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Impact of Sand Mining on Periyar Basin

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***Abstract*— Rivers, termed as arteries of continental masses, are fundamental components of landscape and life scape. Rivers have been subjected to reckless exploitation of sand for construction purposes and other developmental activities.it leads to severe damages to the riverine ecology. Reduction in sediment supply from catchments and erosion of its own channel during high flow regimes is very common in many Kerala rivers.This project aims to study the effect of sand mining on the groundwater table in the Periyar river basin. The study areas selected for the project are Thannipuzha and Neeleswaram situated on the bank of the Periyar river. Our goal is to find depth and reduced water level in wells measured from 60 houses to find the approximate impact of sand mining and conducting a questionnaire survey. A water samples is collected to check turbidity and pH. By using satellite images of 2 years, find the variation in river course by Q GIS.**

Keywords*— *Questionnaire survey ; water fluctuation ; turbidity ; pH ; change in river course

I. INTRODUCTION

Twenty-five percent of Kerala's industries are along the banks of river Periyar, Sand mining is a serious threat to most of the rivers in Kerala but the case is more visible in the Periyar river. The indiscriminate mining has even affected the stability of the Sree Sankara Bridge at Kaladay. Sand deposits in rivers are the biggest source of sand and it is dredged by manual or by mechanical means. The dredging of sand has good or positive effects on nature if the amount being dredged is within a particular limit. These positive effects include decreased chances of flooding damages, improved navigation conditions, increase in revenue of the government, and employment opportunities to over 60000 registered labour in the state. The main impacts on the environment due to excess sand mining are increased grade slope and instability of the river, decrease in groundwater level in the nearby areas, disruption of navigation in upstream dredging pits during the dry season, and brackish water intrusion.

A. Objectives

- To assess the fluctuation of ground water table near to sand mining area using QGIS.
- To find water quality analysis in terms of turbidity and is compared with previous year data.
- To find water quality in terms of pH.
- Find the change in river course due to sand mining.

B. Scope

The amount of sand mining from the river is very larger than the permitted value.Sand depositions are getting exploited by mafias and negative impacts of excess sand mining is clearly seen in such regions. Even though the river is flowing, near to the place there is a big scarcity of water towards the summer season and some wells dried up during peak of summer. This can be due to dredging process occurring near to the place. A systematic study for describing the role of sand mining in unhealthy situation of groundwater table will bring more attention of people as well as government authorities to limit the dredging process and also will helps to boost the groundwater recharging activities.

C. Study area

The study areas selected for the project is Thannipuzha and Neeleeswaram situated on the bank of Periyar river. The study areas are the surrounding regions of kadavu where sand mining is occurring. Thannipuzha is close to Koovapady bridge and is about 0.5km away from the nearest town, Koovapady. The study area I (Thannipuzha) lies between the coordinates and is a moderately populated region without any industries. The residential buildings are almost arranged in grid pattern. The main two kadavus in these regions are Kavungal and Thondukadvu. Study area II (Neeleeswaram) lies between the coordinate and is situated at 4.4km from Koovapady town. The main kadavus of this region are Thottuva and Mundolakadavus. The boundary of both the areas lies at a distance of 400m from bank of the river.

D. QGIS

A geographic data system (GIS) could be a system designed to capture, store, manipulate, analyze, manage and geographic knowledge. QGIS functions as geographic data system (GIS) code, permitting users to investigate and edit spatial info, additionally to composing and exportation graphical maps. QGIS supports each formation and vector layers; vector knowledge is hold on as either purpose, line, or polygonal shape options. Multiple formats of formation pictures area unit supported, and also the code will geo reference pictures. Plugins written in Python or C++ extend QGIS's capabilities.

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E. Extraction of base map of study area

The base map is extracted from the Bhuvan official site of ISRO. The study area was zoomed out and the boundary of the Malayatoor and Koovapady panchayath was drawn using the line tool. The area was saved and the screen shot was taken using the snipping tool and saved to the respective folder.

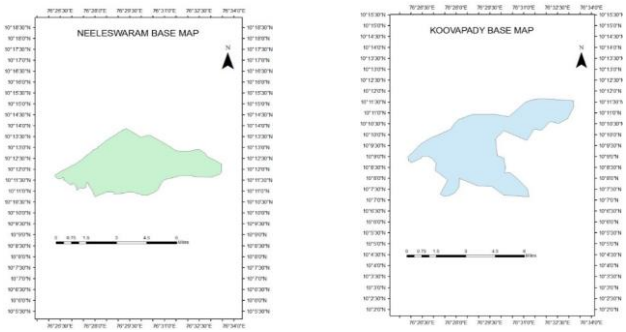

Fig . 1. Basemap of Neeleswaram and Koovapady

F. Digitization of base map

Digitizing is the method of changing options into a digital format, is a method to form knowledge. There are many ways in which to alter new options. These embrace digitizing on-screen or heads up over a picture, digitizing a tough copy of a map on a digitizing board, or victimisation machine-controlled conversion.

