Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 05, May-2016

Review Paper on Development of Water Quality Index

[1]Sneha S. Phadatare
Student
Final M.E. (Environmental),
Dept. of Civil Engineering
ABMSP's Anantrao Pawar College of Engineering& Research, Parvati, Pune
India.

[2]Prof. Sagar Gawande (Guide)
Professor
Dept. of Civil Engineering
ABMSP's Anantrao Pawar College of Engineering & Research, Parvati, Pune
India.

***Abstract*— Water is one of the precious natural resources present on the earth and it is very important for survival of flora and fauna. Quality of water is equally important to the quantity available. While considering of total percentage of water present on earth as 97% in ocean and 3% as a fresh water with considering glacier. Out of which 2 % as fresh water in the form of surface and subsurface water bodies and it usable for the human consumption. So when we consume water its quality measurements are necessary and management should be done in systematic path. Water quality is directly related to the physical, chemical, biological and radiological property of water [1]. These properties of water are affected because of the pollution of water due to various human activities. Depend on the activities; disposal of pollutant in the water bodies are done that changes the standard quantity of parameters in water. There are various parameters which can be assess for measurement of quality of water but when consideration of all parameters may be generates complexity towards quality. So, development of Water Quality Index (WQI) is the quite popular method in water quality assessment. This can be told whole story of water in single scoring number and it is calculated using different methods. It is helpful to decide appropriate treatment technique to meet the concern issue. In this paper, WQI and its development methods are discussed. Also advantages and dis advantages of WQI are elaborated.**

Keywords – Human activities, water parameters, Water Quality Index (WQI).

I. INTRODUCTION

Water is one of the earth's most important resources that use for human life and it's quality is totally depend on geological environment, recovery, utilization as per need and human activities like domestic, industrial or commercial, mining operations, agricultural etc.[1] In short freshwater directly linked with human welfare as it is vital concern for mankind. But today most of the surface and subsurface water bodies are unfortunately under the environmental stress. Stress are due to increase in population, urbanization and to fulfill their food demand advance agrochemicals are used. So there is a high risk of contamination of water by percolation, surface runoff. Human health is threatened by most of the agricultural development activities particularly in relation to the excessive application of the fertilizer and unsanitary conditions. According to WHO organization, about 80% of all the diseases in human being are caused by water. Once the water is contaminated, its quality can't be restored by stopping the pollutant from source. It therefore becomes imperative to regularly monitor quality of water and to device ways and means to protect it. There is certain way to find out quality of water in the form of index on the basis of following categories:

- Human well-being – includes health and population
- Ecosystem well-being – includes assessment of air and water quality

II. ENVIRONMENTAL WATER QUALITY INDEX

An "environmental water quality index" in its descriptive categorization of large quantity of environmental data. It is with primary purpose that can be useful to decision makers. This indices are used in impact studies. That all inclueds air quality index, water quality index, ecological sensitivity and divercity, noice index, visual quality and quality of life. Amonge those different Water quality Index that analyse mathamatically two main explain in deatil.

A. Ojectives

- To summarize existing environmental data.
- To communicate information on the quality of baseline environment
- To evaluate sustainability of environmental category to pollution.
- To focus attention on key environmental factors.

B. National Sanitation Foundation Water Quality Index

The "Water quality Index" (WQI), developed in 1970 by the U.S. National Sanitation Foundation will be described. The WQI was based on the Delphi approach, using a panel of 142 persons from all U.S. with expertise different aspects of water quality management. From which 101 are regulatory officers, 5 are managers local public utilities, 6 are consulting engineers, 26 Academicians and 4 from Others i.e. industrial waste control engineers and representative of professional organizations. The following steps are followed by organization to finalized water quality parameters and water quality index:

i. Total three Questionnaires were given to members in panel.
ii. In first questionnaire they are ask for water pollutant variables that listed in Table no. 1 they were ask to designate each variable as "include", "undecided" or "do not include" that totally depends on significance to overall water quality.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 05, May-2016

iii. The rating is on the highest relative significance to the lowest relative significance.
iv. In second questionnaires they give chance to review their original rating and modify response if desire. The parameters with great importance are Dissolved oxygen, Fecal coliform, pH, 5-days biological oxygen demand, nitrates, phosphates, temperature deviations, turbidity (in NTU) and total solids.
v. In third questionnaire the participants were ask to develop a rating curve for each include variable. For this blank graphs are provided o which level of water quality rating from 0 to 100 were indicated on the ordinate of each graph.
vi. The participants asked to draw curve on graph which represents variation of water quality produced by the different quantities of each pollutant variable.
vii. The team with investigation subsequently arranged the curves and produced a set of "average curves". In which solid line means arithmetic mean of all participants; while dotted lines bounded a shaded area shows 80 percent confidence limit.

