Stop UP

Protecting the aquatic environment from urban runoff pollution

Project Overview

Tone M. Muthanna (NTNU)

This project has received funding from the European Union's Horizon Europe research and innovation program under grant agreement No 101060428.

RELEVANCE OF THE TOPIC

POLLUTED STORMWATER RUNOFF: A GROWING THREAT (Chesapeake Bay Foundation) [3]

Road runoff pollution damages London's rivers, study finds

(The Guardian) [1]

[4]

Urban water pollution is a major threat to groundwater and freshwater ecosystems

(IGB Berlin) [2]

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RELEVANCE OF THE TOPIC

Urban runoff…

… is increasing due to growing populations and subsequent urbanization

… is a significant pathway for pollution to contaminate aquatic ecosystems

… is, if it is not treated, releasing million tons of toxic, non-biodegradable and emerging contaminants to the environment

… pollution is not systematically measured, their toxicity effects are ill-defined and potentially underestimated

Sustainable strategies needed to treat urban runoff:

- Make urban runoff storage and treatment processes more common
- Especially urgent for densely populated cities where natural landscapes are insufficiently available to process, infiltrate and treat urban runoff
- More research needed

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PROJECT PARTNERS

RWTH AACHEN UNIVERSITY

Aquafin

atd GmbH

Institut Supérieur des Sciences Biologiques Appliquées de Tunis

NTNU
Norwegian University of Science and Technology

HR Wallingford
Working with water

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

FLUVES

TAUW

aqua aurora bv

n|w Fachhochschule Nordwestschweiz

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PROJECT DATA SHEET

Protecting the aquatic environment from urban runoff pollution „**StopUP**“

Funding: European Union

Project partners: 11

Funding period: 36 months

Project start: Scheduled for 1st of September 2022

Project coordination: RWTH (Content organization: ISA; Administration: Department 4.2)

Work packages: 6

Funding volume: 3,766,439.50 €

No.	Name of Organization	Acronym	Type	Country
1	Rheinisch-Westfälische Technische Hochschule Aachen	RWTH	University	DE
2	Aquafin NV	AQF	Water Supply	BE
3	Norwegian University of Science and Technology	NTNU	University	NO
4	ATD Ingenieurgesellschaft für Abwasserwirtschaft und technische Dienstleistungen mbH	ATD	SME	DE
5	University of Bologna	UNIBO	University	IT
6	FLUVES NV	FLUVES	SME	BE
7	HR Wallingford Ltd	HRW	Consulting	GB
8	TAUW BV	TAUW	Industry	NL
9	Affiliated Entity: Aqua Aurora BV	AA	SME	NL
10	Associated Partner: Fachhochschule Nordwestschweiz	FHNW	University	CH
11	Institut Supérieur des Sciences Biologiques Appliquées de Tunis	ISSBAT	University	TN

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USE CASES

- **Aachen (DE)**: Retention soil filters in urban catchments
- **Bologna (IT)**: Sewer of Bologna and pilot plant installed at the Bologna WWTP CSO
- **Birsfelden (CH)**: Use of rain radar and adaptive WWTP operation to minimize CSO spills in the Birs catchment

- **Berchem & Wetteren (BE)**: Treatment of high traffic roads and residential areas in the Antwerp region/ Shopping area runoff characterisation and treatment
- **Trondheim (NO)**: Nature-based solution retrofit in an urban catchment
- **Tunis (TN)**: Characterisation and treatment using improved constructed wetlands of stormwater runoff/sewage overflow

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Revised Urban Waste Water Directive

	2025	2030	2035	2040
Storm water overflows & urban runoff	Monitoring in place	Integrated plans for agglo. >100k p.e. & risk areas identified	Integrated plans in place for agglo.at risk between 10 and 100k p.e.	Indicative EU target for all agglo. > 10,000 p.e.
Nitrogen & Phosphorus	Identify areas at risk (agglomerations of 10-100k p.e.)	Interim target for removal at facilities >100 p.e. & new standards	Removal in all facilities >100k p.e. & interim target for areas at risk	Removal in place in all areas at risk (between 10 and 100k p.e.)
Micro-pollutants	Set up of extended producer responsibility schemes	Areas at risk identified (10 to 100 k p.e.) & interim target for facilities > 100k p.e.	All facilities >100k p.e. equipped & interim targets for areas at risk	All facilities at risk equipped with advanced treatment
Individual appropriate systems (IAS)	Regular inspection in all member states (MS) & Reporting MS with high IAS	EU standards for IAS		
Small-scale agglomerations	New threshold of 1000 p.e.	All agglo. > 1000 p.e. compliant		
Energy	Energy audits for facilities >100k p.e.	Audits for all facilities >10k p.e., Interim target	Interim target for energy neutrality	Energy neutrality met and related GHG reduction met

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PROJECT GOALS IN TERMS OF RESEARCH FUNDING

Project's pertinence to the scope:

- *„**good quality of freshwater**“*
- *„urban stormwater runoff **pollution** […] climate change affecting frequency and intensity of precipitation“*
- *„additional knowledge is needed on **sources and transport pathways** of diffuse pollution“*
- *„urban runoff water quality **management plans**“*
- *„develop innovative and integrated **concepts and technologies** for urban drainage systems“*
- *„seek compomenetarities and synergies“ (**Water Quality Interception Tool**)*

Innovations and outputs:

- *#1: Novel alarming protocol for continuous monitoring of water quality (TRL 3 → TRL 5)*
- *#2: Adsorption + sieve filtration to retain pollution from CSO spills (TRL 3 → TRL 5)*
- *#3: RSFcompact technology for CSO treatment (TRL 3 → TRL 5)*
- *#4: Smart real-time control loop for the sewer-WWTP interface (TRL 4 → TRL 5/6)*
- *#5: Urban Rainshell – Nature based solution for stormwater treatment (TRL 3 → TRL 5)*
- *#6: Web-based tool 'Water quality Interception' (TRL 3 → TRL 5)*
- *#7: Decision Support Method for Infiltration and Treatment Technologies (TRL 3 → TRL 5)*

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Urban Runoff Water Quality Management Plans

MAIN HYPOTHESIS AND CONTEXT

Revision of the European Wastewater Treatment Directive

- Wastewater management plan to be developed (including runoff pollution),
- Measures to be taken to limit urban runoff pollution.