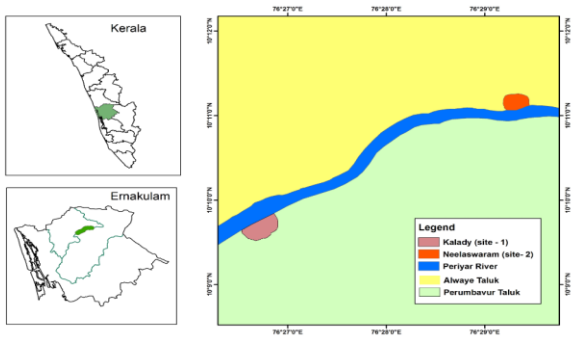

Fig .2. Digitalized map of study area

II. METHODOLOGY

The methodology is that the overall approach that underpins analysis. Showing you perceives the which means, of quantitative and qualitative approaches. The strategy area unit the tools of information assortment, like questionnaires or interviews. This chapter offers a top level view of analysis strategies that were followed within the study. It provides info on the participants, that is, the factors for inclusion within the study and the way they were sampled.The instrument that was used for information assortment is additionally delineated and therefore the procedures that were followed to hold out this study area unit enclosed.

A. Questionnaire survey

To assess the social perception of the local people on sand mining from the Periyar river basin and to study the impact of sand mining on the environment. It is mainly concentrated in the area Thannipuzha and Neeleswaram. About 60 houses near the river affected by sand mining were selected. Data collected from questionnaire survey are shown in bar chart.

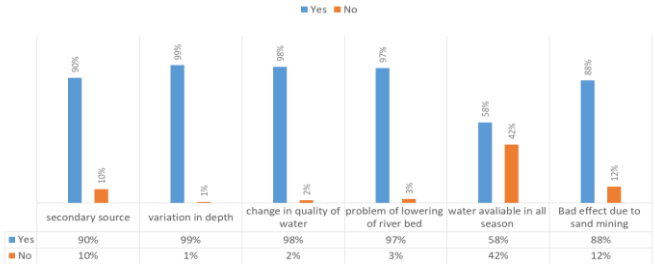

Fig .3. Questionnaire survey from Thannipuzha region

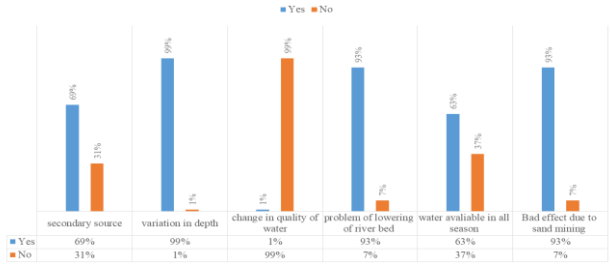

Fig . 4 . Questionnaire survey from Neeleswaram region

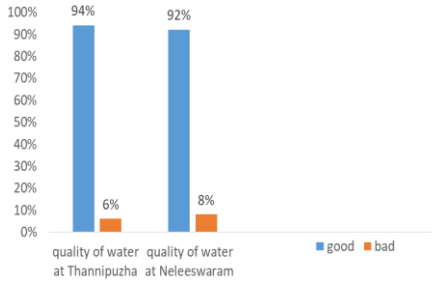

Fig . 5. Quality of water at both region

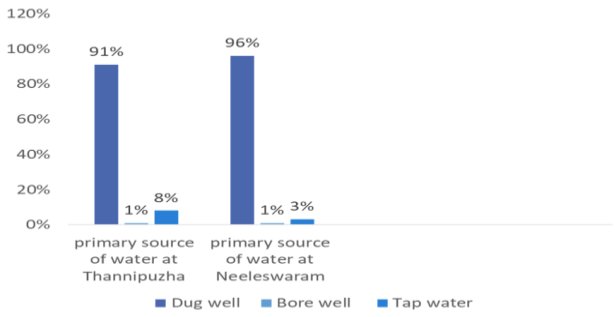

Fig .6. Primary source at both region

International Journal of Engineering Research & Technology (IJERT)
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B. Data collection from CWC

Central water commission may be a premier Technical organization of India within the field of water resources. Central Water Commission facilitate state governments in production and analysing control measures. They undertake flash flood forecast yet. Their skilled help is received by the govt. for numerous irrigation and potable offer comes. Water Power Development is another space wherever central water commission undertakes the tasks of investigations, construction and executions.We collected the data's of groundwater survey conducted on the year 2012 from the CWC in Neeleeswaram (Kerala) to plot the graph and compare it with present years fluctuation of water level.

