Sustainable Water Management Doctoral Programme (Water4All)

Title of the PhD Project	Adaptation of Nature Based Solutions for Stormwater Management in Urban Areas
Acronym	TOXRED-NBS
Research Fields of the Project	Environmental Engineering, Water Sanitation Engineering, Water Resources Engineering, Environmental and Life Science
Keywords	Nature Based Solution, Stormwater Management, Ecotoxicity, Sustainability, Water Resource Conservation
Host Institution, Department and Campus Location	Gebze Technical University, Gebze, Kocaeli, Turkiye
PhD Awarding Institution and Graduate Programme	Gebze Technical University, Gebze, Kocaeli, Turkiye PhD in Environmental Engineering
Name and Affiliation of Main Supervisor	Assist. Prof. Dr. Derya AYRAL ÇINAR
Name and Affiliation of Co-Supervisors	Assist. Prof. Dr. Emel TOPUZ
Research Environment and Infrastructure	GTU Environmental Engineering Department has several laboratories such as Instrumental Analysis, Microalgal Biotechnology, Air Pollution Laboratory, Drinking Water Laboratory, Soil Pollution and Solid Waste Sample Preparation Laboratory, Chemical Oxidation Laboratory, Electrotechnology Application Laboratory and Membrane Technologies Laboratory. https://www.gtu.edu.tr/kategori/368/0/display.aspx?languageId=2

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Scientific Context of the Project	Urban stormwater runoff has been recognized as a severe problem due to its devastating impacts on urban infrastructure, water resources and public life. One of the main reasons is the elevated percentage of impermeable surfaces due to urbanization. This change in landscape disrupts natural water cycle, limits infiltration of runoff into subsurface and increase surface runoff. Furthermore, climate change multiplies these impacts through increasing frequency of heavy rainfalls. In addition to having its volume increased, urban stormwater runoff may include several contaminants ranged from conventional ones like suspended solids, nutrients, organic matter, heavy metals and bacteria to emerging contaminants like pesticides, polycyclic aromatic hydrocarbons, or perfluorooctanesulfonic acids. As a diffuse pollution source, urban runoff is hard to characterize and control, so management of its volume and quality is very important to protect sewer systems and quality of receiving water bodies. Nature based solutions (NBS) are preferred more and more to contribute sustainable options to manage stormwater in urban areas. Generally, contamination level of surface runoff and its environmental impacts are determined by concentration measurement. However, it is common to have a challenge to detect concentration of emerging contaminants. Besides, no regulatory standards exist for most of them. As a result, it becomes critical to evaluate if the level of emerging contaminants poses an environmental risk. Additionally, in stormwater management NBS units, substrate layer is usually known to be responsible for removal of contaminants by several physicochemical processes. Therefore, contaminants are likely to be retained within the substrate layer and detection of the substrate toxicity is as much required as quantification of the effluent toxicity. In this study, performance of a NBS for urban stormwater management will be evaluated in terms of toxicity reduction capacity by the help of whole effluent toxicity which has been emerged as a potential, representative and practical method. Role of different substrate additions and plant presence to provide services like infiltration, filtration, and plant uptake will be investigated. Consequently, sustainability of options by environmental and economical assessment will be determined.
Brief Workplan	Initially, different NBS setups will be constructed in order to observe impact depending on filtration substrate and presence of vegetation. The infrastructure will allow collection of drainage so that concentration of conventional contaminants in the effluent will be measured. Furthermore, whole effluent toxicity will be determined to define risk due to emerging contaminants. At the end of operation, toxicity of soil where contaminants are accumulated will be investigated through soil toxicity assessment. In addition to these environmental impacts, economy of the systems will be quantified and compared to justify the sustainable option.

Innovative Aspects of the Project	It appeared that literature lacks a study assessing the performance of NBS for stormwater management in terms of toxicity reduction combined with sustainability analysis. This study will relate operation parameters and environmental impact of NBS by toxicity assessment. This relation if well-established can help to reduce the work load to measure concentration of emerging contaminants one-by-one. Also, economic evaluation will help make sustainable decision.
Training Opportunities of the Project	The University of Natural Resources and Life Sciences, Vienna, AU University of Naples Federico II, IT Bilgi University, TR
Interdisciplinary Aspects	Architecture, Earth Sciences, Economy, Policy, Hydrology, Life Science
Intersectoral Mobility **☒ Short Visit** **☐ Secondment**	Gebze Municapality, TR
International Academic Secondment	University of Calabria, IT

Main Supervisor	
Brief CV	**Assist. Prof. Dr. Derya AYRAL ÇINAR** **E-mail:** deryacinar@gtu.edu.tr **Academic Degrees** Ph.D. Environmental Engineering, The University of Michigan, USA 2015

	M.Sc. Environmental Engineering, The University of Michigan, USA 2010 B.Sc. Environmental Engineering, Istanbul Technical University, Türkiye 2007 **Professional Networks** Google Scholar: https://scholar.google.com/citations?user=RoyCcVMAAAAJ&hl=tr&oi=ao ResearchGate: https://www.researchgate.net/profile/Derya-Ayral-Cinar Scopus: https://www.scopus.com/authid/detail.uri?authorId=55218032700 ORCID: https://orcid.org/0000-0001-6378-6897
Co-supervisors	
Brief CV	**Assit. Prof. Dr. Emel TOPUZ** **E-mail:** emeltopuz@gtu.edu.tr **Academic Degrees** Ph.D. Environmental Engineering, VU Amsterdam University, Netherlands 2015 Ph.D. Environmental Engineering, Istanbul Technical University, Turkey 2015 M.Sc. Environmental Engineering, Istanbul Technical University, Turkey 2009 B.Sc. Industrial Engineering, Istanbul Technical University, Turkey 2008 B.Sc. Environmental Engineering, Istanbul Technical University, Turkey 2007 **Professional Networks** Google Scholar: https://scholar.google.com/citations?hl=tr&user=h2fX3QoAAAAJ ResearchGate: https://www.researchgate.net/profile/Emel-Topuz Scopus: https://www.scopus.com/authid/detail.uri?authorId=35811536400

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