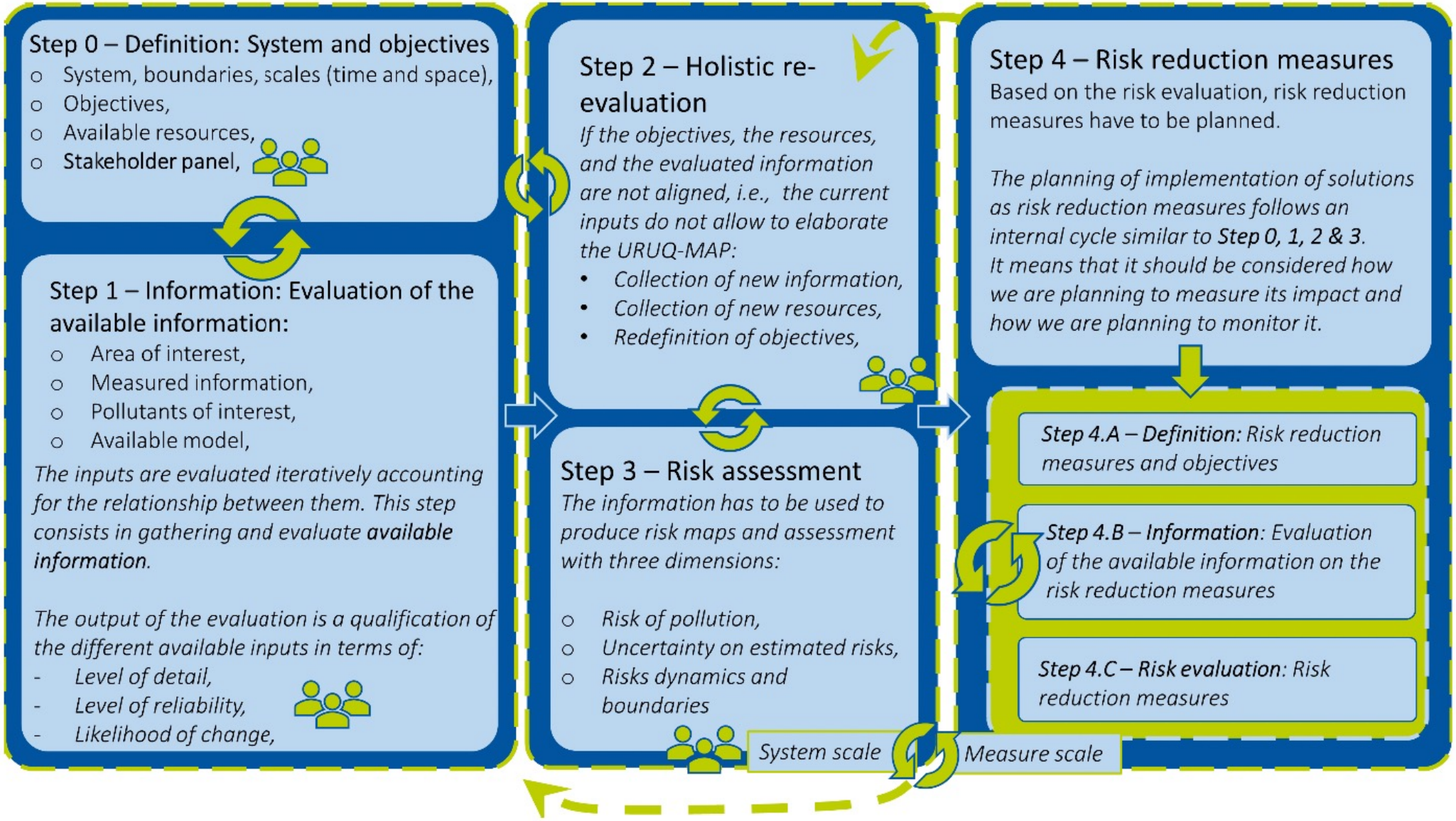
ISO 31000:2018 – Risk management – Guidelines:

- The URUQ-MAP is aligned with the ISO and emphasis on the principes of *Dynamic*, *Best available information*, and *Continual improvement*,
- The ISO is the reference regarding the points not defined in the current deliverable,
- Following the principle of continual improvement of the ISO, the URUQ-MAP is to be updated based on feedback from application in the different case studies.

Pollution and risk:

- Pollution risk is dynamic,
- Likelihood and consequence of pollution risk events are hard to quantify and subject to large uncertainties,
- The URUQ-MAP should be adaptable and explicitly account for uncertainties.

Urban Runoff Water Quality Management Plans - Draft



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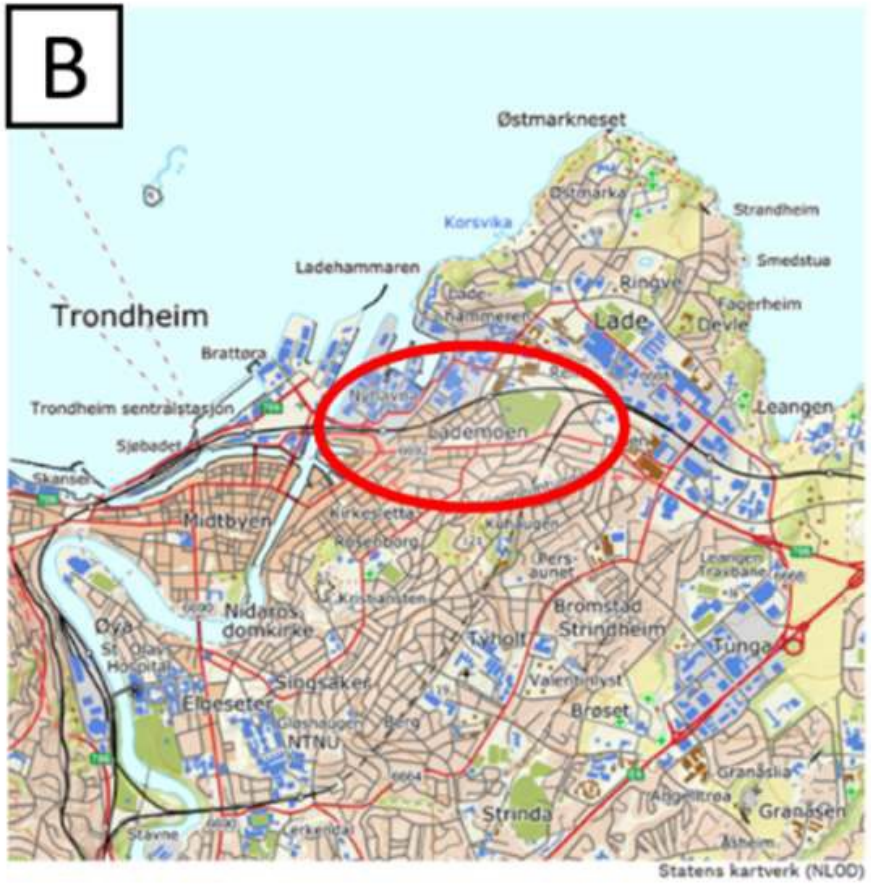
CS #5: Nature-based solutions retrofit in an urban catchment

