Co-UDlabs

BUILDING COLLABORATIVE URBAN DRAINAGE RESEARCH LABS COMMUNITIES

Improving Resilience and Sustainability in Urban Drainage Solutions (WP8)

General overview

Juan Naves (juan.naves@udc.es)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101008626

Improving Resilience and Sustainability in UD Solutions (WP8)

7 partners, 29 researchers and professionals involved

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Luis Cea
Jose Anta
Juan Naves
Joaquín Suárez
Manuel Regueiro
Esteban Sañudo
Daniel Carreres

Deltares

Antonio Moreno-Ródenas
François Clemens-Meyer

eawag aquatic research

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João P. Leitão
Prabhat Joshi

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

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Jean-Luc Bertrand-Krajewski
Ezekiah Barret
Sebastien Alesio-Capolini
Nicolas Walcker
Serge Naltchayan

The University Of Sheffield.

James Shucksmith
K. Brazier

IKT

Marcel Goerke
Thomas Brüggemann
Iain Naismith

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Jesper E. Nielsen
Michael R. Rasmussen
Rasmus Laursen
Jacob B. Jensen
Janni M. Nielsen
Per Møldrup

Improving Resilience and Sustainability in UD Solutions (WP8)

Main activities:

- **Innovative technologies and methodologies** to analyse the hydrodynamic performance of UD infrastructures
- Investigating **plastic transport** in urban environments
- Standard methods to assess long-term **permeable pavement** performance
- Hydrodynamic design for **stormwater detention ponds** optimized for cost-efficient maintenance
- Use of **designer soils** for Sustainable Urban Drainage systems

- **Hydraulic energy losses during sewer to surface flow interactions during urban floods.**
- **Transport of contaminants from UDS to urban surfaces during flooding/network surcharge events**

  James Shucksmith (University of Sheffield)

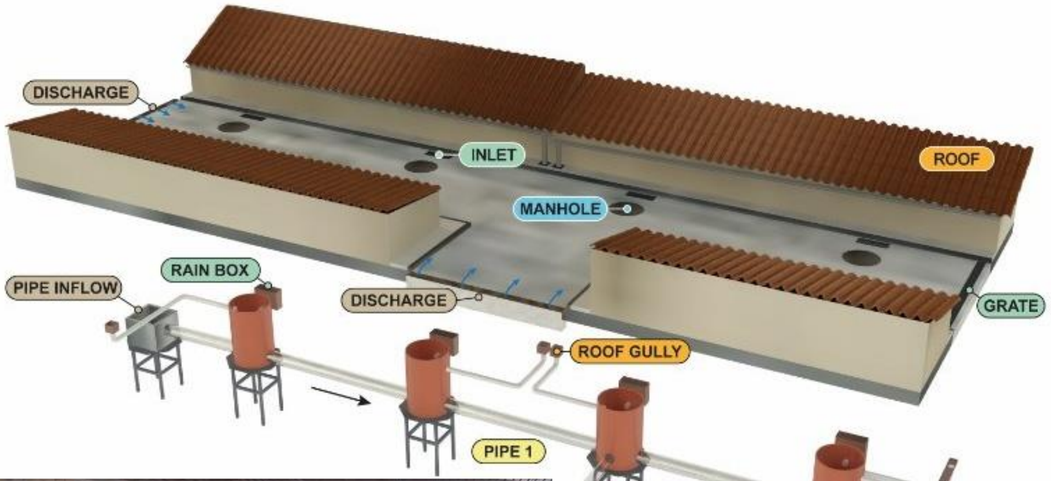
- **Understanding the influence of leaf litter and sand on the water balance composition of blue-green infrastructure**

  João P. Leitão (eawag)

Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

New techniques to build-up high resolution geometry of UD infrastructures

Block facility (Universidade da Coruña)



LiDAR Camera L515

Intel D435i RealSense Depth Camera

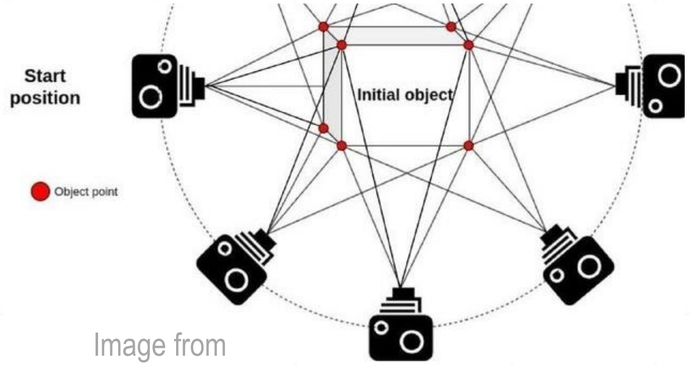
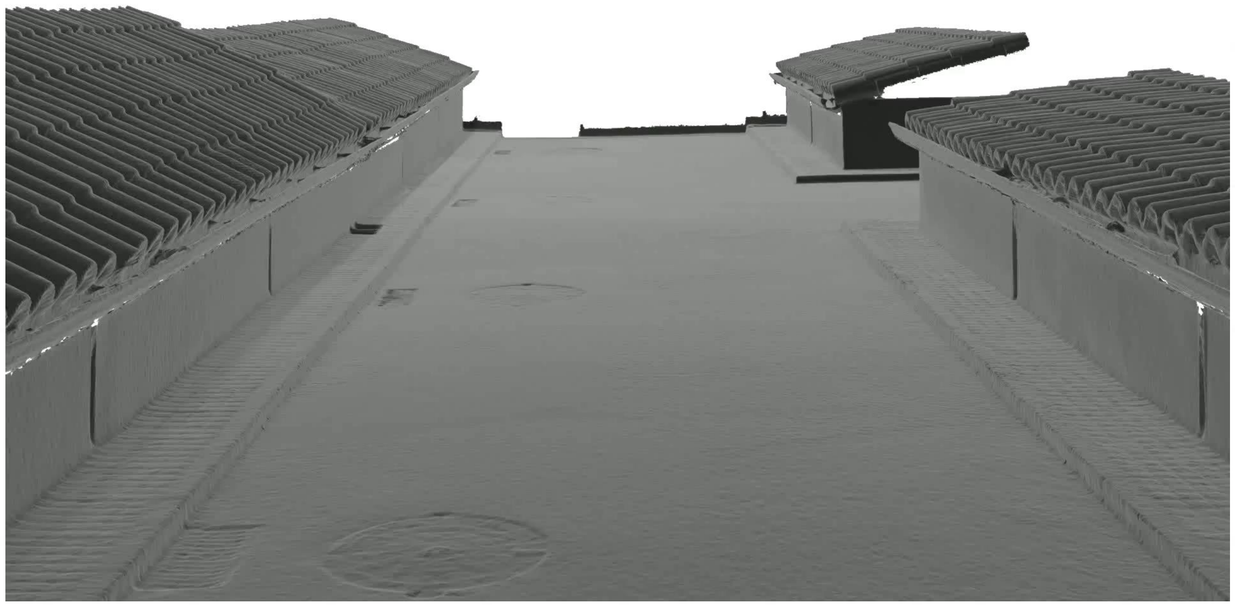


Image from Kugurakova et al. (2023)

Photogrammetry

Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

New techniques to build-up high resolution geometry of UD infrastructures



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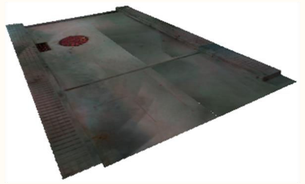
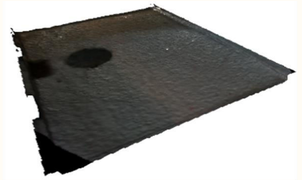
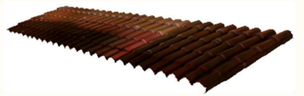
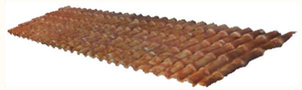
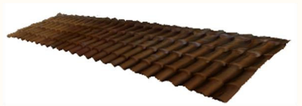
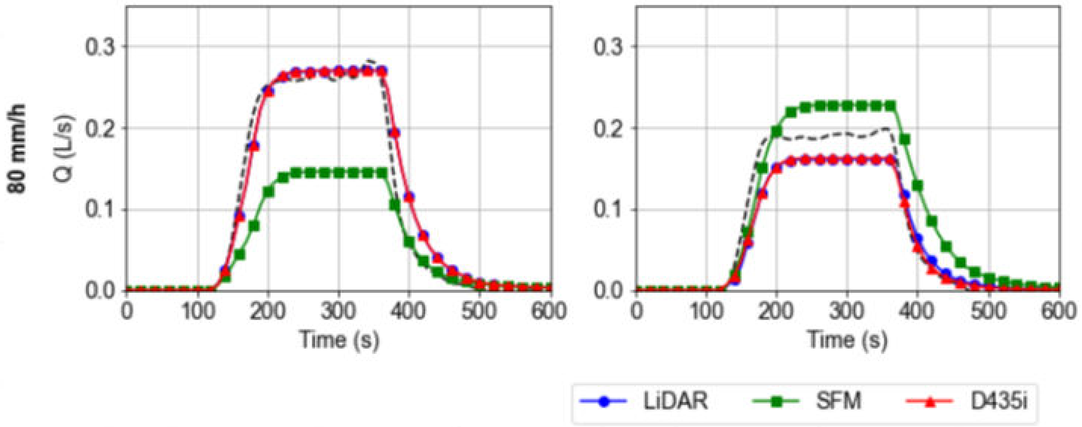
BLOCK Surafce			
BLOCK Roof			



Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

New techniques to build-up high resolution geometry of UD infrastructures

zenodo

October 31, 2023 (1.0) | Project deliverable | Open https://doi.org/10.5281/zenodo.10057707

D8.1. Report on determined Scalable Hydrodynamic Performance Protocols

Cea, Luis; Anta, Jose; Naves, Juan; and 5 others

This document is Deliverable 8.1 of the Co-UDlabs project, funded under the European Union's Horizon 2020 research and innovation programme under grant agreement No 101008626. This deliverable is an output from Tas…

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December 13, 2023 (v1) | Dataset | Open https://doi.org/10.5281/zenodo.10371819

CoUDlabs_WP8_T811_UDC_001 Analysis and assessment of new techniques to build-up the topography/geometry of Urban Drainage infrastructure with high resolution

Sañudo, Esteban; Naves, Juan; Regueiro-Picallo, Manuel; and 3 others

The quality of the results obtained in hydraulic numerical models is strongly conditioned by the accuracy of the input data, especially in the case of shallow waters such as those occurring in urban floods. In addition, urban catchmen…

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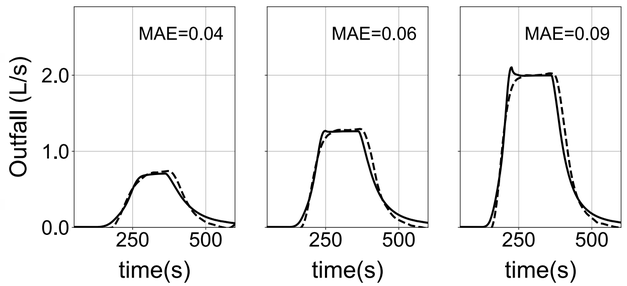
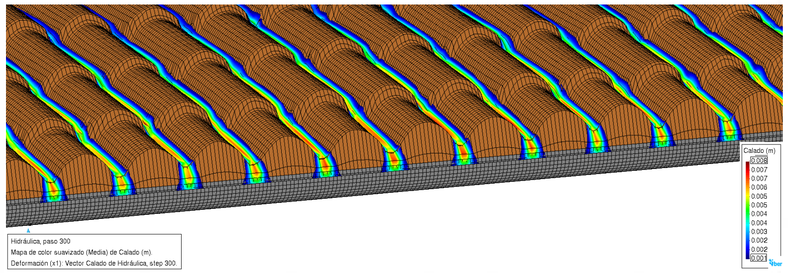
2D OVERLAND FLOW MODEL

1D SEWER NETWORK MODEL






DOI: 10.1002/hyp.15068

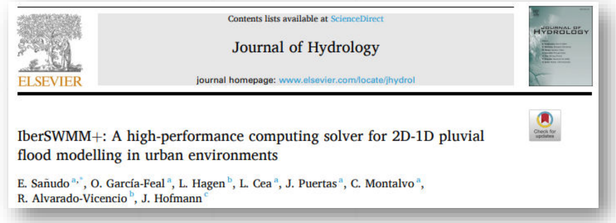
RESEARCH ARTICLE

WILEY

Large-scale physical facility and experimental dataset for the validation of urban drainage models

E. Sañudo | L. Cea | J. Puertas | J. Naves | J. Anta

https://doi.org/10.1002/hyp.15068


Contents lists available at ScienceDirect

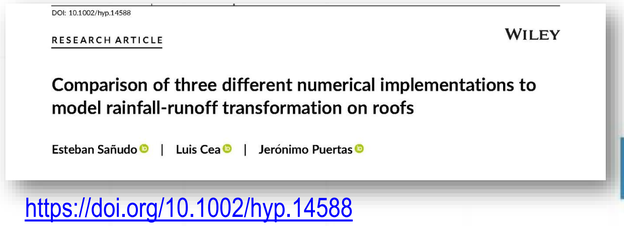
Journal of Hydrology

journal homepage: www.elsevier.com/locate/jhydrol

IberSWMM+: A high-performance computing solver for 2D-1D pluvial flood modelling in urban environments

E. Sañudo [a,*], O. García-Feal [a], L. Hagen [b], L. Cea [a], J. Puertas [a], C. Montalvo [a], R. Alvarado-Vicencio [b], J. Hofmann [c]

https://doi.org/10.1016/j.jhydrol.2024.132603


DOI: 10.1002/hyp.14588

RESEARCH ARTICLE

WILEY

Comparison of three different numerical implementations to model rainfall-runoff transformation on roofs

Esteban Sañudo | Luis Cea | Jerónimo Puertas

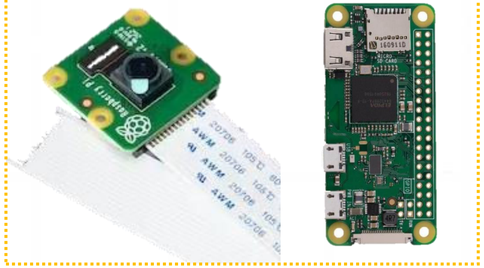
https://doi.org/10.1002/hyp.14588

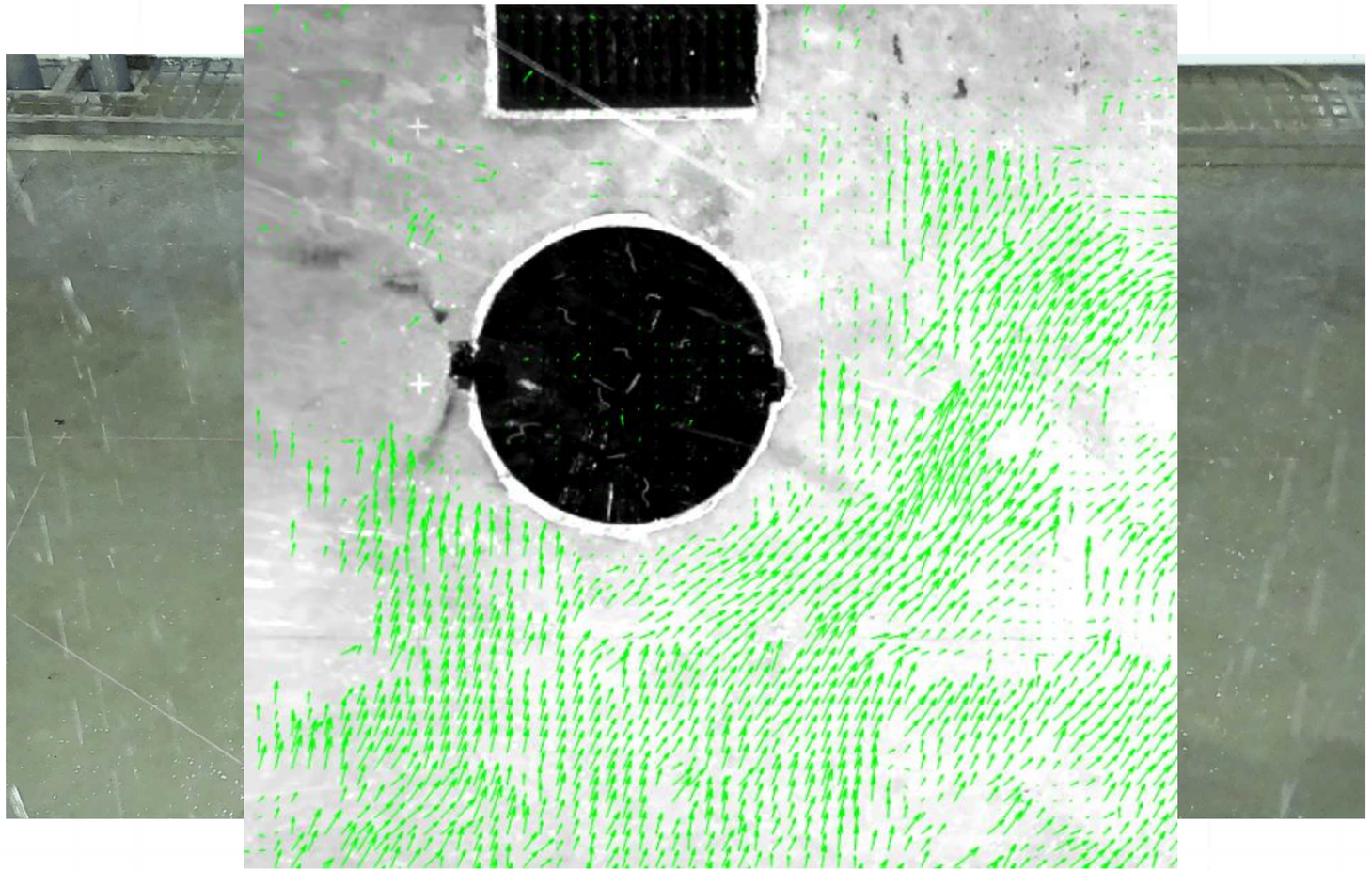
Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

Imaging velocimetry techniques for urban drainage applications

Raspberry PI 4 + 12MPX Camera HQ + fixed lens 16mm (70€+110€)