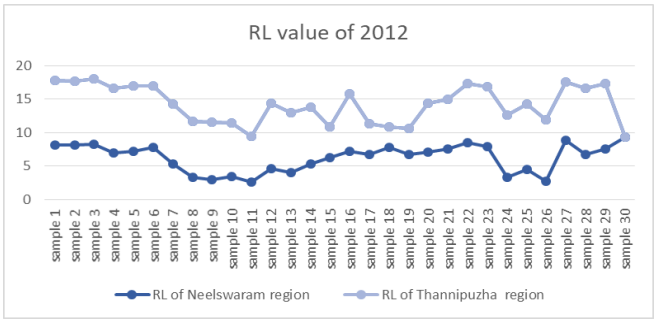

Fig. 7 . Reduced level value of 2012

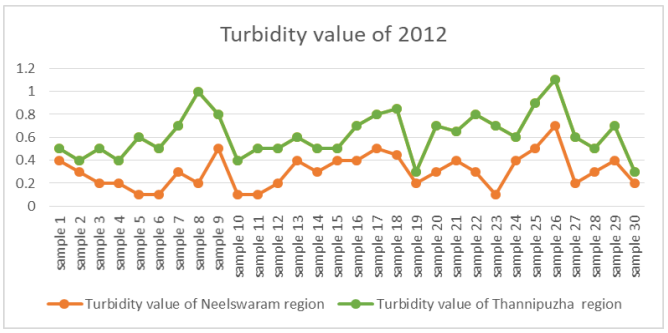

Fig . 8. Turbidity value of 2012

C. Measurement of water level in wells

The groundwater details of Koovapady and Neeleswaram carried out by using GPS and measuring tape. 60 wells were surveyed in both regions to measure the depth of water surface level from the parapet of each well and note down the height of parapet from the ground surface and Latitude and longitude of well location using GPS. Transferred these details into Google earth to get the elevation of the well location. The reduced level of water surface level in each well is the difference between the elevation of the well location and the depth of water surface level from the ground surface. CWC Data's where transferred to GIS where the interpolation of reduced level of water is done and thereby plot the water level fluctuation in that area. This fluctuation is then compared with the previous year water level data of the same area.

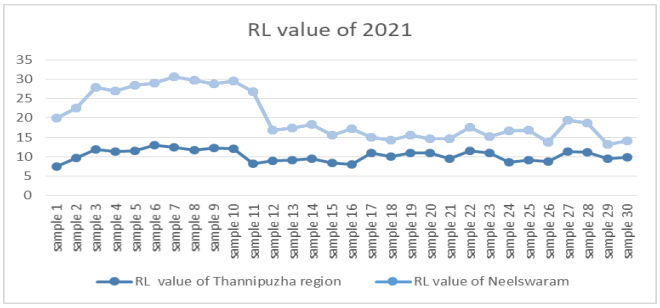

Fig . 9. Reduced level value of 2021

D. Water quality analysis in terms of turbidity

When water mixes with river water, physical and chemical process take place, which may influence the water quality.Turbidity of water is the prime factor that gets affected by sand mining, and turbidity increases with increase in the amount of dredging. The turbidity of the water from Koovapady and Neeleswaram is tested in laboratory using turbidity meter. CWC data where transferred to QGIS and compare it with present year map (2021) .

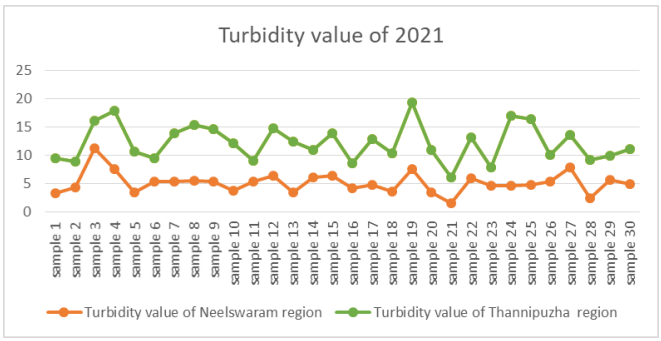

Fig . 10 . Turbidity value of 2021

E. Water quality analysis in terms of pH

We collect water sample from 60 houses at both region and compare it with IS 10500-1991.The normal range of pH for drinking water as per IS 10500-1991 is 6.5 to 8.5. From the analyze we find out that, the pH test results of 18 samples does not conforms to the IS 10500-1991.

