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STUDY AND ANALYSIS OF GROUND WATER LEVEL FLUCTUATION BY USING GIS IN ERODE DISTRICT

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ABSTRACT

In our task depends on the optional information, which is gathered from concern division and through web. The accompanying boundaries have been consider for the investigation, for example, incline map, land use and land spread, precipitation design, surface soil surface, seepage thickness and piezometer area. The spatial variety in the revive because of conveyed land-use, soil type or surface, slant, groundwater level, meteorological conditions, and so on., can be critical and should, accordingly, be considered for coming up with the status of the supportability of a Background .The chose boundaries have been arranged and ordered in GIS condition, at that point weightage for every boundaries and its classes have been doled out utilizing Analytical Hierarchical Process, and afterward weighted overlay investigation in ArcGIS used to discover the outcome. In our undertaking portrays the idea of the model and gives a case of a created dependent on GIS revive map for the pieces of dissolve areas. The amount decided for each procedure is thusly restricted by various requirements. It incorporates a water balance in a Geographical Information System (GIS). This investigation gathers the legitimacy of the mimicked revive in a viable way. The evaluated appropriated revive can, in this manner, be utilized in local consistent state groundwater models and, thus, decline the vulnerability in recreated heads. Changes in land use sway the energize. Ground water energize and invasion can be separated through the season insightful examination of precipitation rate, which can anticipate the great outcome for this investigation.

KEYWORDS: *Study, Analysis water level vacillation, GIS, artificial recharge.*

1. INTRODUCTION

1.1 GENERAL

Water is fundamental for all living things and is utilized in various courses, such as food production, drinking, domestic, industrial, power production and recreational utilize.

Out of 2.5% worldwide fresh water just 1% is accessible for human utilization. As per the world water report .the land accessibility level contracting is increased day by day .the per capita land accessibility is in diminishing pattern and is assessed that just 0.1hectare per capita land will be accessible before the finish of 2025.Rabid increase in population urbanization agricultural expansion and industrialization leads to higher level of human demand.it has become more critical in places where rainfall is very low and erratic .even though India is blessed with a higher average annual rainfall of 1,170 mm as compared to the global average of 800 mm .It faces the problem of water scarcity in most part of the year ground water level deals with aspects of balancing variouscomponents of ground water supply and disposal with storage changes in the ground water reservoirs.In the last few years, change in land use and land cover. Climatic conditions, population explosion, Industries and urban areas have deteriorated the conditions. A main water problem creates in dry season. Even in the absence of climatic change, present population trends and patterns of water use indicate that the basin will exceed the limits. Input and output of water and changes in ground water balance of the basin.Studies determinations of various parameters of water resources such as precipitation, runoff, evapotranspiration and ground water recharge. The study delineates that the GIS technique facilitates integration of thematic maps. There by helps in an identification of rainwater accumulating sites in erode district each with unique characters in – terms of hydrogeology. If feasible, then selecting the best suited artificial groundwater recharging method. Ground water level based on the soil and its characteristics. Input and output of water and changes in ground water storage are studied to draw up the water balance of the basin.

1.2 REASON BEHIND THE PROJECT

The state of Tamilnadu extends around 130060 square kilo meter of southeast part of India. Tamilnadu receives rainfall in the winter season due to northeast trade winds. The normal annual rain fall of the state is 945 mm of which 48% is through the north east

monsoon, and 32% through the south west monsoon. Natural origin of many rivers in Tamilnadu is from other states. In my study are ground water fluctuations levels are suddenly decreased in last five years. So the fluctuation levels are determined based on the rain water level. Agricultural lands are totally depends on the groundwater source. Therefore there is need to resolve the water crisis problem in the selected study area.

1.3 RUNOFF

Runoff is the part of the precipitation, snow melt, or irrigation water that appears in uncontrolled surface streams, rivers, drains, or sewers. When rainfall starts, the first drop of water are intercepted by the leaves and stems of the vegetation. This is usually called as interception storage. As the rain continues, water arrives at the ground surface infiltrates into the soil until it reaches a stage where the rate of rainfall exceeds the infiltration capacity of the soil. Thereafter, surface puddles, ditches, and other depressions are filled. After which runoff is produced.The infiltration capacity of the soil relies in its texture and structure, as well as on the antecedent soil moisture content. The initial capacity is high but, as the rain continues, it decreases until it reaches a steady value referred as final infiltration rate. The process of runoff generation continues as long as the rainfall intensity over-reach the actual infiltration capacity of the soil but it stops as soon as the rate of rainfall drops below the actual rate of infiltration.