Lademoen catchment



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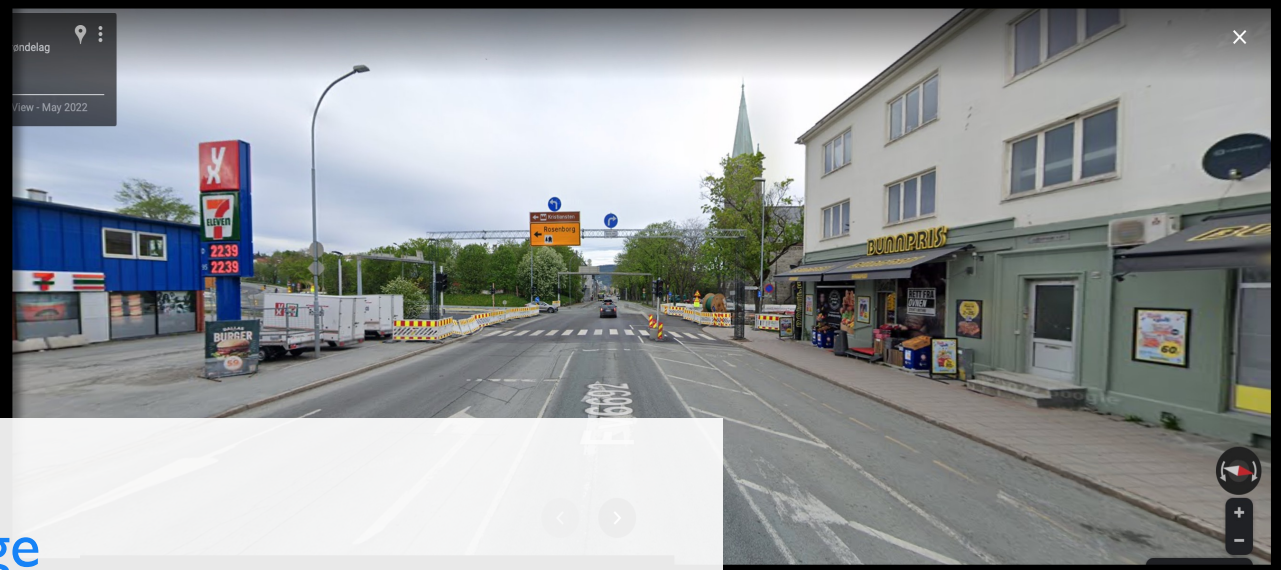
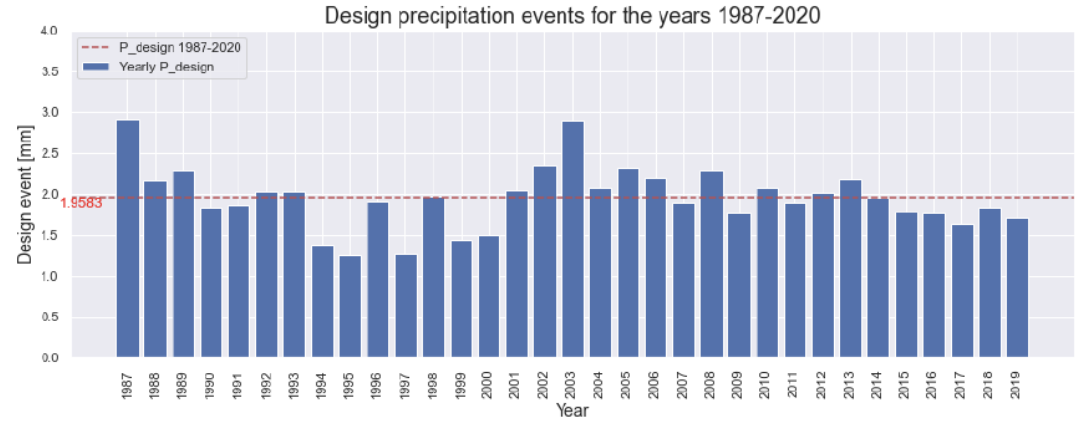
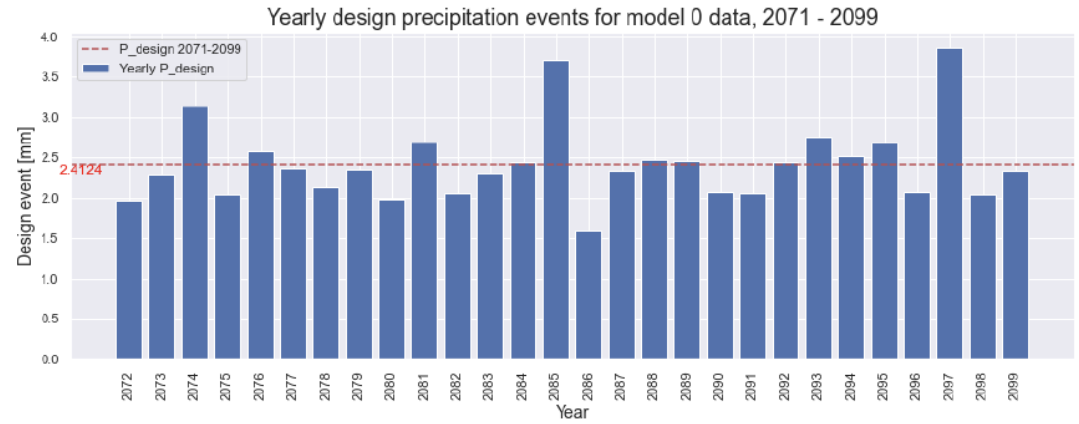
Lademoen

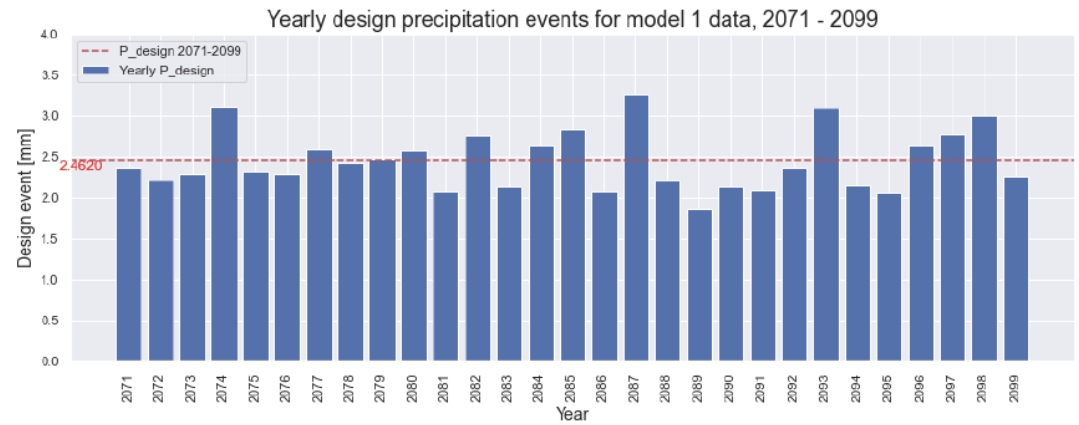


- Dense urban
- Climate change
- Aging infrastructure
- Point and non-point source of pollution

