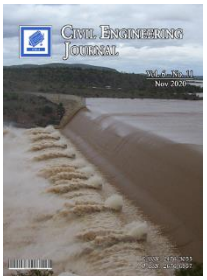
Available online at www.CivileJournal.org

Civil Engineering Journal

Vol. 6, No. 11, November, 2020



An Innovative Holistic Approach to an E-flow Assessment Model

Gorana Ćosić-Flajsig [a*], Ivan Vučković [b], Barbara Karleuša [c]

[a] *Department of Civil Engineering, Zagreb University of Applied Sciences, Av. V. Holjevca 15, 10000 Zagreb, Croatia.*

[b] *Elektroprojekt Water Resources Nature and Environmental Protection Section, Alexandera von Humboldta 4, 10000 Zagreb, Croatia.*

[c] *Faculty of Civil Engineering, University of Rijeka, Radmile Matejčić 3, 51000 Rijeka, Croatia.*

Received 04 August 2020; Accepted 19 October 2020

Abstract

River water resources provide a wide range of necessary ecosystem services, including regulating, provisioning, supporting and cultural services. Ecosystem services are linked to an appropriate level of functionality of river water resource processes, which can be connected with river basin environmental objectives. Environmental objectives can be achieved only if appropriate flow and sediment regimes and related river morphology quality are guaranteed. The obligation to define environmental flow (E-flow) in the European Union Water Framework Directive European (WFD) is not explicit, and the implementation of the WFD is more focused on water quality. Considering the specific climatic, hydrographic and hydrological conditions and the definition of E-flow, each EU country has developed procedures for their investigation and determination. In the Republic of Croatia, no methodology has been elaborated, nor is there any legal regulation to define E-flow downstream of a dam or water intake site. This paper presents the significant pressures that have affected the transboundary rural Sutla River basin between Croatia and Slovenia. These pressures can cause changes in the hydrological regime and biological elements of water quality. The holistic approach defines the E-flow for a profile on the Sutla River by linking hydrological, morphological, and ecological characteristics based on the exploration of the Sutla River and its biological communities. The full implementation of a holistic approach and the transition to Level III of the E-flow definition requires the enhancement of exploratory hydrological and biological monitoring that enables the use of habitat modelling.

Keywords: Environmental Objectives WFD; Good Water Status; E-flow; Measures; Holistic Approach; Sutla River Basin.

1. Introduction

Flow alteration is among the most serious threats to freshwater ecosystems. Natural seasonal increasing and seasonal decreasing water levels shape aquatic and riparian habitats, provide migration and spawning conditions, and enable rivers to function properly [1, 2]. Altering natural flow by damming, diverting or channelling water has serious impacts on biodiversity and ecosystem services [3]. The critical question to answer is how much change in flow is too much and when "change" becomes "degradation" or "unacceptable adverse impact". River water resources provide a wide range of Ecosystem Services (ESs) that can be classified into four main categories: (i) Food services, i.e., products derived from ecosystems; (ii) Regulation services, i.e., processes and functions; (iii) Habitat services; and (iv) Cultural services [4]. ESs are linked to the appropriate level of functionality of river water resource processes, which can be explained by the environmental objectives of a river basin [5]. Environmental objectives can be achieved only if

* Corresponding author: gcflajsig@tvz.hr

http://dx.doi.org/10.28991/cej-2020-03091611