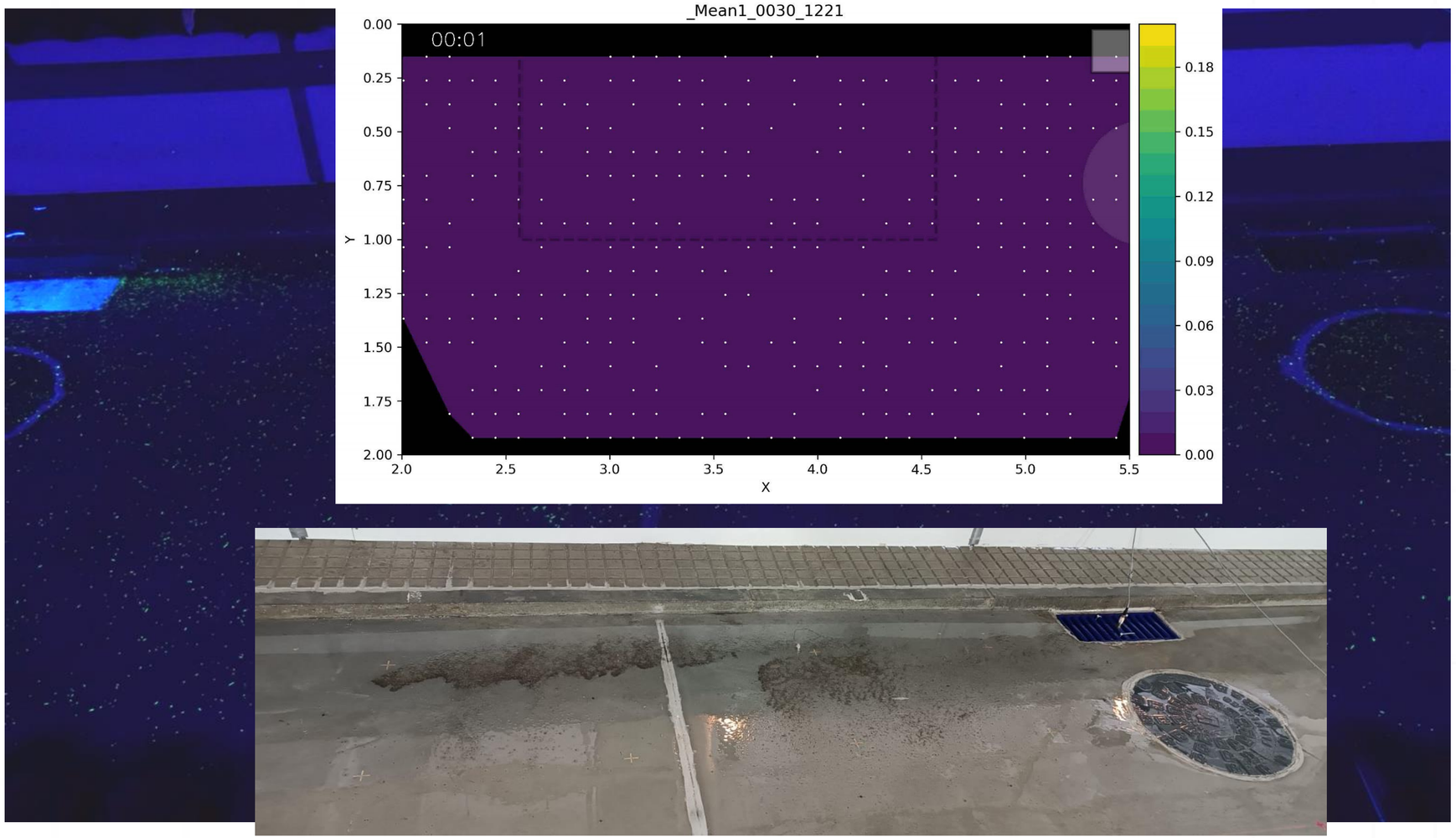
Raspberry PI Zero W + 8MPX picamera V2 (19€+28€)





Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

Imaging velocimetry techniques for urban drainage applications



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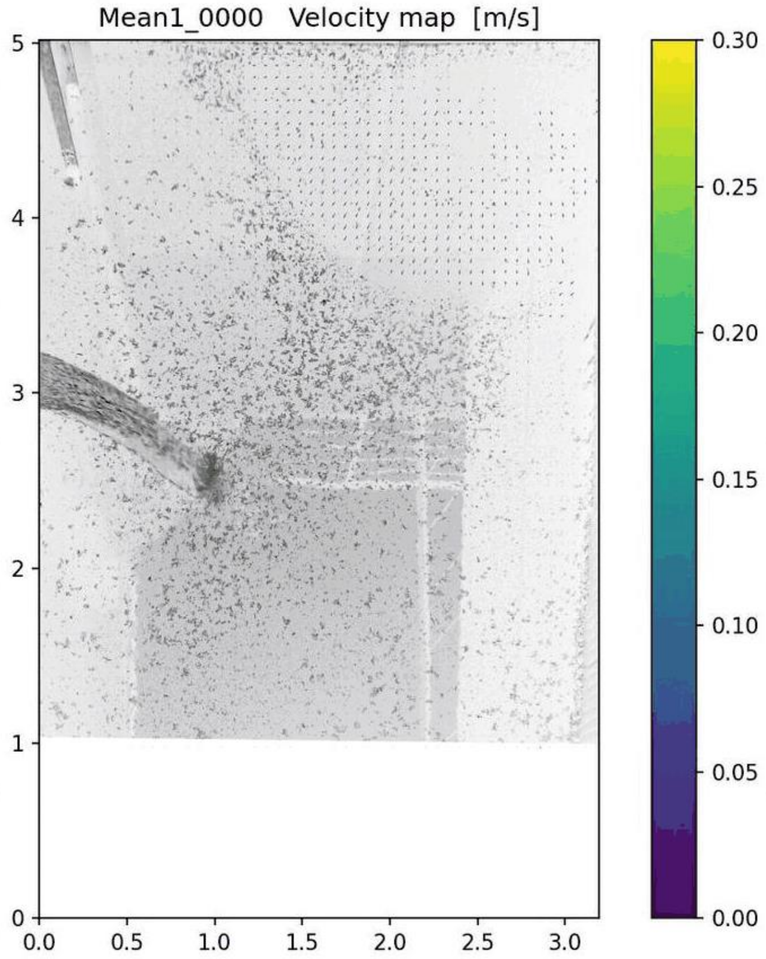
Imaging velocimetry techniques for urban drainage applications



Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

Imaging velocimetry techniques for urban drainage applications

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Cea, Luis; Anta, Jose; Naves, Juan; and 5 others

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October 31, 2023 (1.0) | Project deliverable | Open https://doi.org/10.5281/zenodo.10057888

D8.4. Report on hydrodynamic design for stormwater detention ponds optimized for cost-efficient maintenance

Nielsen, Jesper E.; Nielsen, Janni M.; Rasmussen, Michael R.; and 4 others

This document is Deliverable 8.4 of the Co-UDlabs project, funded under the European Union's Horizon 2020 research and innovation programme under grant agreement No 101008626. This deliverable is an output from Tas…

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61 35

December 13, 2023 (v1) | Dataset | Open https://doi.org/10.5281/zenodo.10371731

CoUDlabs_WP8_T811_UDC_002 Application of imaging velocimetry techniques for urban drainage applications

Naves, Juan; Anta, Jose; Carreres, Daniel

This dataset includes the data obtained during the installation of a camera system and development of a LSPIV methodology to determine the velocities of runoff generated in the BLOCK rainfall simulator located at the…

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232 204

December 13, 2023 (v1) | Dataset | Open https://doi.org/10.5281/zenodo.10371665

CoUDlabs_WP8_T831_AaU_001 Application of Large-Scale Particle Image Velocimetry (LSPIV) technique in Aalborg retention pond

Naves, Juan; Nielsen, Jesper E.; Anta, Jose

This dataset includes the data obtained during the installation of a camera system to determine the surface velocities in a retention pond monitored by Aalborg University (AAU). The dataset consists of raw and processed images an…

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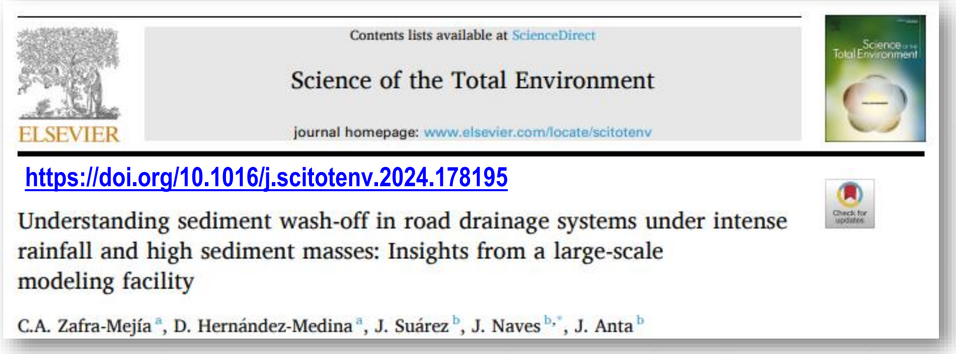