Lademoen







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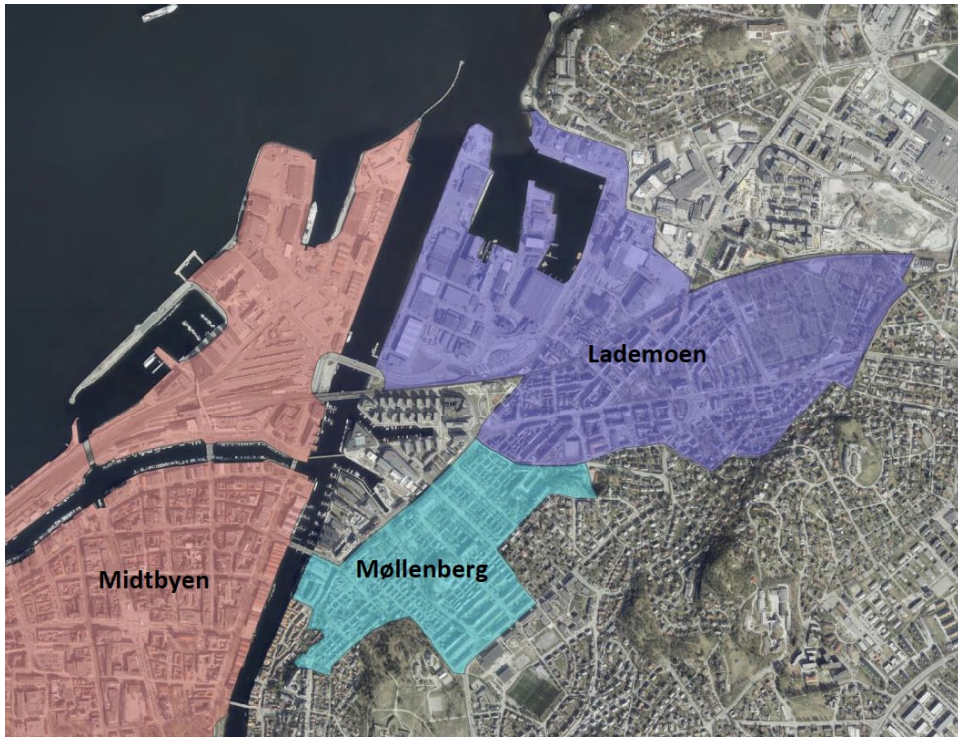
Lademoen
Midtbyen
Møllenberg


N
Railway
Thomas von Westens gate
Strandveien
Pedestrian road
Innherredsveien

Availabel area for SUDS

Land use type	Area [m^2]	% of total area
Total area of project site	189978	-
Roofs (projected area)	52192	27.5%
Roads and sidewalks	49880	26.3%
Unavailable area in Lademoen Park	11347	6.0%
Marked parking	5033	2.6%
Total unavailable area	118453	62.4%
Total available area for retrofit	71525	37.6%

Data	Name	P_{design} [mm/hr]	Roof area (A_{drain}) [m^2]	Area of Rain Garden surface	% of the available area
Historical, measured 1987 - 2020	$P_{d,historical}$	1.9	52192	831	4.74%
Future, model 0, 2071 - 2099	$P_{d,m0}$	2.4	52192	1024	5.84%
Future, model 1, 2071 - 2099	$P_{d,m1}$	2.5	52192	1045	5.96%

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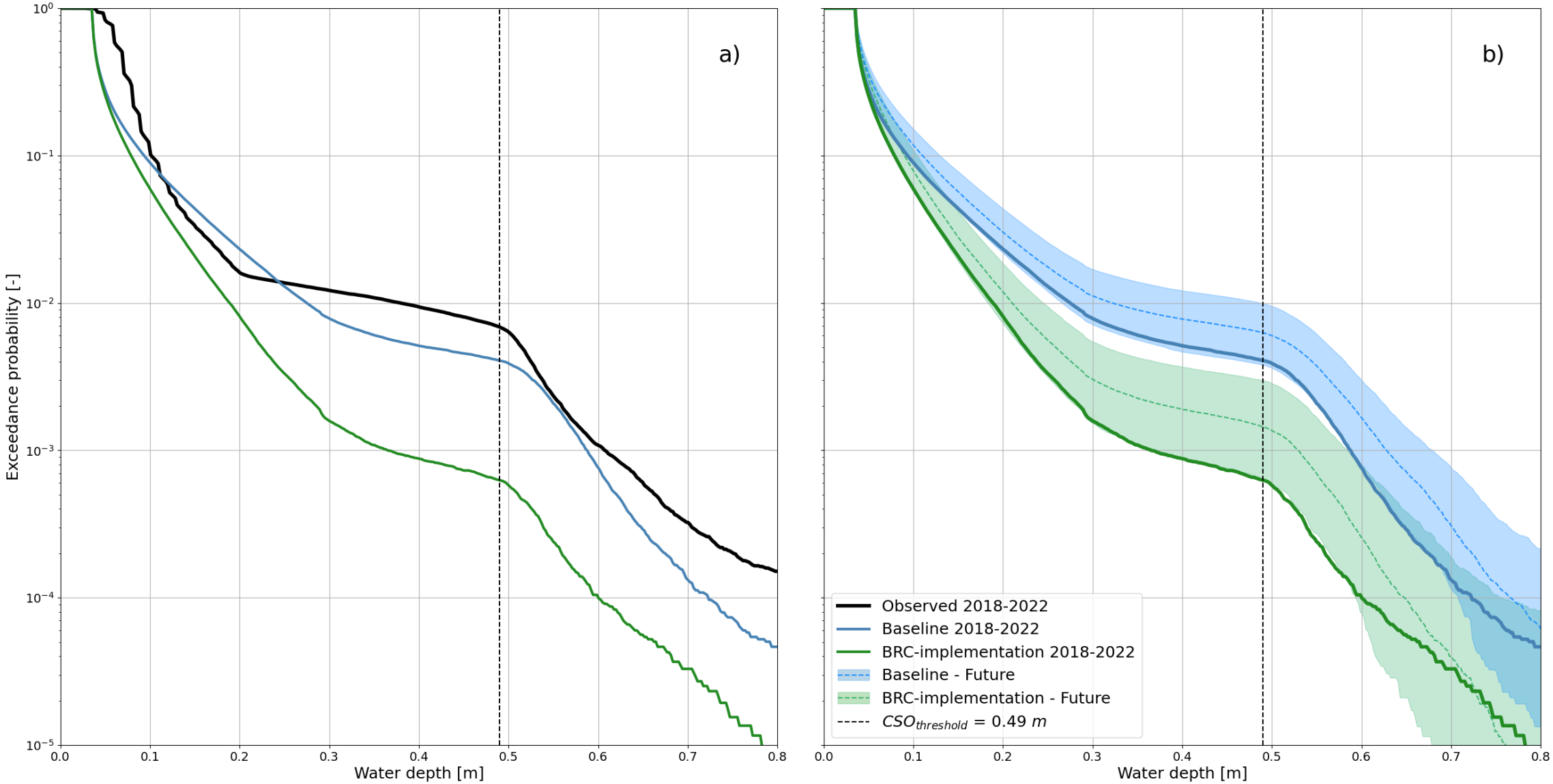
a)
b)
Exceedance probability [-]
Water depth [m]
Water depth [m]
Observed 2018-2022
Baseline 2018-2022
BRC-implementation 2018-2022
Baseline - Future
BRC-implementation - Future
$CSO_{threshold}$ = 0.49 m