1.4 SOIL TYPE

The infiltration capacity is dependent on the porosity of a soil which finds the water storage capacity and affects the resistance of water to flow into deeper layers. Porosity varies from one soil type to the other. The highest infiltration capacities are noticed in loose, sandy soils while heavy clay or loamy soils have substantial smaller infiltration capacities. The infiltration capacity depends furthermore on the moisture content conquering in a soil at the onset of a rainstorm. The study area contains six types of soils every soils have a different characteristics.

- The red non-calcareous soils are seen in erode, perunthurai and gopicheetipalayam taluks.
- The black soils are occurring as patches in four taluks. Brown soil occupies only a small portion of Bhavani, kanga yam, and Gopicheetipalayam Taluks.
- Alluvial soils are fund in small patches along the Noyil and bhavani rivers. Alluvial soils are found in the foothills of Western Ghats.
- Forest soil is confined to the reserve forest area in northwestern parts of the district, where a surface layer of organic matter is present.They are mostly sandy to loamy and characterized by the hard and compact layer of lime.

1.5 VEGETATION

The measure of downpour lost to capture stockpiling on the foliage depends on the sort of vegetation and its development stage. Estimations of block attempt are at 1 and 4mm. A grain crop, to give a model, has a littler stockpiling limit than a thick grass spread. Increasingly prominent is the impact the vegetation has on the penetration limit of the dirt. A thick vegetation spread shields the dirt from the raindrop effect and diminishes the crusting impact as portrayed before. Furthermore, the root framework just as natural issue in the dirt climbs the dirt porosity in this manner permitting more water to penetrate. Vegetation likewise postpones the surface stream especially on delicate inclines, giving the water more opportunity to invade and to vanish. In last, a region thickly secured with vegetation, yields less overflow than uncovered ground. We have biggest assortment plants like yearly blossom, sea-going plants, fragrant plants, prickly plant, greeneries, and indoor plants.

1.6 WASTE

Waste is the characteristic or counterfeit evacuation of a surface's water and sub-surface water from a region with abundance of water. The inside waste of most farming soils is adequate to forestall serious waterlogging (anaerobic conditions that mischief root development), however numerous dirts need counterfeit seepage to improve creation or

to oversee water supplies. Point waste, which captures water at gorges (focuses). Ravines interface with waste funnels underneath the ground surface and profound exhuming is required to encourage this framework. Backing for profound channels is required looking like planking, swaggering or shoring. Channel seepage, which captures water along the whole run of the channel. Channel seepage is ordinarily produced from solid, steel, polymer or composites. The capture pace of channel waste is more prominent than point seepage and the exhuming required is typically considerably less profound.

Dendritic examples which are by a wide margin the most well-known, create in zones where the stone (or unconsolidated material) underneath the stream has no specific texture or structure and can be disintegrated similarly effectively every which way. Models would be stone, gneiss, volcanic stone, and sedimentary stone that have not been collapsed. Most regions of British Columbia have dendritic examples, as do most regions of the grasslands and the Canadian Shield.

Trellis waste examples regularly create where sedimentary rocks have been collapsed or inclined and afterward dissolved to differing degrees relying upon their quality. The Rocky Mountains of B.C. also, Alberta are a genuine case of this, and a considerable lot of the seepage frameworks inside the Rockies have trellis designs.

Rectangular examples create in territories that have next to no geology and an arrangement of sheet material planes, breaks, or blames that structure a rectangular system. Rectangular seepage designs are uncommon in Canada.

PARALLEL framework is an example of waterways brought about by steep inclines with some alleviation. In light of the precarious inclines, the streams are quick and straight, with not many tributaries, and all stream a similar way. Equal seepage designs structure where there is an articulated slant to the surface. An equal example likewise creates in areas of equal, lengthen landforms like outcropping safe musical gangs.

RADIAL framework, the streams emanate outwards from a focal high point. Volcanoes as a rule show great outspread waste. Other geographical highlights on which spiral waste generally creates are vaults and laccoliths. On these highlights the waste may show a blend of outspread examples.

centripetal seepage framework is like the spiral waste framework, with the main exemption that outspread seepage streams out versus centripetal waste streams

An **unhinged** seepage framework is a waste framework in seepage bowls where there is no rational example to the waterways and lakes. It occurs in zones where there has been a lot of geographical disturbance. The great model is the Canadian Shield. During the last ice age, the topsoil was scratched off, leaving generally exposed stone.

