

## Original articles

## Development of a water quality index for rivers in West Java Province, Indonesia

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## ABSTRACT

The West Java Water Quality Index (WJWQI) described in this paper was specifically developed to replace the currently used indices in West Java, Indonesia. The WJWQI addressed the limitations of the currently used indices, namely their inability to make accurate comparison of the general status of water quality between the rivers in West Java, inability to make these comparisons in a cost effective manner, and the lack of credibility and acceptability of the currently used indices by relevant authorities in West Java (since the local conditions and local expert opinion have not been considered in the development of the currently used indices). Addressing these limitations increases the credibility and acceptability of WJWQI to be used by the relevant authorities and the users of WJWQI in West Java. This index was developed using four basic steps, which are selection of parameters, obtaining sub-index values (transformation to a common scale), establishing weights, and aggregation of sub-indices to produce the final index. The methodology for parameter selection used in the development of WJWQI, which considered cost effective monitoring of water quality parameters in West Java rivers and the inclusion of local experts' opinion in establishing the parameter weights will increase the credibility and acceptability of WJWQI among the relevant authorities and the users of WJWQI. The application of WJWQI for the West Java Province was demonstrated using monitoring data taken between 2001 and 2011, to evaluate the general status of water quality spatially and temporally. The results of the application show that most monitoring stations had marginal water quality, indicating that rivers in the West Java Province have been experiencing water quality deterioration significantly. Moreover, an uncertainty and sensitivity analysis was undertaken through Monte Carlo simulation to determine the robustness of WJWQI, which proved to be robust.

## 1. Introduction

Having good water quality is important for a healthy river, as it affects the humans, animals and plants that utilise the water. However, it is difficult to quantify the state of river water quality due to the large choice of possible water quality parameters used to describe it. On the other hand, insufficient funding, particularly in developing countries, is one of the most common constraints towards monitoring all water quality parameters of a river as it is laborious and expensive. Thus, Water Quality Indices (WQIs) have been used in the past as one of the most commonly used approaches to evaluate water quality of a water body (Soliman and Ward, 1994; Abbasi and Abbasi, 2012). A WQI is a single dimensionless number expressing the status of water quality of a water body (e.g. river) and is obtained by aggregating the measurement values of the selected water quality parameters.

WQIs have been proposed as early as in 1965, to define the state of river water quality (Horton, 1965). Since then, this approach has been one of the most effective ways to communicate information on water quality (Walsh and Wheeler, 2012). Even though the WQI cannot evaluate the quality of water for all types of uses and all hazards, and nor can it provide complete information on water quality (Cude et al., 1997), it can be a useful tool with the following benefits:

- It is able to express the general state of water quality spatially and temporally; therefore, it can be used to assess water quality improvement programs (Cude et al., 1997).
- It can be used to compare water quality of different water sources and sites, without undertaking highly technical assessment of water quality data. Thus, this approach can be used for reporting the general status of water quality to policy makers and the public in a

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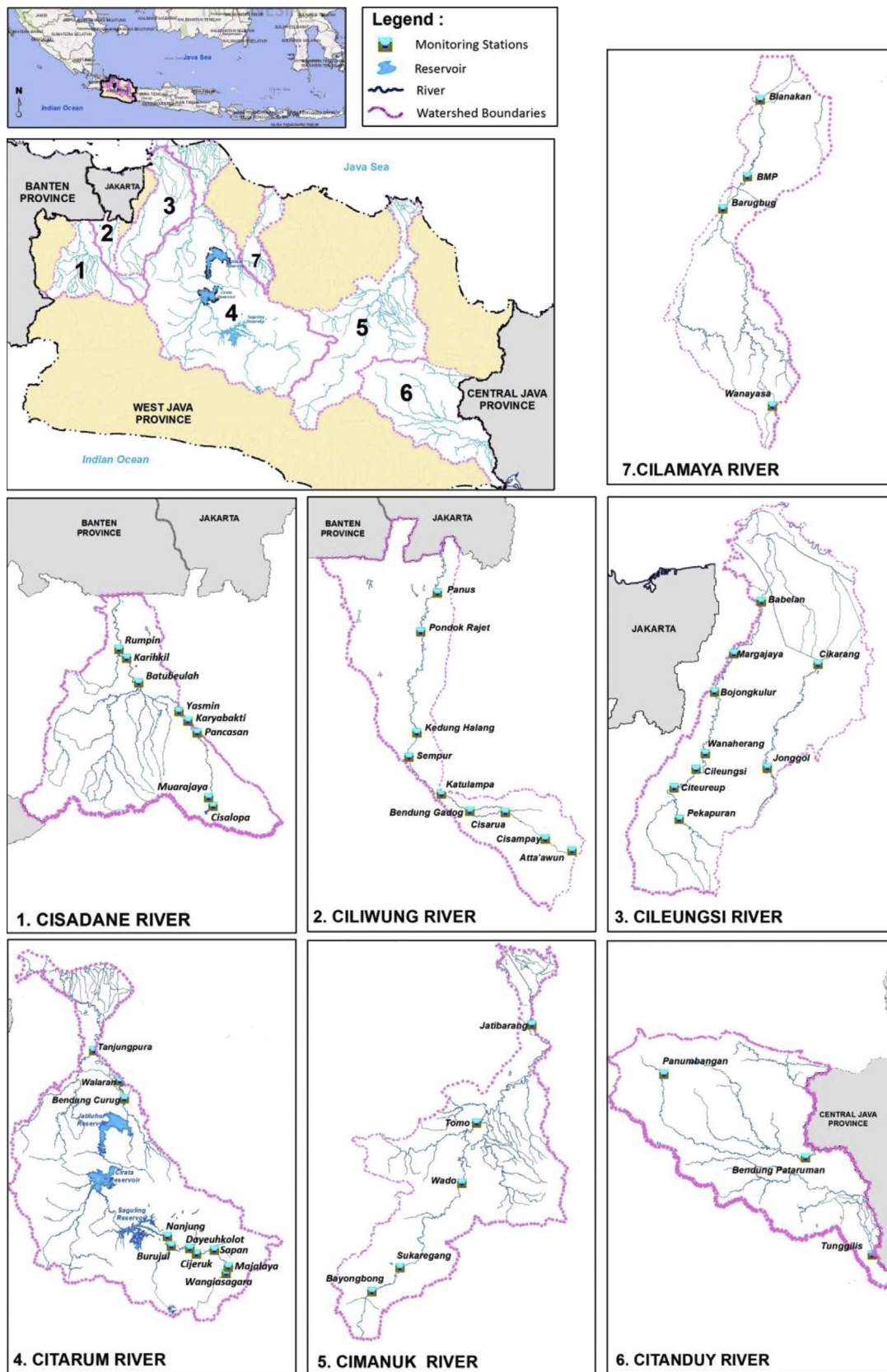


Fig. 1. Water quality network of West Java Province used for application of WJWQI.

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