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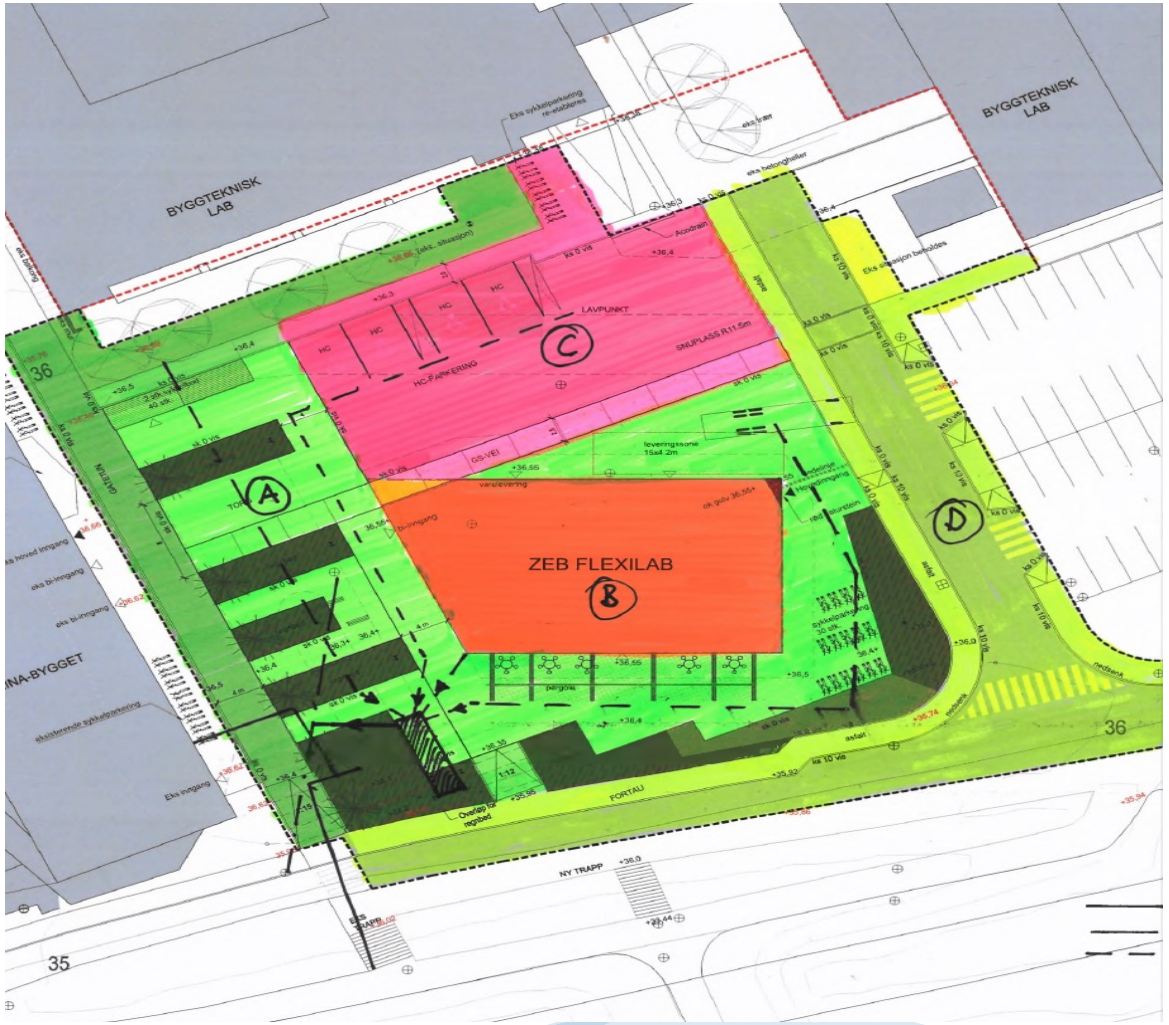
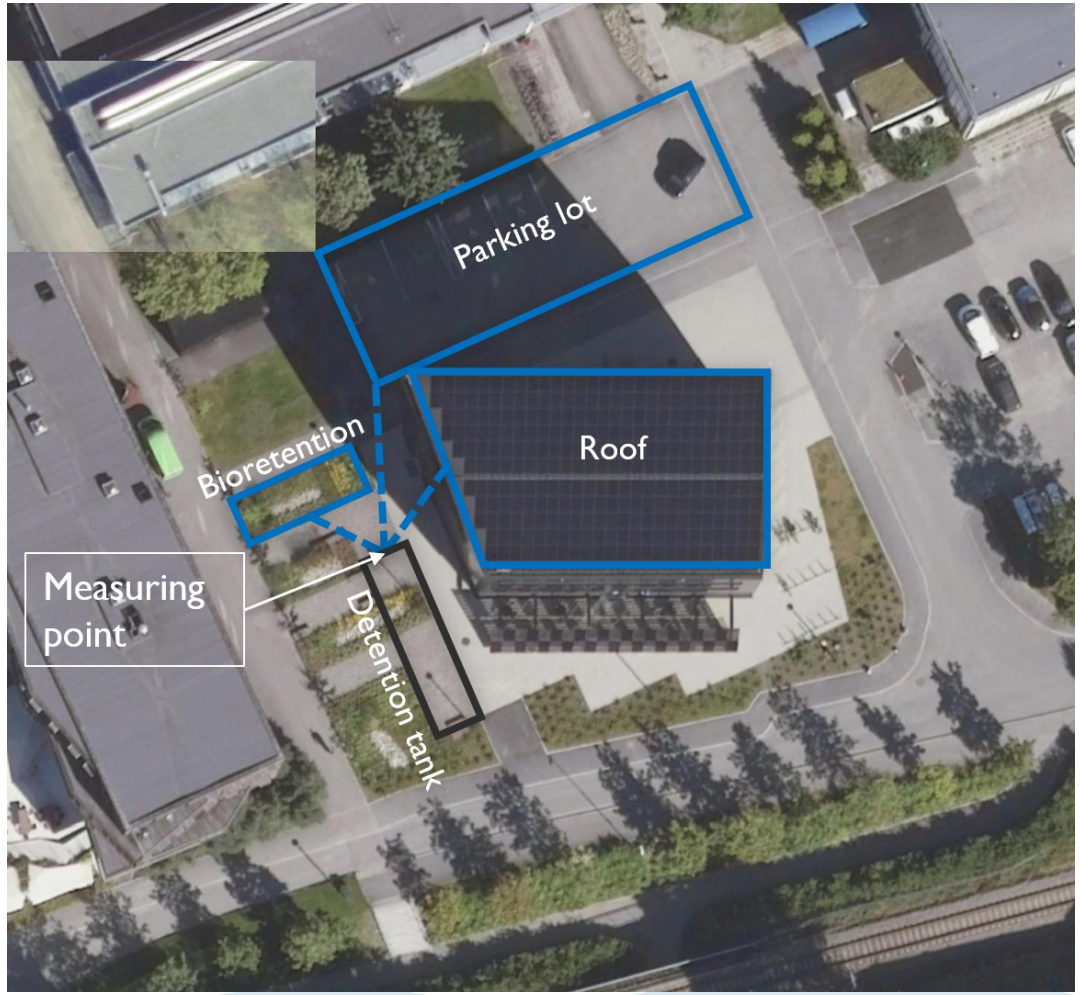
