Suitability pre-assessment for decoupling urban streams to support blue-green climate mitigation measures

F. Prenner[1*], H. Müller[2], P. Stern[3], H.-P. Rauch[2], F. Kretschmer[1]

[1] *Institute of Sanitary Engineering and Water Pollution Control, University of Natural Resources and Life Sciences, Vienna (BOKU), Muthgasse 18, 1190 Vienna, Austria*
[2] *Institute of Soil Bioengineering and Landscape Construction, University of Natural Resources and Life Sciences, Vienna (BOKU), Peter-Jordan-Straße 82/III, 1190 Vienna, Austria*
[3] *Institute of Building Research and Innovation ZT GmbH (IBRI), Wipplingerstraße 23/3, 1010 Vienna, Austria*

**Corresponding author email: flora.prenner@boku.ac.at*

Highlights

- Decoupling of urban streams from sewers for integration in blue-green infrastructure.
- Presentation of pre-assessment method considering urban streams and the built environment.
- Urban heat mitigation using clean stream water, not compromising drinking water resources.

Introduction

On-going climate change poses a big challenge to cities of today, leading to an increase of urban heat islands. To mitigate the urban heat island effect, the focus has turned to blue-green infrastructure (BGI) and the use of evaporative cooling. As these systems are based on the natural water cycle and vegetation growth, irrigation water is a key for a successful implementation. To reduce the pressure on drinking water resources, alternative water resources for irrigation, such as harvested rainwater, have increasingly received attention. However, the use of urban stream water has been neglected until now.

In Austria, a current research project investigates the decoupling of urban streams (e.g., surface stream bed or in-sewer solution) and the lateral roof runoff from the combined sewer systems, specifically looking at the situation in Vienna. As in other cities, urban streams are integrated in the combined sewer network. Thus, clean stream water is diverted to the wastewater treatment plant and, depending on the volume, can pose an additional burden on the treatment plant (Gantner, 2008; Conradin and Buchli, 2004).

In this article, we are presenting a pre-assessment method to assess 1) the decoupling of urban streams and lateral roof runoff, and 2) the built environment. The presented method is a decision support tool to identify the most promising sites to use urban stream water for BGI. Subsequently, the identified sites are suggested for a more detailed planning and implementation of BGI.

Methodology

The presented pre-assessment method for urban streams and the built environment is based on the theory of relevance tree method (Fürst and Scholles, 2008). As an acknowledged practice in environmental and spatial planning, relevance trees help to classify planning options according to selected indicators.

Relevance trees are developed following four steps (Stöglehner, 2019):

1. Selection and ranking of characteristics (the higher, the more important),
2. Assignment of assessment criteria to the characteristics (e.g., threshold values or yes/no questions),
3. Determination of class number (e.g., school grade system 1-5), and
4. Assignment of characteristics to class numbers.

To achieve an overall assessment of the research objective, a preference matrix is used. Here, the results of the relevance trees are combined to receive an overall grade (Fürst and Scholles, 2008).

Results and discussion

Selection of characteristics and assessment criteria (step 1 and 2)
To assess the suitability of decoupling urban streams for the implementation of BGI, two categories are compared: Stream suitability and built environment suitability. For each, two assessment criteria were chosen for evaluation.

Stream suitability is based on
1. Stream flow (3 classes based on discharge and permanency of flow), and
2. Lateral roof runoff area (in a 50 m buffer distance) (2 classes: densely built area with ≥ 2.400 m²/100 m stream or less densely built area with < 2.400 m²/100 m stream).

Built environment suitability is based on
1. Structure of settlement is suburban (yes or no), and
2. Lateral surface space availability (in a 50 m buffer distance) (3 classes: unused open space, large areas, street width).

Classification and pre-assessment procedure (step 3 and 4)
A school grade system was chosen as classes, with 1 being the best and 5 the worst grade. The above-mentioned criteria were assigned to these classes in the relevance trees shown in Figure 1 and 2.