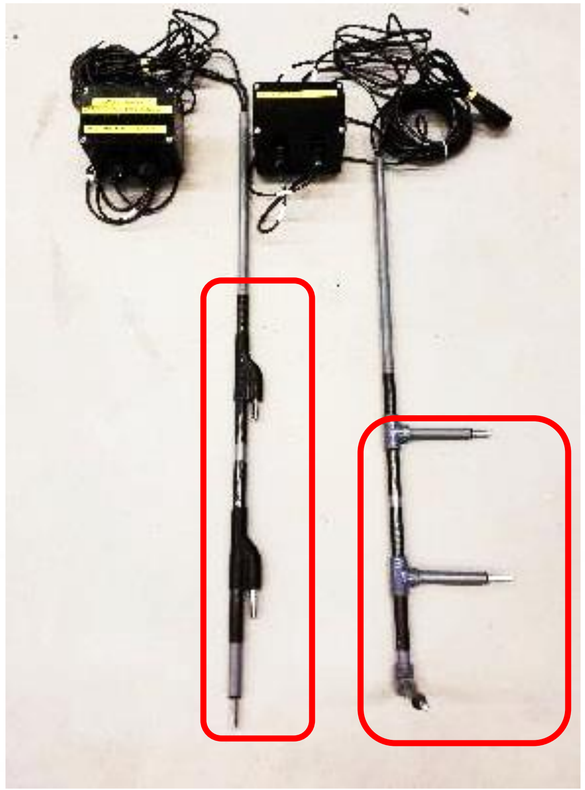
https://doi.org/10.1016/j.scitotenv.2024.178195

Understanding sediment wash-off in road drainage systems under intense rainfall and high sediment masses: Insights from a large-scale modeling facility

C.A. Zafra-Mejía[a], D. Hernández-Medina[a], J. Suárez[b], J. Naves[b,*], J. Anta[b]

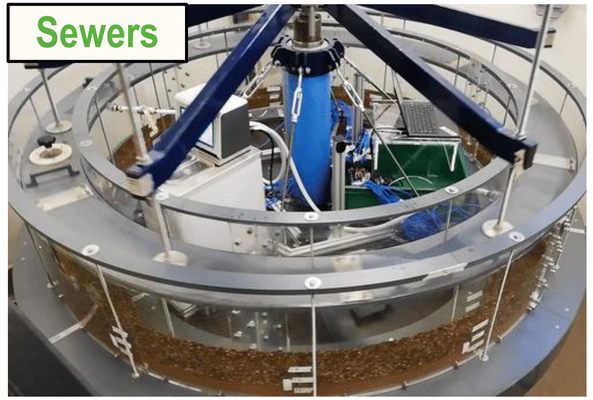
Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

Sediment depths estimations from temperature measurements

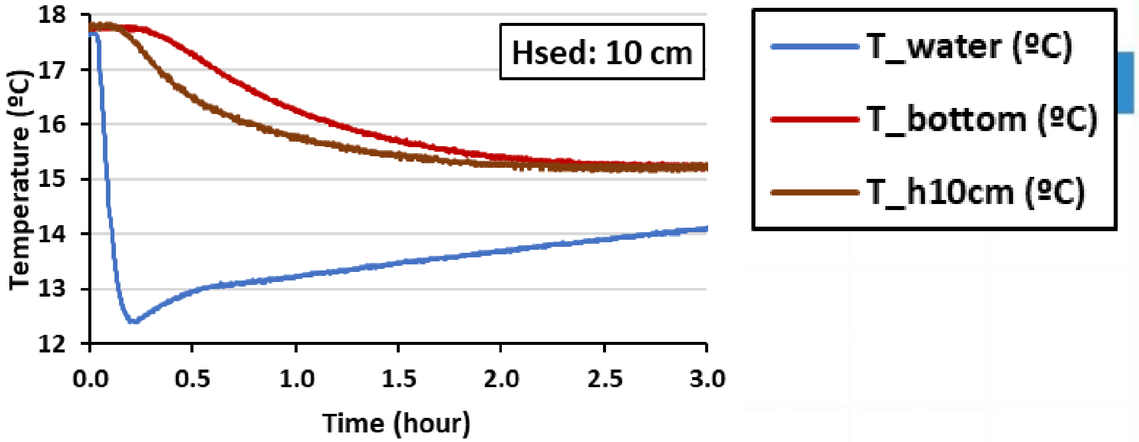


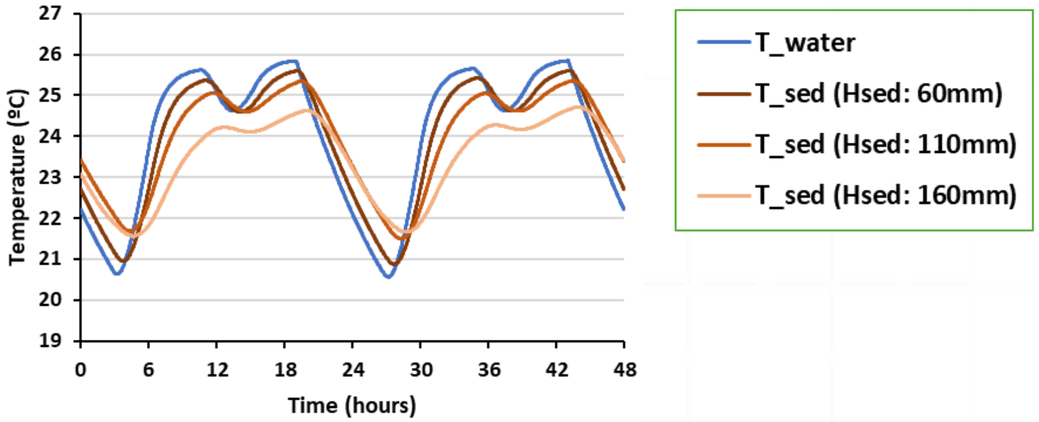
Gully pots

Sewers



Temperature data





Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

Sediment depths estimations from temperature measurements

DOI: 10.1039/D2EW00820C (Paper) *Environ. Sci.: Water Res. Technol.*, 2023, **9**, 3200-3212

Towards urban drainage sediment accumulation monitoring using temperature sensors†

Manuel Regueiro-Picallo *[a,c], **Jose Anta** [a], **Acacia Naves** [b], **Alejandro Figueroa** [c] **and Jörg Rieckermann** [c]

[a] *Universidade da Coruña, Water and Environmental Research Team (GEAMA), Centro de Innovación Tecnolóxica en Edificación e Enxeñaría Civil (CITEEC), 15071 A Coruña, Spain. E-mail: manuel.regueiro1@udc.es*

[b] *Universidade da Coruña, Centro de Investigaciones Científicas Avanzadas (CICA), 15071 A Coruña, Spain*

[c] *Eawag, Swiss Federal Institute of Aquatic Science and Technology, CH-8600 Dübendorf, Switzerland*

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https://doi.org/10.1039/D2EW00820C

DOI: 10.1039/D4EW00389F (Paper) *Environ. Sci.: Water Res. Technol.*, 2024, **10**, 2392-2405

Measuring heat transfer processes in gully pots for real-time estimation of accumulated sediment depths†

Manuel Regueiro-Picallo *[a], **Antonio Moreno-Rodenas** [b] **and Francois Clemens-Meyer** [c,d]

[a] *Water and Environmental Research Team (GEAMA), Centro de Innovación Tecnolóxica en Edificación e Enxeñaría Civil (CITEEC), Universidade da Coruña, 15071 A Coruña, Spain. E-mail: manuel.regueiro1@udc.es*

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[d] *SkillsInMotion B.V., Esdoornlaan 11, 3454 HH De Meern, The Netherlands*

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https://doi.org/10.1039/D4EW00389F

DOI: 10.1039/D3EW00825H (Paper) *Environ. Sci.: Water Res. Technol.*, 2024, **10**, 922-935

Combining a daily temperature pattern analysis and a heat-pulse system to estimate sediment depths in sewer systems†

Manuel Regueiro-Picallo *[a], **Jeroen Langeveld** [b], **Haoyu Wei** [c], **Jean-Luc Bertrand-Krajewski** [d] **and Jörg Rieckermann** [e]

[a] *Universidade da Coruña, Water and Environmental Engineering Group (GEAMA), Centro de Innovación Tecnolóxica en Edificación e Enxeñaría Civil (CITEEC), 15071 A Coruña, Spain. E-mail: manuel.regueiro1@udc.es*

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[d] *University of Lyon, INSA Lyon, DEEP EA 7429, F-69621 Villeurbanne cedex, France*

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D8.2. Report on determined Scalable Measurement Protocols to Assess the Pollutant Retention and Release Potentials of Urban Drainage Structures

Brüggemann, Thomas; Goerke, Marcel; Naismith, Iain; and 9 others

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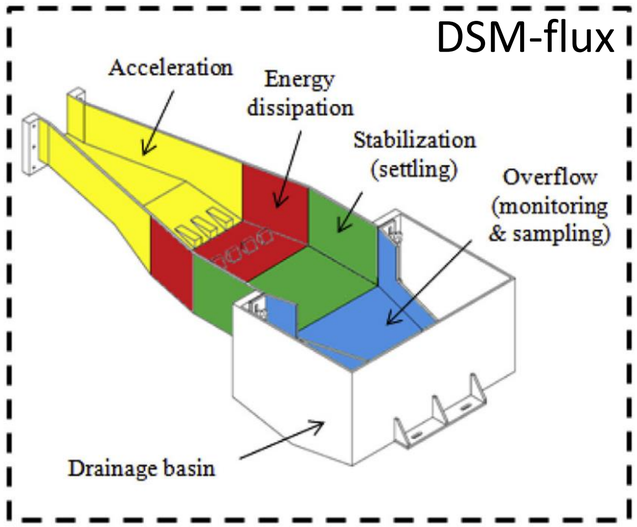
Investigating plastic transport in urban environments