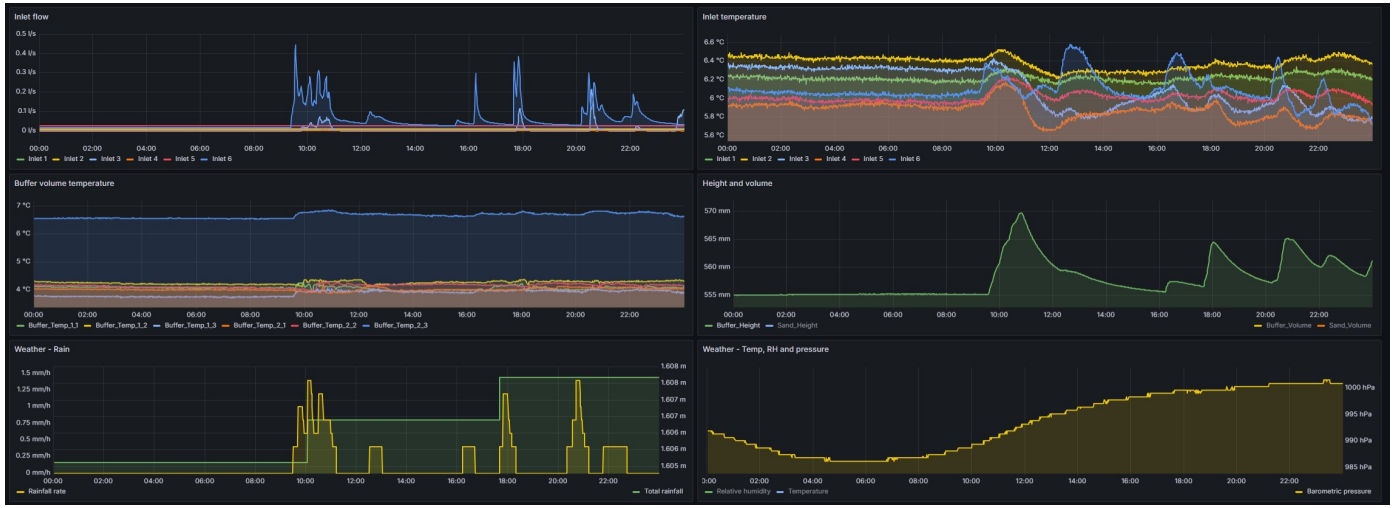
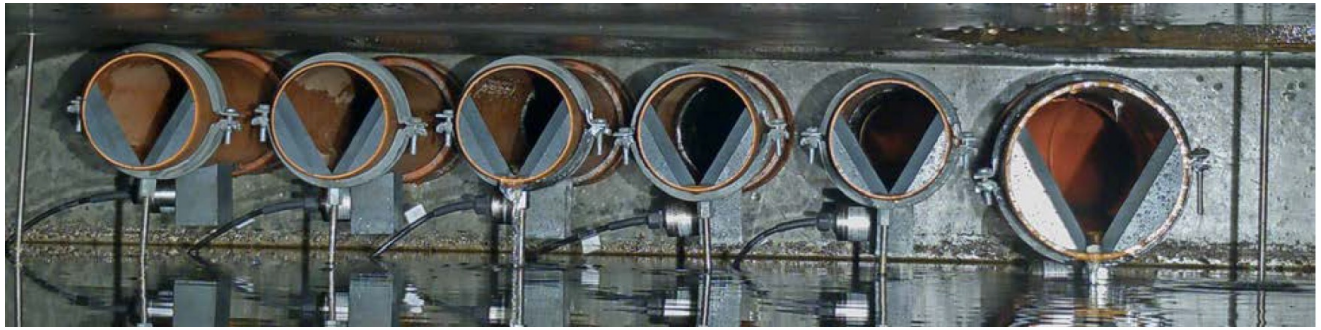
ZEB lab Pilot



