

Evaluation Of Water Quality Status Of Kadalundi River Basin Using Geospatial Technology

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Abstract

Water quality refers to the physical, chemical, biological and radiological characteristics of water, which can help to decide the suitability of a particular water sources for any desired use. Each category is measured by various parameters/variables and the level of which varies depending on the origin of the water body, its location/geology, the climate, other environmental factors and anthropogenic influences. In general, water quality testing is focused for assessing the suitability of the particular water sources for human consumption (drinking and other domestic uses), irrigation purposes and industrial uses. The present study was focused on water quality assessment of Kadalundi river basin a medium river basin in Kerala. Canadian Water Quality Index and Geospatial Technology were used to assess the water quality and its spatial distribution in the study area in pre monsoon and post monsoon period. The study highlights the places of poor quality, moderate and good quality of water based on the selected samples. A spatial study of the observed samples indicates that in the lowland area in Kadalundi river basin the condition of water quality is not suitable for drinking and domestic purpose. The field survey justifies the reasons supporting the result of water quality index in the selected observed areas. The study can be further used for hydrology and river basin management and planning purpose related to Kadalundi river basin.

Keywords: Water Quality, Kadalundi River Basin, Geospatial Technology, Water Quality Index

1. INTRODUCTION

The quality of water sources in the present scenario are getting altered or impaired due to natural as well as by human interferences leading to pollution of water bodies (Bindu 2019). Common pollution sources are domestic/community sewage, agricultural runoff and industrial effluents. Pollutants may be of many kinds that include microorganisms such as viruses, protozoa and bacteria; inorganic contaminants such as salts and metals; organic chemical contaminants like oil/petroleum products from industrial operations; pesticides and herbicides from agricultural outfalls etc. Both surface and ground water sources are affected by

pollution problems leading to quality impairment. As these are the main source of water for human and other living organisms, any kind of changes in quality can degrade the water as toxic and unusable, causes several health problems and risk to an ecosystem. Hence, as a part of the study on the hydrological status of Kadalundi river basin, water quality status was assessed for both surface water and ground water resources in Kadalundi river basin.

2. STUDY AREA

Kadalundi river originating from Western Ghats is one among the four major rain fed rivers flowing through Malappuram district of Kerala in

India. The major tributaries of Kadalundi are: Olipuzha and Veliyar. The Veliyar tributary originates from the forests of Eratakombanmala and the Olipuzha takes its origin from the Cherakkombhanmala. The river originates in Palakkad and flow through Malappuram having total length of 130 km, with a drainage area of 1122 sq. km. The Fig 1 shows the Digital Elevation Model of Kadalundi river basin. Topographically this basin exhibit undulating terrain with steep slope. The ground elevation ranges from 0 MSL to 1200 MSL. Based on the physiographic condition, the study area falls into three well defined natural divisions – lowland,

midland and highland. The drainage pattern is complex with considerable variation in the spatial arrangements, controlled by topography, slope, rock type and structural deformations. Climatically the river basin experience normal tropical climatic condition with major influence of south west monsoon season. The average annual rainfall of Kadalundi river basin is 3610 mm, of which 60 percent is received during the south west monsoon (June – September) and 30 percent during the north east monsoon and the remaining 10 percent during the summer season. The average annual surface water potential of the basin is estimated as 1829 Mm³.