Investigating plastic transport in urban environments

Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

Investigating plastic transport in urban environments



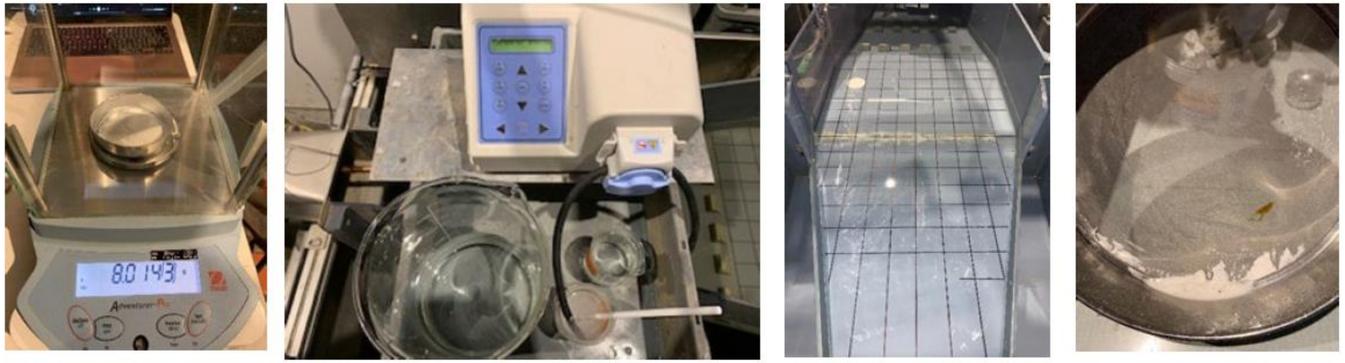


Figure 3. Protocol for the measurement of MPs interception rate in DSM-flux prototype (Kisterman & De Lorgeril, 2023)

Experiments	1	2	3	4	5	6	7
Injected mass (g)	7,049	6,064	8,061	8,013	8,06	8,011	8,013
Escaped mass (g)	5,237	4,788	6,07	6,322	6,321	6,1g	5,964
Trapped rate (%)	25,71%	21,04%	24,70%	21,10%	21,58%	23,85%	25,57%

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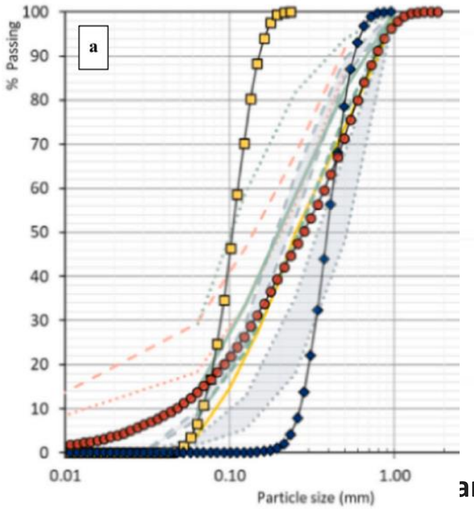
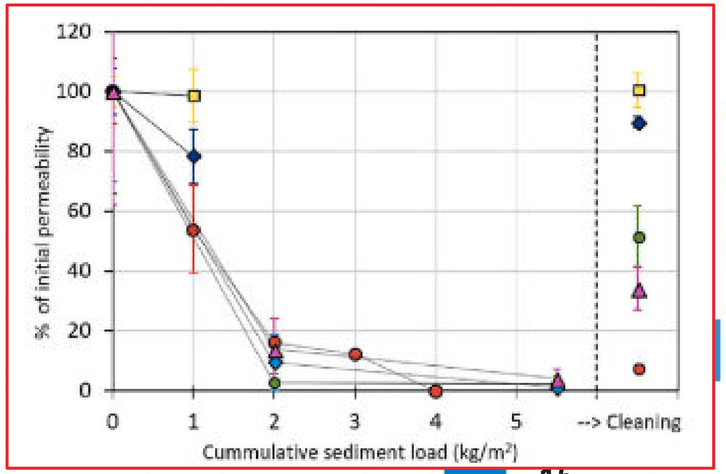
Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

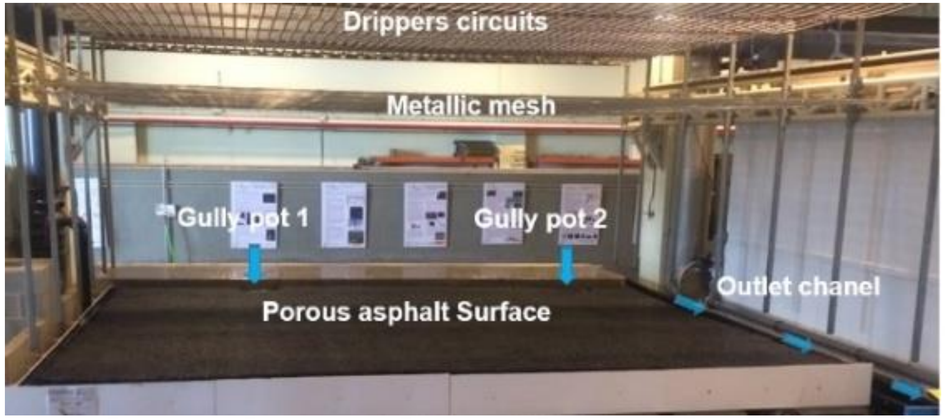
Towards standard methods to assess long-term permeable pavement performance

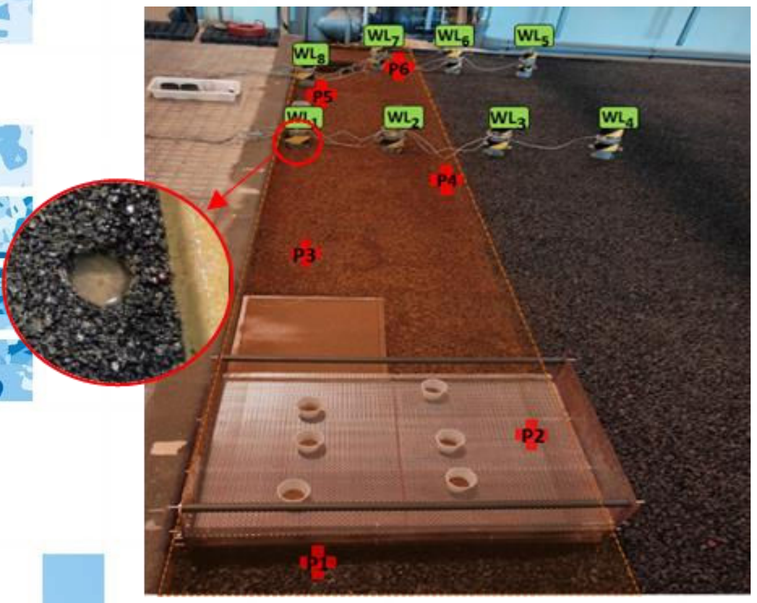


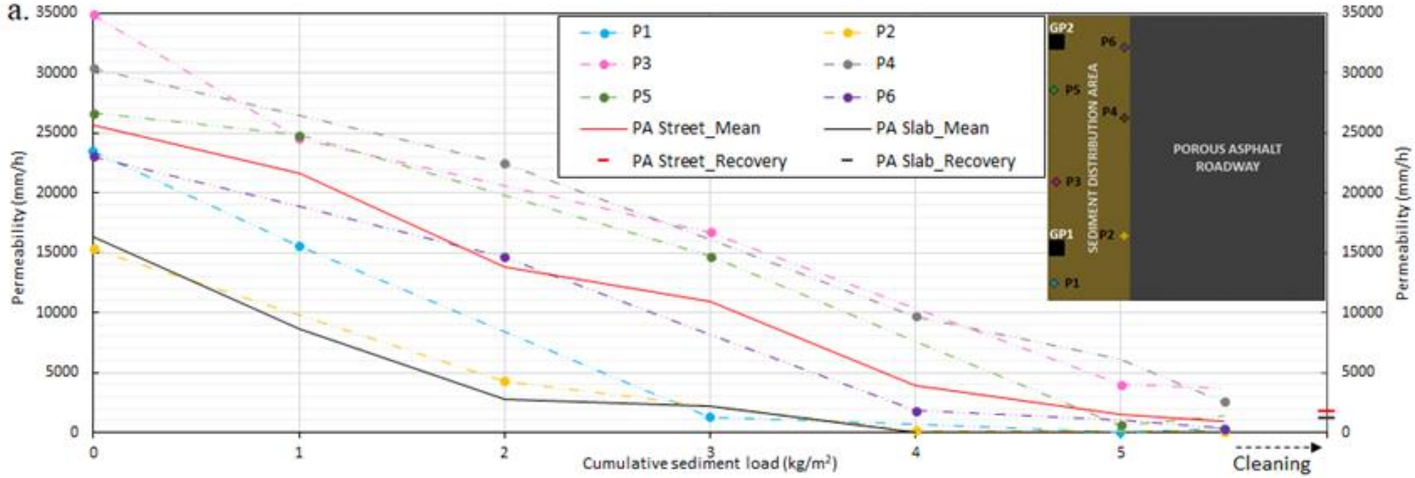


Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

Towards standard methods to assess long-term permeable pavement performance







Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

Towards standard methods to assess long-term permeable pavement performance

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https://doi.org/10.5281/zenodo.10370890

CoUDlabs_WP8_T812_IKT_001 Permeable pavement clogging assessment using sediments with different properties

Goerke, Marcel; Bersuck, Frank; Torunski, Simon; and 3 others

This dataset includes raw and processed data from a series of laboratory tests that were conducted to develop and assess new and existing methods for analysing pavement performance and to gain insights into how these system…