ZEB lab Pilot







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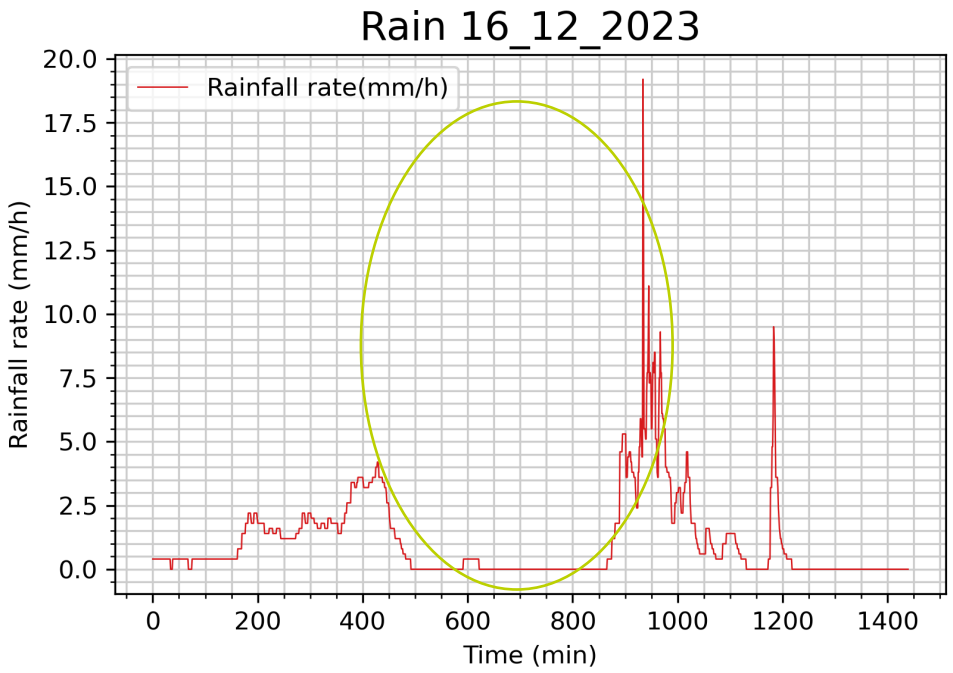
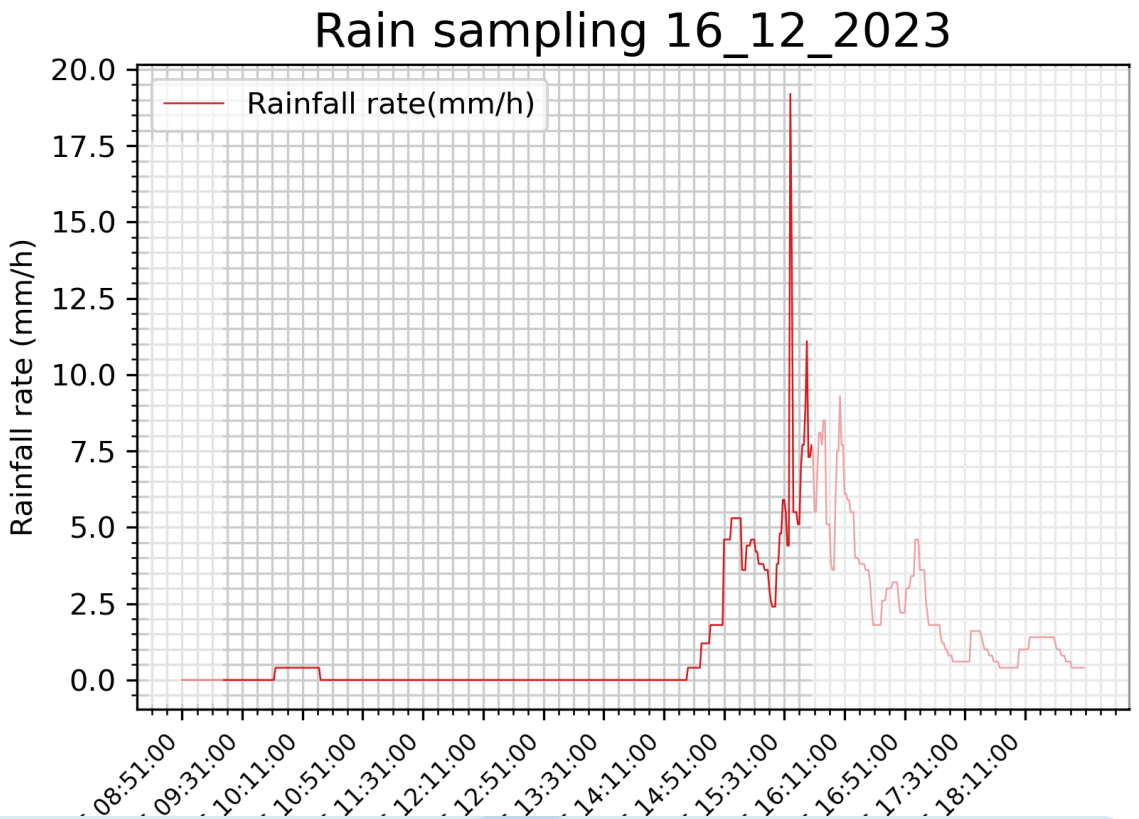
When did we sample ?