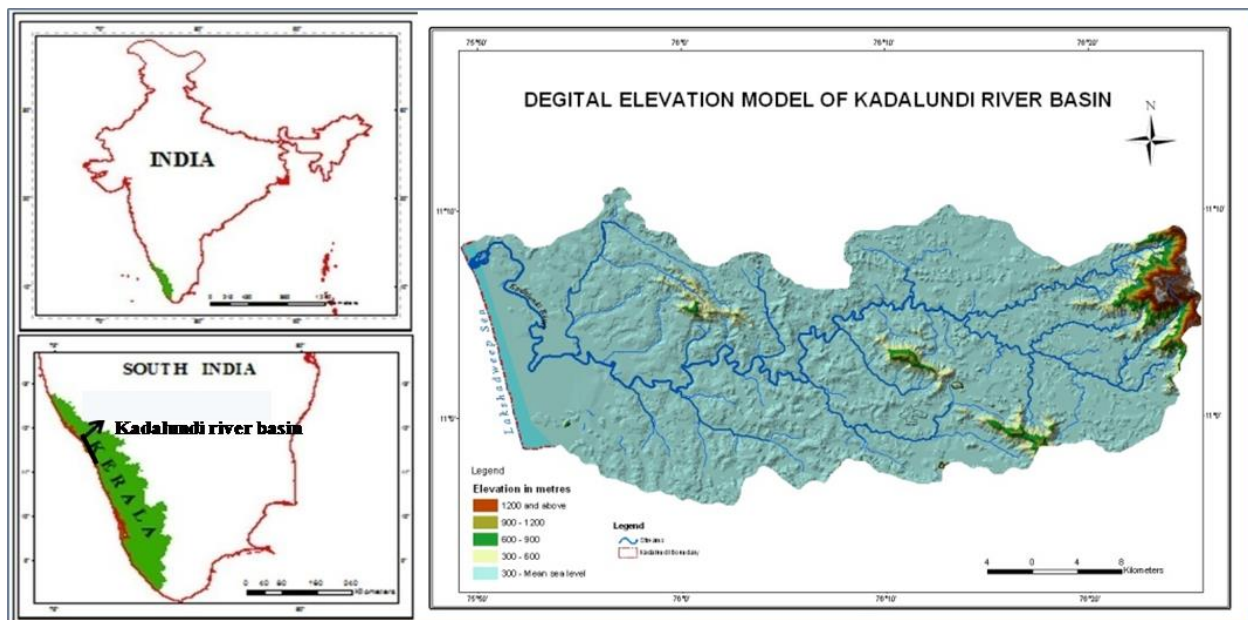


Fig 1: Location map of Kadalundi river basin.

The geological, soil and landuse cover in the river basin indicate a well fertile land. Charnockite is covered by alluvial formation in the coastal belt and laterite in the midland and highland regions. The different types of soil that occurs in the basin are coastal alluvium, riverine alluvium, laterite, brown hydromorphic soil and forest loam. The various types of landuse which are seen in this river basin are water bodies, river and streams, wasteland, plantations, arable land and forestland (Yasodharan and Bindu 2015; Bindu & Jayapal 2016; 2017; 2019). The river basin has less influence of urbanization. The main economic activity is agriculture. There are no major irrigation schemes in the river basin. Agricultural

activities are mainly dependent on rainfall or dug wells. With different agro climatic conditions experienced in different physiographic zones, a large variety of crops such as paddy, coconut, tapioca, arecanut, pepper, rubber, cashew nut etc are grown in this basin. The industrial activities are very limited only small scale industries especially coir making factories are found in this basin. Hence there is no artificial man made influence in this basin.

3. MATERIALS AND METHODS

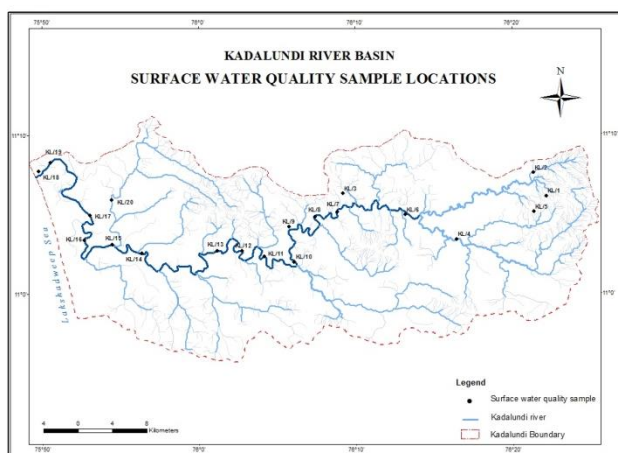
Secondary data on water quality pertaining to 20 surface water samples and 39 ground water samples were gathered from Centre for Water Resource Development and Management, based on which the spatial and temporal variations of

surface and ground water quality of Kadalundi river basin were analyzed for the year 2015. The data was analyzed based on their physico-chemical and biological characteristics. The level of some important parameters were compared and evaluated based on the Indian Standard-Drinking Water Specification (IS 10500: 1991) and CPCB classifications. The results and observations of the water quality data analyses are discussed in the following sections.