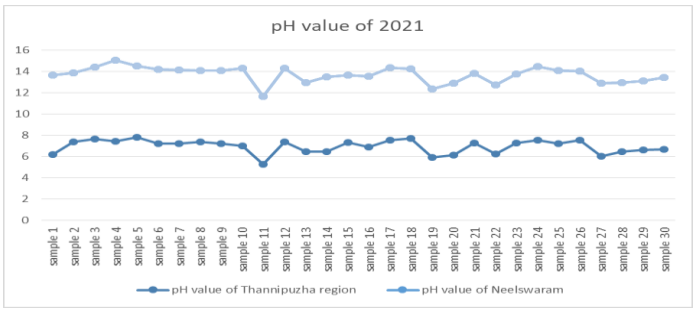

Fig . 11. pH value of 2021

International Journal of Engineering Research & Technology (IJERT)
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F. Change in river course due to sand mining

The side from being a source of water, river's sediment also has potential as a producer of natural resources extractive namely mineral sands. Uncontrolled mining activities will cause environmental problem at the mine site. The effect of sand mining is not only degrading the water quality of the river but also changing the physical quality of the river, such as river bank erosion, river bank slump, changes in the river flow, and decreasing the river flow. Following steps are included in comparing river widening:-

- Satellite image were extracted from Bhuvan of the year 2008 and 2011
- Image transformed into GIS platform.
- Image was cluster using ISO tool.
- Image was re-classified using reclassify tool.
- Raster file is then converted to polygon.
- After that it is edited and river area is been extracted
- The extracted river area is then converted to shape file and a portion of river near to the Kadavu is taken.
- Shape area of river is thus obtained.

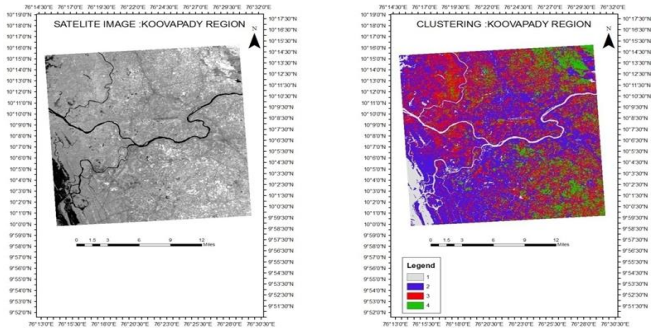

Fig . 12 . Satellite image and clustering of Koovapady region

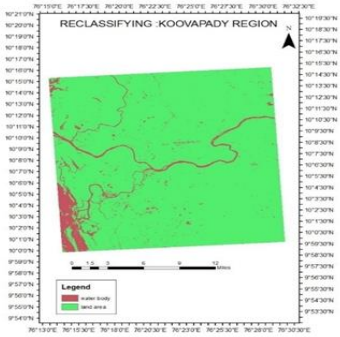

Fig . 13. Reclassifying of Koovapady region

III. RESULTS AND DISCUSSION

A. Comparison of variation in water level

From analysis it can be concluded that water is at greater depth in regions closer to Kadavu were sand mining is occurring and decreases when moving away from mining regions.The variation in water level is not in a uniform manner. Evaluating the ground water levels in both the study areas of Koovapady and Neeleeswaram region which mainly predicts the water shortage. From the comparison there is an undesired effects on reduced level due to the fluctuation of ground water level. The main consequence include the alteration of groundwater flow and reduced level gradually decrease from the year 2012 to 2021.This can become physically difficult to pump from increasingly lower depths.

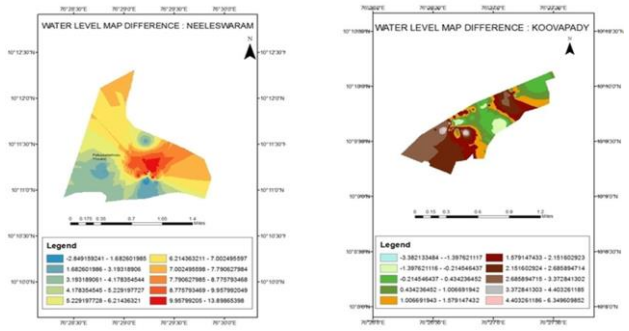

Fig . 14 . Water level difference map

B. Water quality analysis and comparing turbidity map

Turbidity value increase as compared to the previous year data. As per IS 10500 - 1991, the permissible maximum limit of turbidity for drinking purpose in the absence of alternate source is 10 NTU and desirable limit is 5 NTU. The given sample of water is suitable for drinking although the turbidity has increased.

