout the city,
- Targeted retention, focused on upper catchments and critical areas for runoff control and flood protection.

Retention in source areas captures water before it reaches lower-lying parts of the system, effectively reducing peak flow and preventing local flooding.

Results:

- targeted retention at strategically selected points yields significantly greater benefits than uniform measures throughout the city
- retention creates opportunities for water reuse
- retained water can be directed to urban green infrastructure (rain gardens), or incorporated into non-potable water systems –for irrigation of parks and sports fields, street cleaning, toilet flushing, or as process water for selected industrial plants.

This approach simultaneously reduces drinking water demand and reduces sewer network congestion

5.3.5 Key conclusions – Stormwater management in Braniewo

1. Confirmed climate risk	Climate change will increase the risk of rainfall floods in Braniewo
2. Infrastructure constraints	Expanding the historic sewer network overloads central collectors during peak flows
3. Targeted retention is most effective	Retention in upstream catchments effectively reduces flood peaks, while retention in downstream sections of the network primarily serves as storage for periods of drought
4. Linkage to water reuse	Retained rainfall can support pilot projects such as rain gardens and pool water reuse
5. Evidence-based strategy	Detailed hydrological and hydraulic modeling provides a solid basis for decision-making and adaptive planning
6. Regional relevance	Braniewo's integrated approach provides a model for application to other municipalities in the Baltic Sea region

6. OBJECTIVES AND ACTIONS PROPOSED FOR IMPLEMENTATION

Main Objective : Building a climate-resilient urban water cycle

Objective 1.
Increasing public awareness of the potential use of rainwater, treated sewage, and greywater

- Action 1.1
  Strengthening the competencies and raising awareness of officials, unit employees, and designers.
- Action 1.2
  Educating children and youth to increase awareness of climate change adaptation and biodiversity
- Action 1.3
  Continuous raising of awareness among residents and dissemination of knowledge about climate change and closed-loop water management

Objective 2.
Investments in projects based on pilot experience

- Action 2.1
  Continuation of pilot activities and nature-based solutions
- Action 2.2
  Implementation of a water recycling system in newly constructed facilities
- Action 2.3
  Construction of retention reservoirs
- Action 2.4
  Improving stormwater drainage infrastructure

Objective 3
Increasing the management of rainwater at the place of precipitation

- Action 3.1
  Using potential rainwater drainage sites directly into green areas from sealed areas
- Action 3.2
  Promoting the use of tools that support the creation of home retention
- Action 3.3
  Creating good practice guidelines for City units
- Action 3.4
  Promoting the development of green and blue infrastructure through provisions in local plans, technical conditions for connection to the stormwater network, and administrative decisions.

OBJECTIVES AND ACTIONS PROPOSED FOR IMPLEMENTATION

Objective 1. Increasing public awareness of the potential uses of rainwater, treated sewage, and graywater

Action 1.1 – Strengthening the competencies and raising awareness of officials, unit employees, and designers.

In addition to informational and promotional activities focused on the Braniewo community, it is first necessary to raise awareness among officials and designers, who influence the actions taken in the city. Therefore, it is necessary to co-organize workshops and training for officials and designers, organize presentations for decision-makers, and present the results of pilot projects.

Action 1.2 – Educating children and youth to increase awareness of adaptation to climate change and biodiversity.

Educating children and youth is an important factor in shaping the behaviors not only of future generations but also, through children and youth, their parents and their surroundings.
Another method of action could be to introduce climate change education into school and preschool education. Developing a long-term approach based on a standardized school and preschool education program could be effective.

Action 1.3 - Continuous awareness raising and dissemination of knowledge among residents about climate change and circular water management

This measure aims to increase public understanding of the need to close water cycles. This measure encompasses all promotional activities undertaken by the City Hall and organizational units, such as: public appearances, incorporating the circular economy concept into developed documents, preparing promotional materials, leaflets, and other materials with information about the concept of circular water management.

OBJECTIVES AND ACTIONS PROPOSED FOR IMPLEMENTATION

Objective 2. Investments in projects based on pilot experience

Action 2.1 Continuation of pilot activities and nature-based solutions

The implementation of pilot projects demonstrated the merits of continuing similar solutions in other areas of the city. Mathematical modeling confirmed that water retention is the most effective way to reduce the risk of rainfall flooding, therefore, it is recommended to continue measures such as: • landscaping to allow water to flow into green areas • unsealing the area – increasing the number of semi-permeable surfaces • construction of rain gardens, retention beds, and flower meadows • green walls, green roofs • construction of an irrigation system.

Action 2.2 Implementation of a water recycling system in newly constructed facilities.