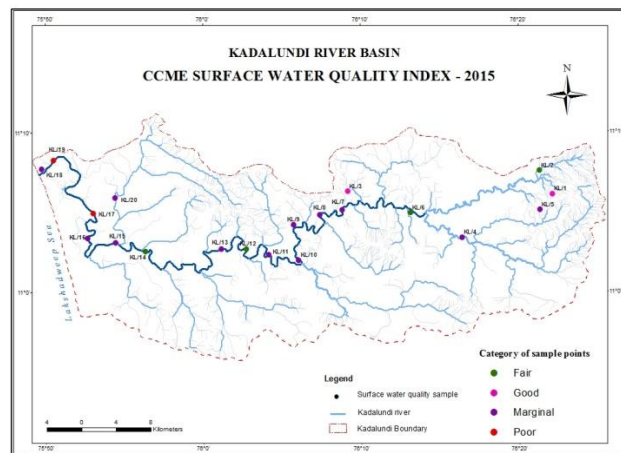
4. RESULT AND DISCUSSION

Fig. 2(A) represents the 20 surface water sample locations in Kadalundi river basin. The surface water samples are located along the river and based on which both spatial and temporal study was done for the year 2015. The quality parameters considered for the present study are Temperature, Colour (Hazen), Turbidity (NTU),

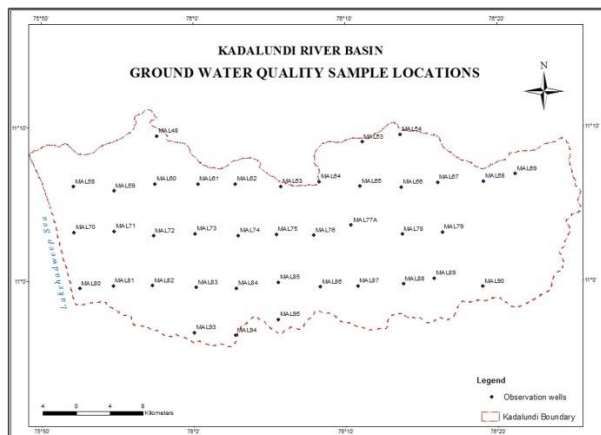
pH, EC (Micro Siemens/cm), Total Alkalinity (mg/l), Total Dissolved Solids-TDS(mg/l), Calcium (mg/l), Magnesium (mg/l), Sodium (mg/l), Potassium (mg/l), Iron (mg/l), Chloride(mg/l), Nitrate (mg/l), Sulphate (mg/l) and phosphate-P (mg/l) (Environment Protection Agency 2001). Table 1 shows the minimum and maximum values recorded for different parameters during the year 2015. While analyzing the physico-chemical parameters of surface water, variations are recorded during pre monsoon and post monsoon seasons and changes were noted in values recorded in one season to another. Fig. 3 represents the Canadian Council of Ministers of Environment (CCME) Water Quality Index (WQI) based classification of surface water samples in Kadalundi river basin. The objective of the WQI is to turn complex water quality data into information that is understandable and useful to common public.



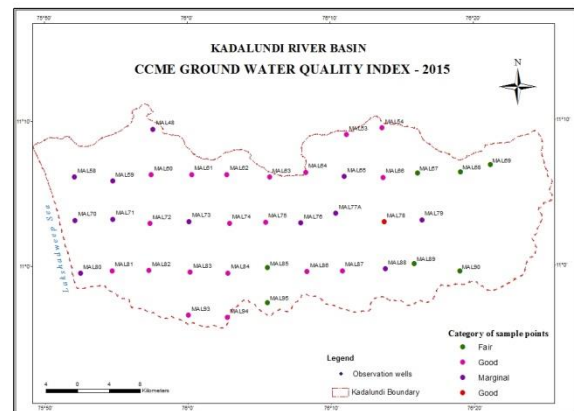
(A)



(B)



(C)



(D)

Fig 2: Water quality status and its spatial distribution using Geospatial Technology

The CCME water quality index is broadly classified into 5 categories as excellent (95 – 100 %) which represents conditions very close to the natural level, Good (80 – 94 %) which shows minor degree of threat or impairment, Fair (65 – 79 %) which shows conditions of occasionally threatened or impaired, marginal (45 – 64 %) which are frequently threatened or impaired and

poor (0 to 44 percent) which are almost threatened and impaired. In Kadalundi river basin all the surface samples belonged to categories ranging from good to marginal. Among the 20 samples only 2 samples are categorized as good, 4 samples as fair, 12 samples as marginal and 2 samples are categorized as poor. Excellent condition is not predicted in any of the site which indicates that naturality of the water content is changing due to either man made or natural causes Fig 2(B).