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Journal of Water Process Engineering 53 (2023) 103658

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Journal of Water Process Engineering

journal homepage: www.elsevier.com/locate/jwpe

https://doi.org/10.1016/j.jwpe.2023.103658

Influence of sediment characteristics on long-term hydrology and water quality behaviour during the clogging process of a permeable asphalt

Eduardo García-Haba [a,*], Juan Naves [b], Carmen Hernández-Crespo [a], Angélica Goya-Heredia [b], Joaquín Suárez [b], Jose Anta [b], Ignacio Andrés-Doménech [a]

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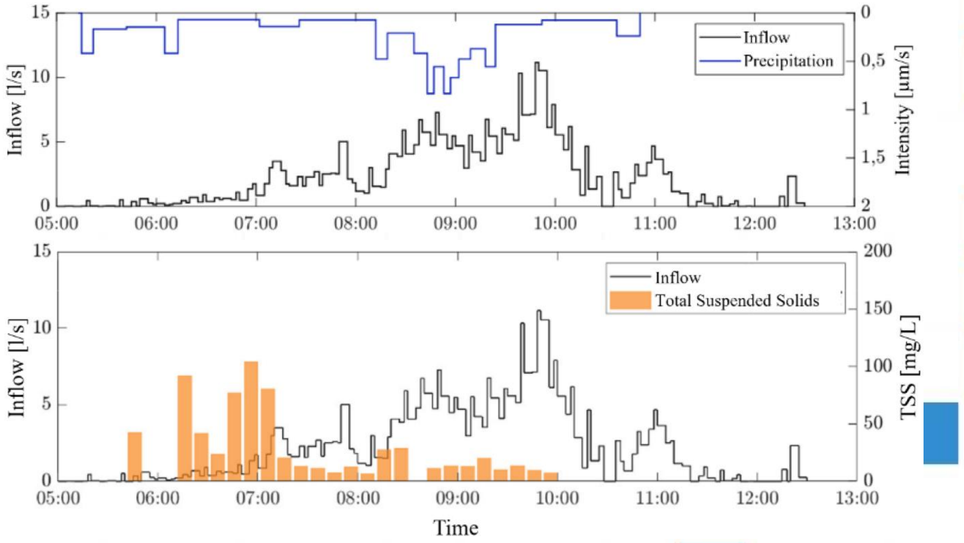
Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

Hydrodynamic design for stormwater detention ponds optimized for a cost-efficient maintenance

Inflow monitoring



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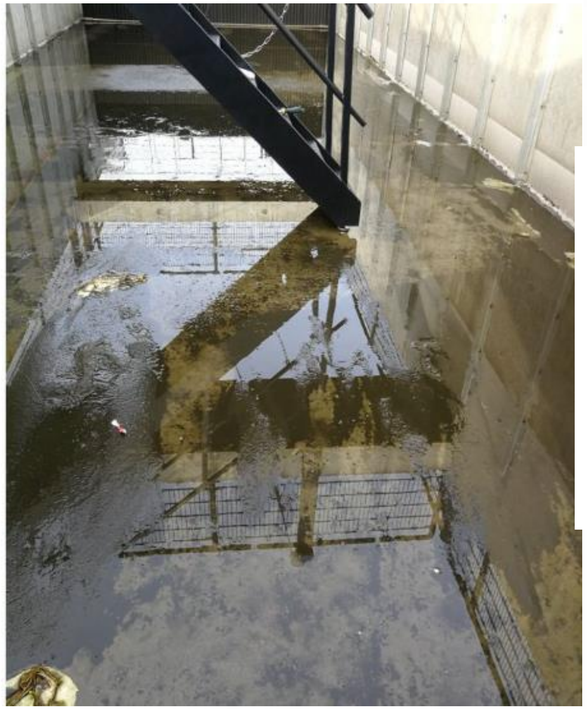
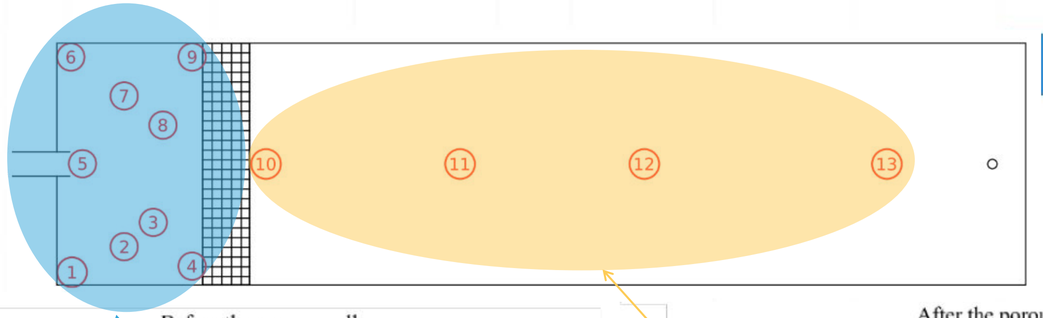
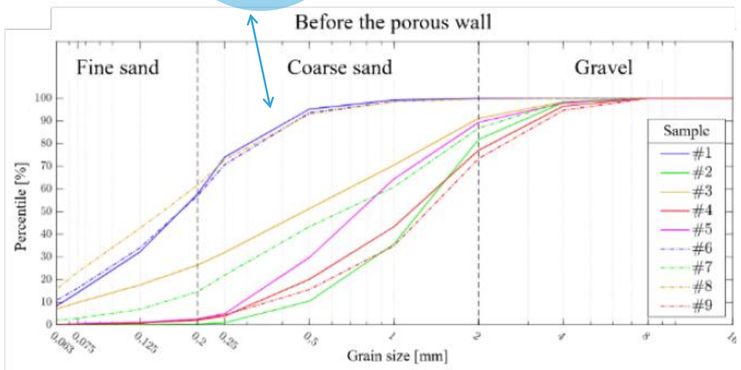
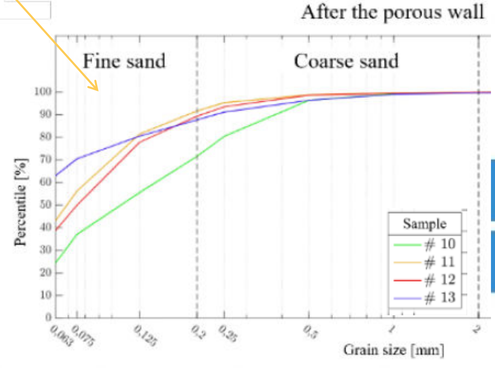
Hydrodynamic design for stormwater detention ponds optimized for cost-efficient maintenance

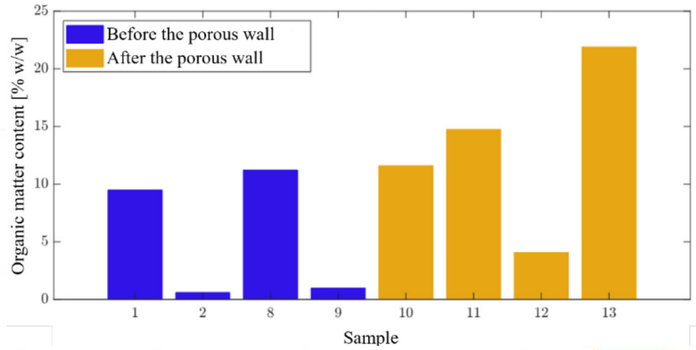
Grain-size distribution and organic matter content of the sediment