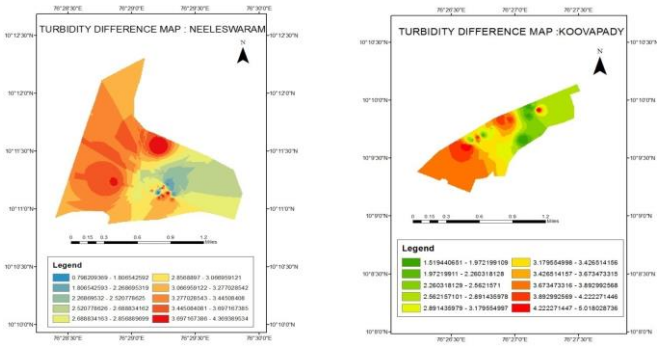

Fig . 15. Turbidity difference map

C. Comparing pH value as per is 10500-1991

The normal range of pH for drinking water as per IS 10500-1991 is 6.5 to 8.5. pH test results of 18 samples does not conforms to the IS 10500-1991.

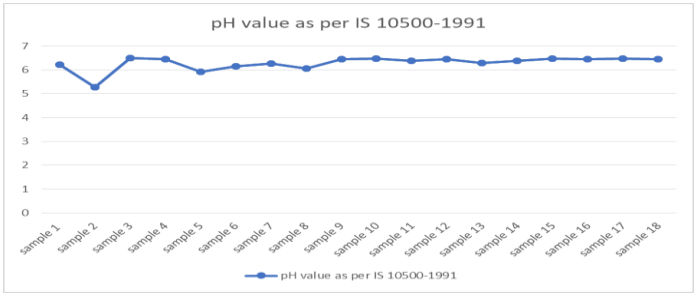

Fig .16. pH value as per IS 10500-1991

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 10 Issue 07, July-2021

D. Change in flow pattern

It is observed that there is change in flow pattern and channel has widened as compared to 2011.Erosion of river occurred in bank of river and deposition occur in the other side. it was observed that the river area has increase from 2008 to 2011.

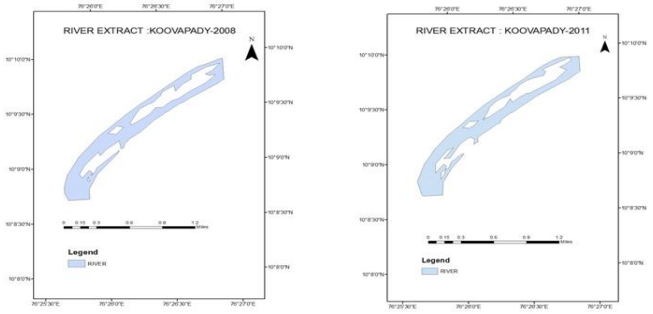

Fig. 17. River extract

IV. CONCLUSIONS

Neelesweram and Thannipuzha are two places on bank of Periyar river where dredging is going in excess amount. Even though the government authorities keep a well-polished record of dredging, the actual extend of dredging is beyond the critical level. This excess mining is badly affecting the environment as well as ground water seriously. Water scarcity in wells is another main problem that highlighted in the survey conducted. From analysis of interpolation of RL of water table it can be concluded that, the regions near to sand mining Kadavus are more subjected to ground water fluctuation when comparing with regions away from Kadavus. This type of fluctuation of water table is not caused by other factors like industrialization, deforestation, plantation of crops etc.to considerable extent. It is seen that the pattern of variation of ground water table is similar in both study areas, from which it can be inferred that sand mining might be the main reason for ground water table fluctuation. As per IS 10500-1991, the permissible maximum limit of turbidity for drinking purpose in the absence of alternate source is 10 NTU and desirable limit is 5 NTU. The given 34 sample is not suitable for drinking purpose as per desirable limit. The given 5 sample not suitable for drinking purpose in the absence of alternate sources. The normal range of pH for drinking water as per IS 10500-1991 is 6.5 to 8.5. pH test results of 18 samples does not conforms to the IS 10500-1991.Considering the turbidity criteria. From satellite images is it is observed that river widens the year 2008 to 2011. It was also observes that there is change in river course in both years .This was due to erosion at banks and deposition at the other edge.

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