Table 1: Maximum and minimum values surface quality parameters – 2015

Parameters	Pre Monsoon 2015		Post Monsoon 2015	
	Max	Min	Max	Min
pH	8.2	6.4	7.9	5.8
Colour (Hazen)	64	1.2	21.8	1.6
Turbidity (NTU)	39	1.7	12	1.3
Total Alkalinity	194.0	6.5	197.0	7.0
TDS, (mg/l)	5572.0	45.5	3114.5	39.5
Total Hardness (mg/l)	1124.0	10.0	298.2	9.4
Calcium Hardness (mg/l)	411.0	2.9	275.1	8.5
Calcium (mg/l)	182.7	1.5	59.6	2.0
Magnesium (mg/l)	158.4	5.4	48.9	1.8
Sodium (mg/l)	1748	9.0	329	1.2
Potassium (mg/l)	45.0	0.41	27.5	1.0
Iron (mg/l)	ND	ND	ND	ND
Chloride (mg/l)	812.0	20.7	658.5	12.5
Nitrate (mg/l)	2.9	0.7	2.4	ND

Sulphate (mg/l)	35.5	1.3	31.8	1.0
Phosphate-P (mg/l)	1.4	ND	0.1	ND

Fig 2(C) represents the 39 ground water sample locations in Kadalundi river basin and the ground water samples are distributed all over the Kadalundi river basin and based on which both spatial and temporal study was done for the year 2015. Table 2 shows the minimum and maximum values recorded for different constituents representing ground water quality in the river basin for pre-monsoon and post-monsoons seasons during the year 2015. In general, the ground water quality in Kadalundi river basin was found to be good for drinking and domestic purposes as recommended Bureau of Indian standards. In the coastal region, especially

nearest to the coast, the ionic concentrations in a few wells were marginally higher due to sea water intrusion affecting the portability, which is not being used for drinking (Fig 2 (D))). In the case of biological quality with reference to microbial contamination in the groundwater sources, earlier studies indicated that over 80% of the wells are contaminated with certain level coliform bacteria including the presence of E. coli. This is mainly due to poor maintenance of wells and their environment. Disinfection using UV/Ozone and boiling the water before drinking are practiced to tide over the bacterial contamination.

Table 2 Maximum and minimum values of ground water quality parameters– 2015

Parameters	Pre Monsoon 2015		Post Monsoon 2015	
	Max	Min	Max	Min
pH	7.9	6.3	8.0	6.4
TDS, (mg/l)	556.0	26.0	368.0	22.0
Total Alkalinity, mg/l as CaCO ₃	178.0	9.8	185.0	11.0
Bicarbonate	218.0	12.0	226.0	13.0
Total Hardness (mg/l)	142.0	22.0	102.0	14.2
Calcium Hardness (mg/l)	94.0	16.0	60.0	8.0
Magnesium Hardness (mg/l)	48.0	6.0	42.6	6.2
Chloride (mg/l)	96.0	8.0	82.0	6.0
Sulphate (mg/l)	28.0	2.2	16.2	1.9
Nitrate (mg/l)	10.5	05	9.8	1.8
Sodium (mg/l)	78.0	4.0	52.0	2.2
Potassium (mg/l)	8.0	1.0	10.0	1.0
Calcium (mg/l)	37.6	3.0	24.0	3.2
Magnesium (mg/l)	11.7	1.5	10.4	1.5
Iron (mg/l)	0.8	ND	1.0	ND

5. CONCLUSSION

The water quality analysis of both surface and ground water samples indicated that in general the water quality is of moderate level throughout the

Kadalundi river basin. The hydrological inferences derived from this study highlighted both positive and negative aspects of hydrological characteristics of Kadalundi river basins and this may change time to time. There are several natural and manmade factors which influence the hydrological characteristics and among these factors, the man made factors are more dominating than natural factors.

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