The pilot project at the swimming pool demonstrated how much water is wasted and how much water can be recovered using modern technologies. It is advisable to implement technologies that allow for better water management in new or remodeled projects.

Action 2.3 Construction of retention reservoirs

Small-scale retention and nature-based solutions don't solve all problems or prepare for all the effects of climate change, such as torrential rains. The city lacks retention reservoirs, so building them in key locations is crucial. The possibility of using the old city moat bed and adapting it for retention purposes should be analyzed and explored.

Action 2.4 Improving stormwater drainage infrastructure

An inventory of the storm sewer system revealed that it was functioning properly but required ongoing expansion and modernization. Parts of the sewer system date back to pre-war times, and there are sections with unknown routes that have not been inventoried. Sections with lower capacity, where flooding occurs frequently, urgently require reconstruction, particularly in the lower part of the city.

OBJECTIVES AND ACTIONS PROPOSED FOR IMPLEMENTATION

Objective 3 Increasing the management of rainwater at the place of precipitation

Action 3.1 Using potential rainwater drainage sites directly into green areas from sealed areas

The action should focus on creating an effective mechanism for identifying and implementing solutions in which rainwater, e.g. from a sidewalk or roof, can be drained into the area without the need to concentrate the runoff and therefore without the need for costly design concepts or obtaining water permits.

Action 3.2 Promoting the use of tools that support the creation of home retention

By promoting pilot projects and raising awareness of the necessity and effectiveness of small-scale water retention, measures should be implemented to encourage residents to apply similar solutions on their own plots, e.g. by providing advice on the construction of rain gardens or by providing budgetary funding for such activities.

Action 3.3 Creating good practice guidelines for City units

Preparation of best practice guidelines for individual City departments and units based on international projects observed as part of the Waterman project and other similar projects. Specific practical guidelines, both organizational and technical, which may be annexed to technical specifications for the execution and acceptance of works

Action 3.4 Promoting the development of green and blue infrastructure through provisions in local plans, technical conditions for connection to the stormwater network, and administrative decisions

Increased emphasis on formal arrangements and issuing conditions to investors for connection to the drainage and retention system and in the preparation of projects implemented by the City, as well as in the preparation of the General Plan, tender documents, etc.

6. OBJECTIVES AND ACTIONS PROPOSED FOR IMPLEMENTATION

Building a climate-resilient urban water cycle

Objective 1. Increasing public awareness of the potential uses of rainwater, treated sewage, and graywater

Objective 2. Investments in projects based on pilot experience

Objective 3 Increasing the management of rainwater at the place of precipitation

The indicated goals and directions of action will be re-verified and adjusted as work begins on a broader document, the Municipal Climate Change Adaptation Plan (MPA).

The Municipal Climate Change Adaptation Plan is a strategic document containing the characteristics of a given area, analysis of climate data, assessment of vulnerability, potential and sensitivity, and proposals for actions aimed at both mitigating the effects of climate change and adapting to them.

The future MPA document will contain at least: an analytical part, a concept for the management of rainwater and meltwater resulting from atmospheric precipitation within the city, a set of spatial data, a programmatic part, an indication of the method of implementing the plan, conclusions and recommendations.

7 FORECASTED FUTURE ACTIVITIES

In accordance with the actions defined in the City Strategy until 2030 and the conclusions from the implementation of the Waterman project, the most important investments necessary in the near future have been selected:

1. Development of urban standards for landscaping and maintenance of green spaces.
2. Protection of wetlands in the city from non-natural development.
3. Development of a water retention program for the city.
4. Development of a municipal climate change adaptation program.
5. Construction of a water and sewage network and storm drainage system in the block between Bażyńskiego Street and ul. Długa Street
6. Modernization of the city's storm sewer system
7. Modernization of the sewage treatment plant
8. Development of small-scale water retention – subsidies for residents for infrastructure purchases
9. Construction of neighborhood green spaces/pocket parks with seating areas and natural playground elements
10. Creation of recreation and relaxation zones within the Botanical and Zoological Park on Botaniczna Street – potential for green retention solutions
11. Revitalization of the city moat: Stage III – renovation of the medieval walls to make them accessible for residents' recreational needs and tourism – potential for green retention solutions
12. Revitalization of the city moat: Stage IV – modernization of the amphitheater within the city moat– potential for green retention solutions

9 CONSULTATIONS

On June 10, 2025, a consultation meeting was held to discuss the implementation of activities within the WaterMan project and the development of the Strategy. The event aimed not only to summarize activities to date but, above all, to open a social dialogue with residents, experts, and project partners. The participants discussed the challenges facing the city and the opportunities offered by modern water management solutions..

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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.