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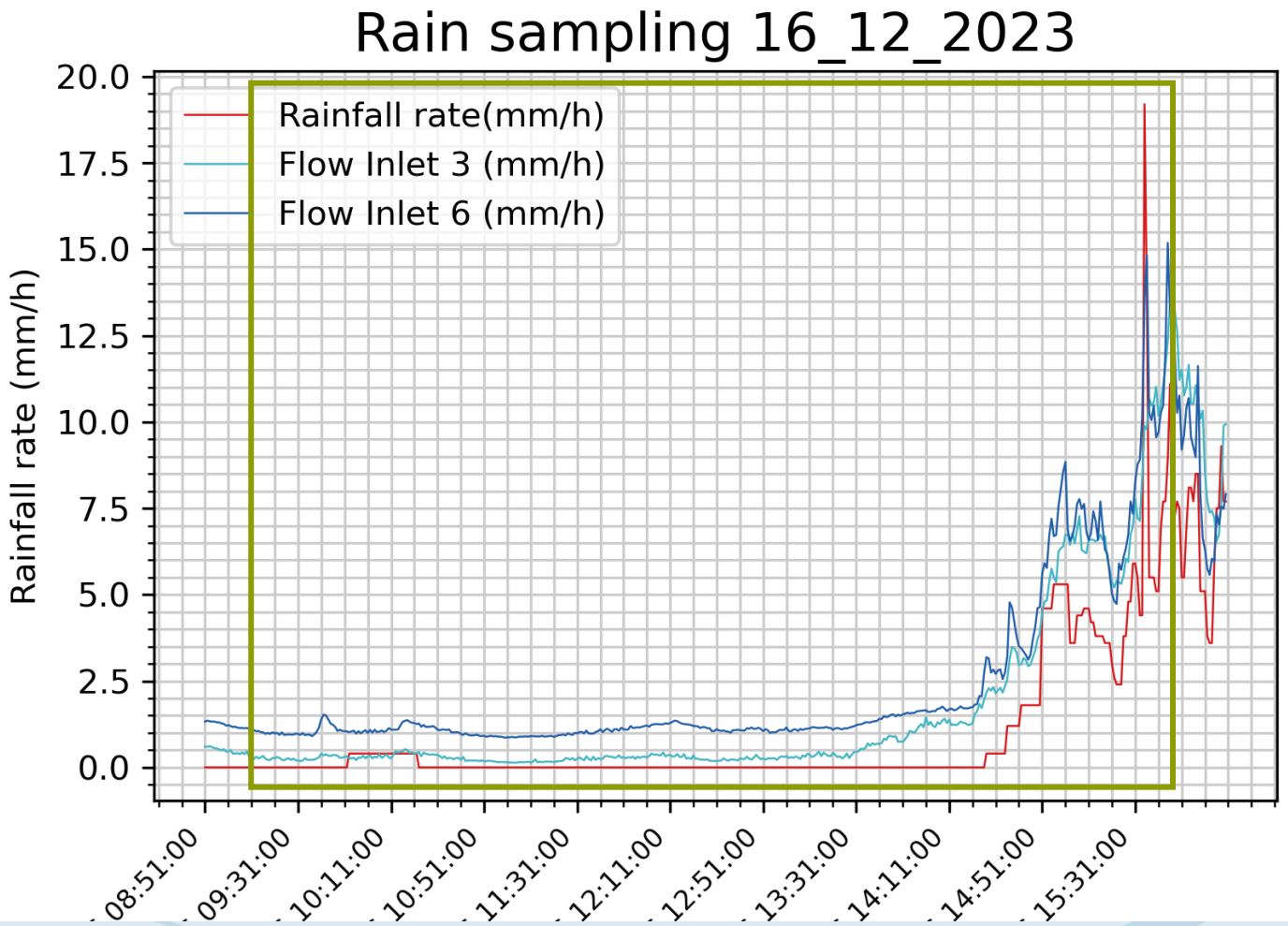
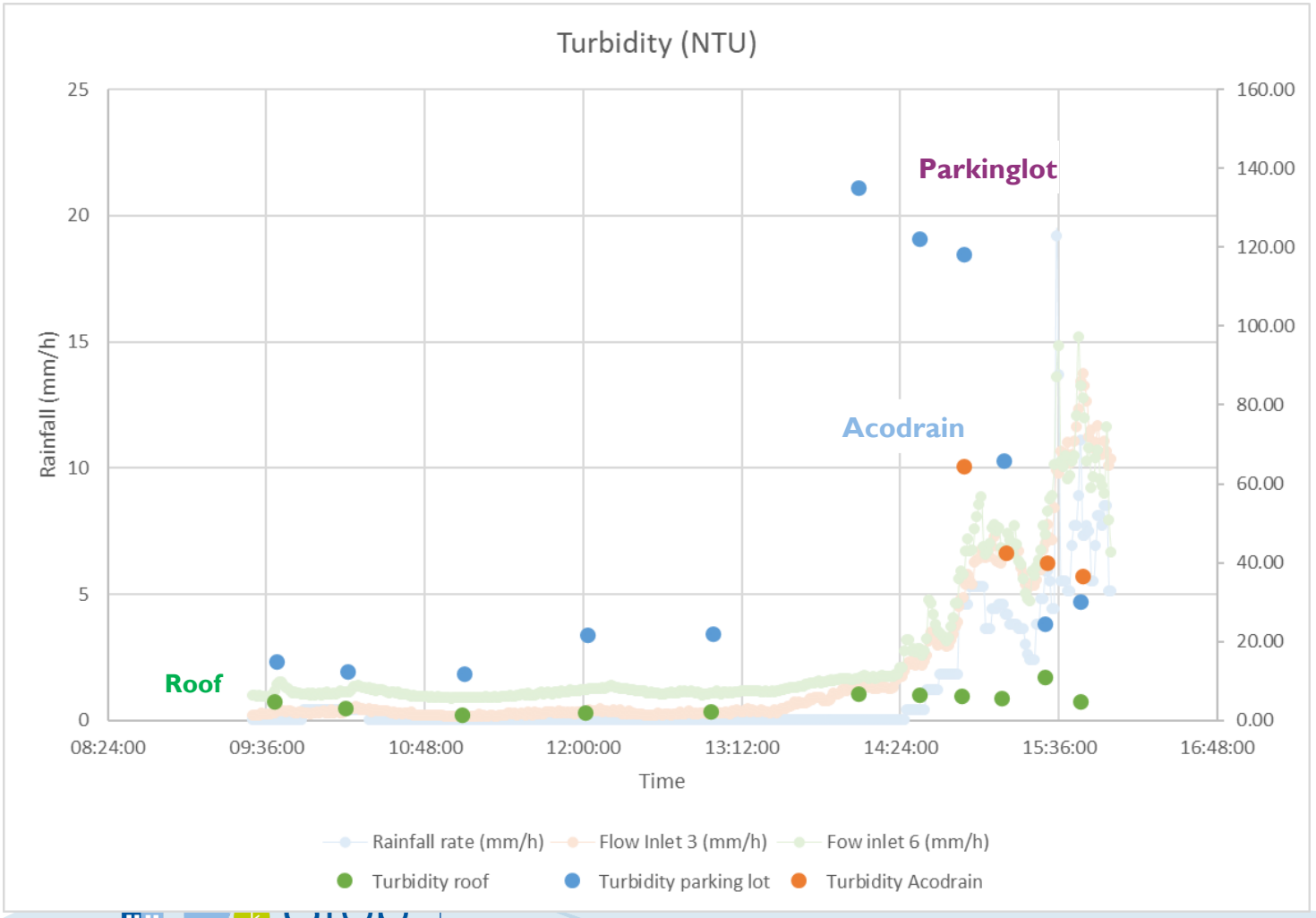
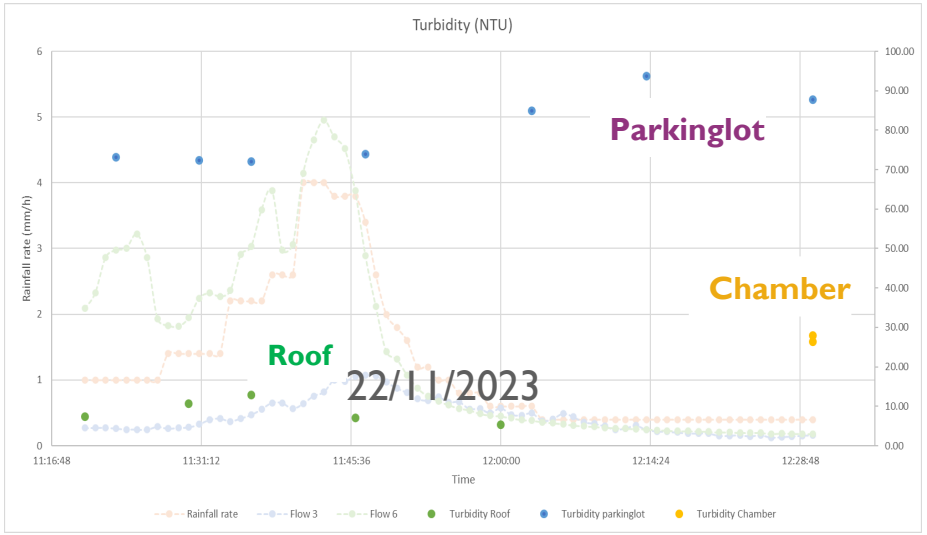

Rain sampling 16_12_2023
Rainfall rate(mm/h)
Flow Inlet 3 (mm/h)
Flow Inlet 6 (mm/h)
Rainfall rate (mm/h)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
08:51:00
09:31:00
10:11:00
10:51:00
11:31:00
12:11:00
12:51:00
13:31:00
14:11:00
14:51:00
15:31:00


Turbidity (NTU)
Rainfall (mm/h)
Time
Parkinglot
Acodrain
Roof
Rainfall rate (mm/h)
Flow Inlet 3 (mm/h)
Fow inlet 6 (mm/h)
Turbidity roof
Turbidity parking lot
Turbidity Acodrain


Turbidity (NTU)
Rainfall rate (mm/h)
Time
Parkinglot
Chamber
Roof
22/11/2023
Rainfall rate
Flow 3
Flow 6
Turbidity Roof
Turbidity parkinglot
Turbidity Chamber

16/12/2023

Stop UP

StopUP website:
www.stopup.eu

www.linkedin.com/company/87183165/

www.twitter.com/StopUPeurope