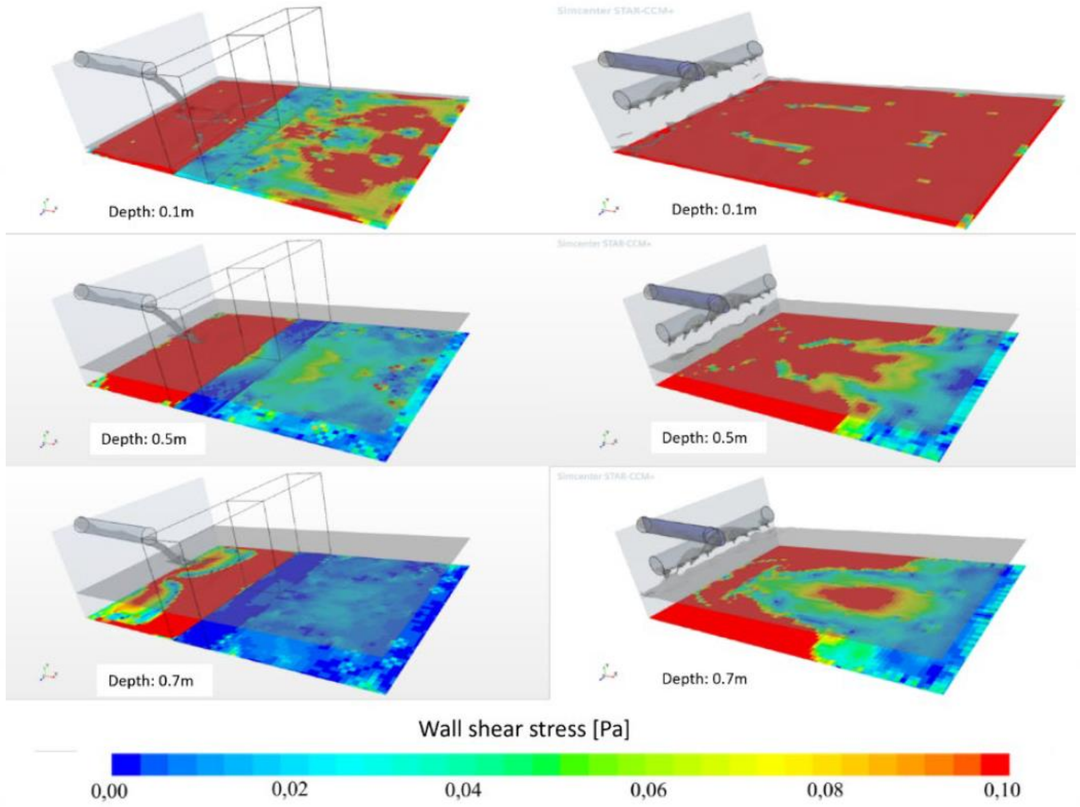


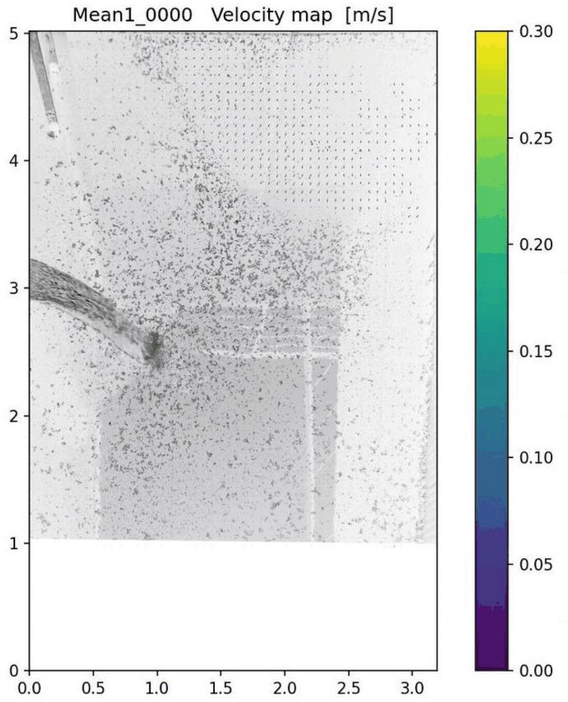


Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

Hydrodynamic design for stormwater detention ponds optimized for cost-efficient maintenance

Design optimization by numerical analysis





Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

October 31, 2023 (1.0) | Project deliverable | Open | https://doi.org/10.5281/zenodo.10057888

D8.4. Report on hydrodynamic design for stormwater detention ponds optimized for cost-efficient maintenance

Nielsen, Jesper E.; Nielsen, Janni M.; Rasmussen, Michael R.; and 4 others

This document is Deliverable 8.4 of the Co-UDlabs project, funded under the European Union's Horizon 2020 research and innovation programme under grant agreement No 101008626. This deliverable is an output from Tas…

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Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

Use of designer soils for Sustainable Urban Drainage systems

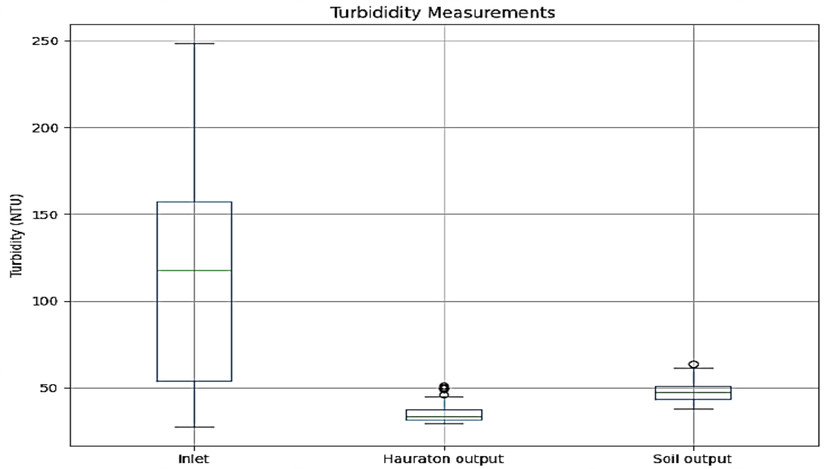
Automated Infiltrometer tests

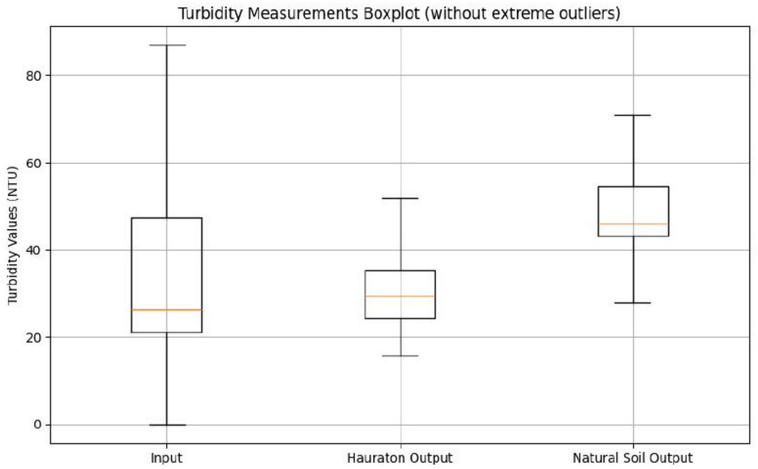
Physical and hydrodynamic characterizations

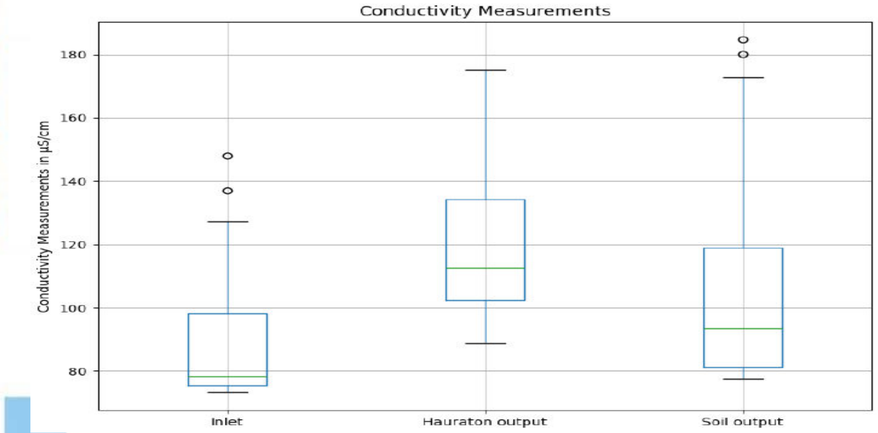
Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

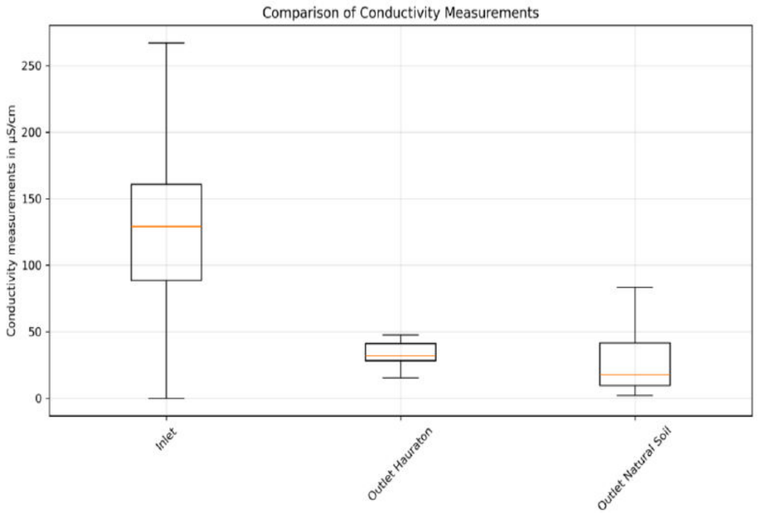
Use of designer soils for Sustainable Urban Drainage systems

Continuous monitoring of flow, conductivity and turbidity (inlet and outlet)





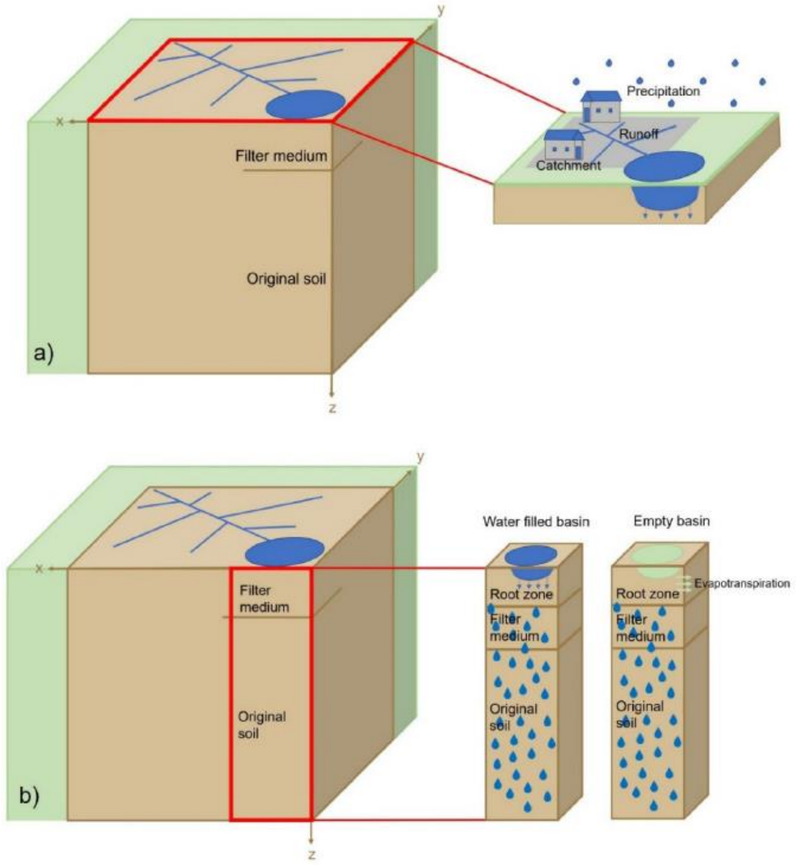




Sampling and chemical analysis: Dissolved organic carbon (DOC)and Heavy metals concentrations at the inlet and outlet od substrates

