

Abstract

The study deals with water quality indices (WQI), based on physical and chemical parameters, as valuable indicators for water management of agricultural drainage. It took place in the Lower Tap Salao irrigation project in Uthai Thani province, Central Thailand. A random sampling of 45 stations was realized to cover the different streams and canals in the study area. Firstly, based on a Delphi method, a questionnaire answered by a panel of 65 experts allowed to sort out the most important parameters in describing water quality and to define the score that should be attributed to their different values. Secondly, water samples were taken between the 19th and 22nd of January 2007 and analyzed the following days to determine the WQI.

The questionnaire showed that thirteen parameters should be included in the WQI: pH, total organochlorine chlorines (TOrCl), phosphate (PO_4^{3-}), nitrate (NO_3^-), biological oxygen demand (BOD), dissolved oxygen (DO), ammonia (NH_3), conductivity (EC), suspended solids (SS), fecal coliform bacteria (FCB), total coliform bacteria (TCB), total solids (TS) and turbidity (Tur), giving the equation: $\text{WQI (Agr}_{13}) = 0.102 (\text{pH}) + 0.100 (\text{TOrCl}) + 0.088 (\text{PO}_4^{3-}) + 0.088 (\text{NO}_3^-) + 0.083 (\text{BOD}) + 0.082 (\text{DO}) + 0.082 (\text{NH}_3) + 0.068 (\text{EC}) + 0.064 (\text{SS}) + 0.063 (\text{FCB}) + 0.061 (\text{TCB}) + 0.060 (\text{TS}) + 0.059 (\text{Tur})$. Ten parameters were used for measuring water quality: pH, PO_4^{3-} , NO_3^- , BOD, DO, NH_3 , EC, TS, SS and Tur. The average of the scores given by experts was considered as the weight for each of these parameters and allowed the calculation of the WQI defined as their weighted sum. Also, for each parameter an equation was found to model the score according to their values and significantly fit the answers of experts. These equations provided the corresponding score for each water measurement and allowed to calculate the WQI. The equation of ten parameters is: $\text{WQI (Agr}_{10}) = 0.132 (\text{pH}) + 0.113 (\text{PO}_4^{3-}) + 0.113 (\text{NO}_3^-) + 0.107 (\text{BOD}) + 0.106 (\text{DO}) + 0.106 (\text{NH}_3) + 0.087 (\text{EC}) + 0.082 (\text{SS}) + 0.078 (\text{TS}) + 0.076 (\text{Tur})$. $\text{WQI (Agr}_{10})$ gave a score of 66.53. A final attempt in simplifying the calculation showed that three parameters with a low dispersion (NO_3^- , PO_4^{3-} and TS) were not necessary for the WQI assessment. A chi-square test showed no significant

difference ($p < 0.05$) between the ten parameters-WQI and the seven parameters-WQI. The equation of seven parameters is $WQI (Agr_7) = 0.190 (pH) + 0.152 (BOD) + 0.152 (DO) + 0.152 (NH_3) + 0.125 (EC) + 0.118 (SS) + 0.109 (Tur)$. A final WQI (Agr_7) score of 61.91 was found to describe the study area, indicating that water was suitable for agricultural use. These concentrations were classified as the 3rd category of national surface water quality standard.