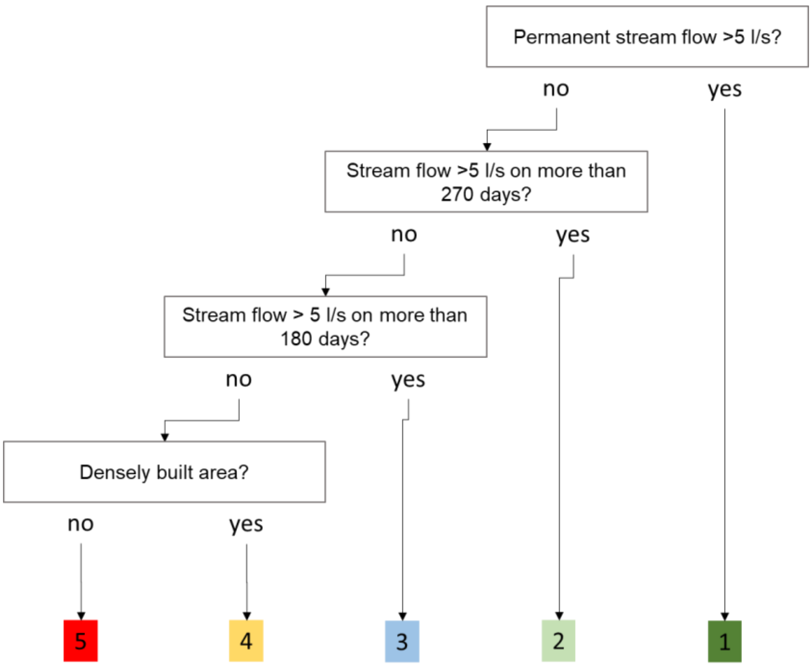

Figure 1. Relevance tree for the pre-assessment of the stream.

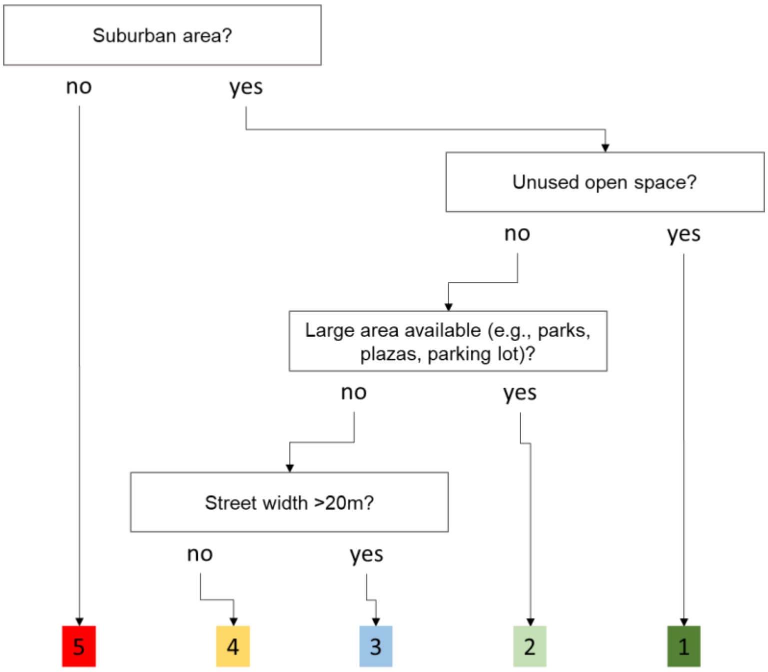

Figure 2. Relevance tree for the pre-assessment of the built environment.

The overall suitability of a stream and the built environment is assessed by entering the results of the relevance trees in the preference matrix (Figure 3).

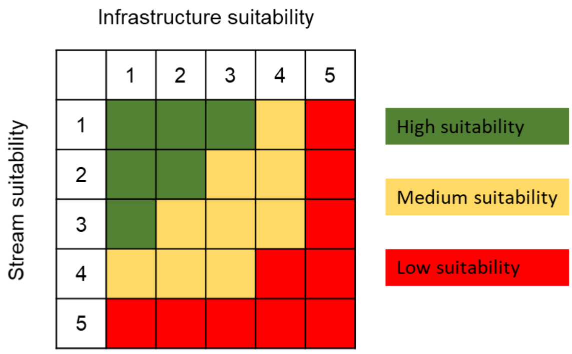

Figure 3. Matrix for the assessment of the overall suitability of a stream and the built environment.

Conclusions and future work

This article presents a pre-assessment method of urban streams and the built environment based on selected characteristics. This approach acts as a decision support method to select the most suitable site to decouple urban streams from the sewer network and integrate the clean stream water into BGI.

As the project ProBACH is on-going, the method is currently tested and refined on a case study, which will be finished by the time of the conference. A detailed description of the final values for the pre-assessment and the practical application will be presented in the conference contribution and the full paper.

References

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