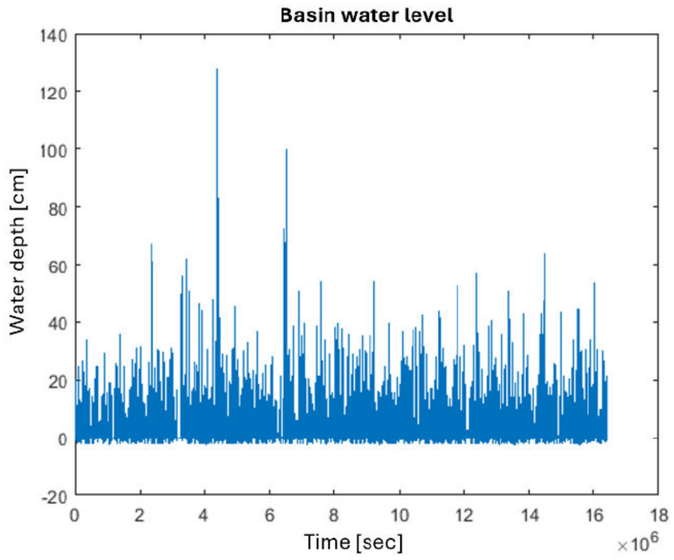
Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

The LAZE (Local-Area-Zero-Emission) model tool for designing technosoils



The main design criteria are:

1. Sufficient water infiltration to avoid flooding above basin level, and
2. Sufficient residence time and retardation of selected environmental impact chemicals



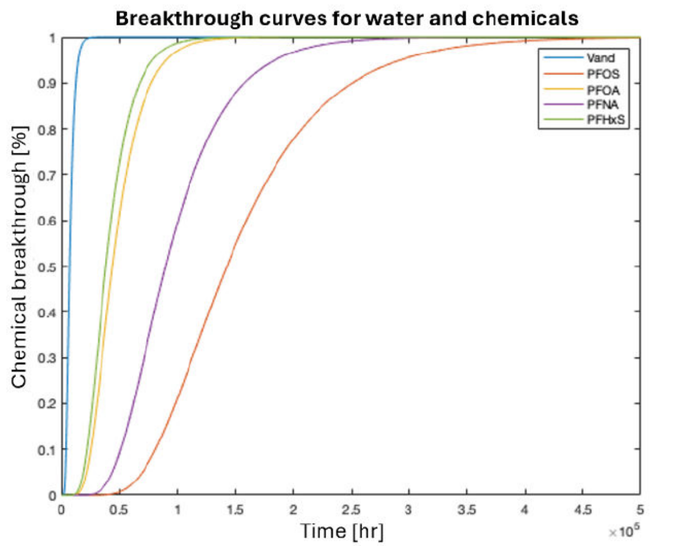


Figure 15. The above (a) and below (b) soil compartments and processes considered in the LAZE filter medium design model.

Innovative technologies and methodologies to analyse the hydrodynamic performance of UD infrastructures

February 28, 2025 (1.0) | Project deliverable | Open

https://doi.org/10.5281/zenodo.14946325

D8.5. Report on use of designer soils for Sustainable Urban Drainage systems

LIPEME KOUYI, Gislain; Nielsen, Jesper E.; Møldrup, Per

This document is a Deliverable of the Co-UDlabs project, funded under the European Union's Horizon 2020 research and innovation programme under grant agreement No 101008626. This report compiles investigations conducted …

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Research papers

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Sets of infiltration models for water infiltration in sustainable urban drainage systems

Asra Asry [a,d], Gislain Lipeme Kouyi [a], Tim D. Fletcher [c], Jeremie Bonneau [a,b], Damien Tedoldi [a], Laurent Lassabatere [d,*]

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[b] INRAE, UR HHLy, Hydrology and Hydraulics, 5 rue de la Doua, 69100 Villeurbanne, France
[c] School of Ecosystem and Forest Sciences, University of Melbourne, 500 Yarra Boulevard, Burnley, Victoria 3121, Australia
[d] Univ Lyon, Université Claude Bernard Lyon 1, CNRS, ENTPE, UMR 5023 LEHNA, F-69518, Vaulx-en-Velin, France

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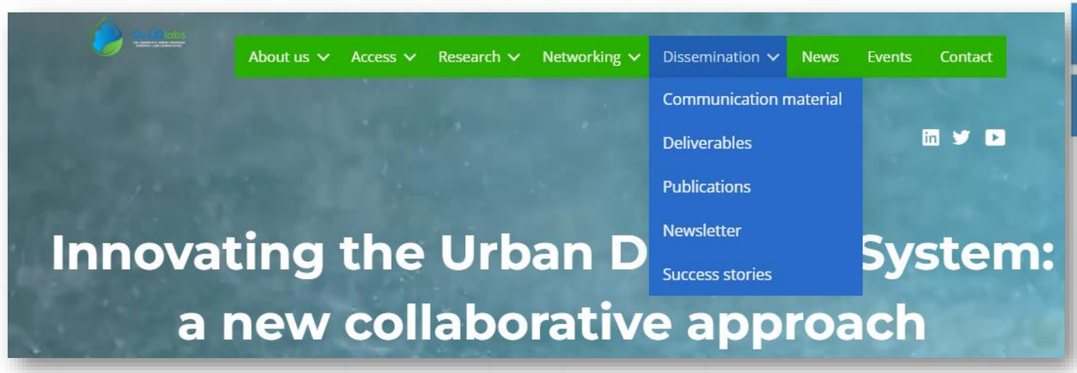

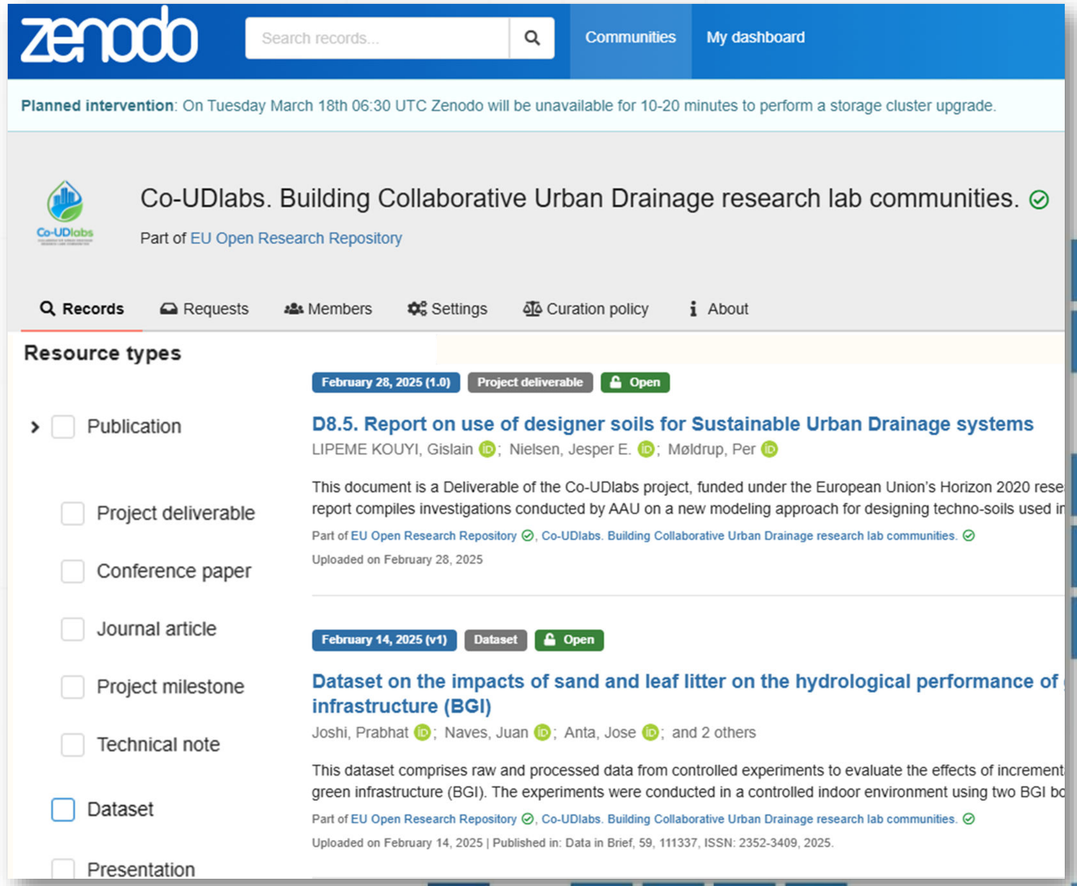

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