TABLE NO. I: Different variables considering for NSF WQI questionnaires no. i

Candidates variables considered for the NSE WQI in questionnaire	
Dissolved oxygen	Oil and grease
Fecal coliforms	Turbidity
pH	Chlorides
Biological oxygen demand (5 days)	Alkalinity
Coliform Organisms	Iron
Herbicides	Color
Phosphates	Manganese
Temperature	Fluorides
Pesticides	Copper
Nitrates	Sulfates
Dissolved solids	Calcium
Radioactivity	Hardness
Phenols	Sodium & potassium
Chemical Oxygen Demand	Acidity
Carbon chloroform extract	Bicarbonate
Ammonia	Magnesium
Total Solids	Aluminum

To calculate the aggregate WQI, mathematical expression for National Sanitation Foundation Water Quality Index is;

$$\text{NSF WQI} = \sum_{i=0}^{n} WiQ\, i \qquad \text{Equation (1)}$$

Where,
Q_i is the sub-index for i_{th} water quality parameters
W_i is the weight (in terms of importance) associated with i_{th} water quality parameter
n is the number of water quality parameters

TABLE II: Classification criteria standards based on NSF-WQI with colors suggested for reporting the WQI

NSF-WQI	Descriptor words	Category	Color
91 – 100	Excellent	A	Blue
71 - 90	Good	B	Green
51 – 70	Medium	C	Yellow
26 – 50	Bad	D	Orange
0 - 25	Very bad	E	Red

C. Weighted Arithmatic Water Quality Index

This method is adopted when most common quality variables are measured. The parameters or variables were analyzed in the lab as per the standard procedures of APHA 1995. To calculate water quality index following equation is used:

Step1: To calculate quality rating (Q_n):

$$\text{Quality rating } (Q_n) = 100 \times \frac{(Vn - Vi)}{(Vs - Vi)}$$

Where,
V_n = actual value of particular parameter in water sample
Vi = ideal value of parameter (0 for all parameters except pH 7 Milligram per liter)
$V_{S=}$ standard value for the parameter

Step2: To find unit weight (Wn):

$$Wn = K / Vs$$

Where, $K = \frac{1}{\frac{1}{Vs1} + \frac{1}{Vs2} + \cdots + \frac{1}{Vsn}}$

Step3: To calculate water quality index (WQI):

$$WQI = \frac{\sum QnWn}{\sum Wn} \qquad \text{Equation (2)}$$

TABLE NO. III: Water quality Index and Status of Water Quality

Water Quality Index	Description status	Category
0 – 25	Excellent quality	A
26 – 50	Good quality	B
51 – 75	Poor quality	C
76 – 100	Very poor quality	D
>100	Unsuitable for drinking	E

III. ADVANTAGES AND DIS ADVANTAGES OF WATER QUALITY INDEX METHODS

A. Advantages of NSF-WQIare as follows :

i. In NSFWQI data can be summarized in a single index value in an objective, rapid and reproducible manner.
ii. We can identify changes in water quality by evaluating different areas.
iii. Index values are relate to a potential water use

B. Disadvantages of NSF-WQI are as follows :

i. It does not represent specific use of water, as it represents general water quality
ii. There is loss of data during handling

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 05, May-2016

iii. In this lack of dealing with uncertainty and subjectivity present in complex environmental issues

C. Advantages of Weight Arithmatic WQI are as follows :

i. We can use number of quality parameters into mathematical equation that give rating and grading to the water bodies.
ii. Particular use of water simplifies with less comparison as less number of parameters required.
iii. For the policy makers and citizens this number is very useful for communication of overall water quality information.
iv. Assurance about suitability of water for human consumption in case of fresh water bodies.
v. Different parameters that can be used with their composition that is important for assessment and management of water quality.

D. Disadvantages of Weight Arithmatic WQI are as follows :

i. The number given by water quality index may not be give real situation of quality of water.
ii. A single bad parameter value changes the whole story of Water Quality Index.
iii. There are many other water quality parameters that are not considered in index.

IV CONCLUSIONS

After study both indices, it is quite clear that main objective of Water Quality Index is give single number by using mathematical expression given equation (1) and equation (2). That single score number reduced complexity created due to different water quality parameters, as high numbers of variables results into single number that tell whole story of water bodies in particular area. It is the easy interpretation of water quality monitoring data. As we discuss the advantages and disadvantages of both National Sanitation Foundation WQI and Weight Arithmetic WQI that are useful globally to monitor, assessment and impact studies for different water bodies with different regions. It is helpful for different decision makers to take proper action or find out remedies.

ACKNOWLEDGMENT

The authors are thankful to ABMSP's Anantrao Pawar College of Engineering & Research, Parvati under Savitribai Phule University, Pune for providing necessary facilities.

REFERENCES

[1] Wagh G.S, Sayyed M.R.G, Sayadi M. H (2014), Evaluating groundwater pollution using statistical analysis of hydrochemical data: A case study from southeastern part of Pune metropolitan city (India), International Journal of Geomatics and Geosciences, 4(3), 456-476.

[2] Wagh G.S, Sayyed M.R.G, Sayadi M. H (2015), Seasonal variations in the ground water quality form the area surrounding the solid waste disposal site from the Pune city (India), Journal of International Academic Research for Multidisciplinary, 2(12), 405-410.

[3] Samantray P., Mishra B.K., Panda C.R., Rout S.P, Assessment of Water Quality Index in Mahanadi and Atharabanki Rivers and Taldanda canal in Paradip area, India, J Hun Ecol 26(3), 153-161.

[4] Rubio Arias H, Ochoa Rivero J M (2013), Development of Water Quality Index of an artificial Aquatic Ecosystem in Mexico, Journal of Environmental Protection, 4, 1296-1306.

[5] Tyagi S, Sharma B, Singh P (2013), Water Quality Assessment in terms of Water Quality Index, American Journal of Water Resource,1(3), 34-38.

[6] Kavidha R, Elangovan K (2014), Seasonal variation of ground Water Quality in Erode District, Tamilnadu, India, J. Environmental Science and Engineering, 56(3), 295-302.

[7] Larry W C, Environmental Impact Assessment, McGraw-Hill Publication,125-130.