1.7 WATERSHED

Watershed is defined as any surface area from which runoff resulting from rainfall is collected and drained through a common point. It is synonymous with a drainage basin or catchment area. A watershed may be only a few hectares as in small ponds or hundreds of square kilometers as in rivers. All watersheds can be divided into smaller sub-watersheds. When a hydrological watershed is defined:

- The size of the catchment is known
- Water demand can be derived
- Water availability can be computed
- Management area can be split into pieces due to geomorphologic conditions.

1.8 GROUND WATER QUALITY

Ground water in phreatic springs in Erode locale all in all is Colorless. Scentless and somewhat antacid in nature .the particular electrical conductance of ground water in phreatic zone during May 2006 was in the scope of 660 to 4080 in the locale .it is between 750 µS/cm at 25º c in the significant piece of the area. Conductance underneath 750 µS/cm

has been seen in ground water in just a single straightforward is vellakottai while conductance surpassing2250 µS/cm has been seen at pudupalayam, bhavani.

Long haul vacillation: the long – term water level variance for the period1998-2007 demonstrates ascend in water level in the region 0.0335-0.6159m/year. The fall in water level extending between 0.0186-0.9738m/year.

Ground water assets: The ground water assets have been figured together by focal ground water board and state ground and surface water assets and improvement Center, as on 31st March 2004.

1.9 ARTIFICIALRECHARGE

Fake revive frameworks are built frameworks where surface water is put on or in the ground for invasion and progressive development to springs to increase ground water assets. The significance of ground water for household, mechanical and horticultural utilizations and its promptly and locally accessible trademark have prompts aimless extraction of this valuable common asset. Mechanical advancement in development of profound cylinder wells, water deliberation gadgets and siphoning strategies have likewise added to huge – scale abuse of ground water from profundities surpassing 300m subterranean level.

ARTIFICIAL RECHARGE VARIOUS PURPOSES:

- To ensure that ground settlements caused by drawdown are small, this reducing the risk of damage to nearby structures.
- To avoid depletion of water resources when dewatering is carried out in aquifers used for water supply.
- To reduce environmental impacts on sensitive water-dependent features such as wetlands.

- Artificial recharge supplies ground water users an opportunity to increase the amount of water available during periods of high demand typically summer months.

1.10SCOPE FOR THE PRESENT WORK:

Finally the runoff is estimated using GIS. After that the rainfall – ground water levels are identified. Each identified sites in the erode district is checked for the feasibility of artificial groundwater recharging. Using induced injection methods to increase the ground level gradually.

1.11 OBJECTIVES OF STUDY

The main aim of this study is to delineate the water rainwater conservation site in erode district. The following objectives have been adopted to meet this study aim.

- To estimate the runoff depth.
- To understand the water level fluctuation in the study area.
- To delineate ground water potential zones for artificial recharge to sustainable groundwater development.
- To identify the rainwater accumulation sites using remote sensing and GIS.
- To select the best suited artificial ground water recharging method.

2.METHODOLOGY

2.1 INTRODUCTION

The main aim of the study area to understand the water level fluctuation in the study area. To delineate ground water potential zones for artificial recharge to sustainable ground water development .First of all, Chosing the study area and the area selected for this study is erode district. Then the data needed to do the project are identified and collected. The data used for the project are survey of India Toposheets, Cartosat – carto DEM version- 3 R1, surface soil texture coverage over the study area, Resource sat- 1/2

LISS-III Satellite imagery, and rainfall data from SWAT Global Weather Data. After the data collection gets, boundary of the erode district was delineated through the digitation of survey of India Toposheets and base map for the GIS analysis was prepared. With the help of base map, all the required thematic maps such as slope map, Land use map, surface soil texture map, Rainfall map, drainage map, piezometer location map are created using the software ArcGIS 10.5. Finally the rainfall – runoff accumulation site is identified. In the identified accumulation sites, checking the feasibility for artificial ground water recharging method. Then ground water level fluctuation levels are identified in the study area. Recharging levels are maintained based on the ground water level fluctuation. Wells and drains are identified in the recharging methods. Different methods are used in groundwater level fluctuation.

METHODOLOGY

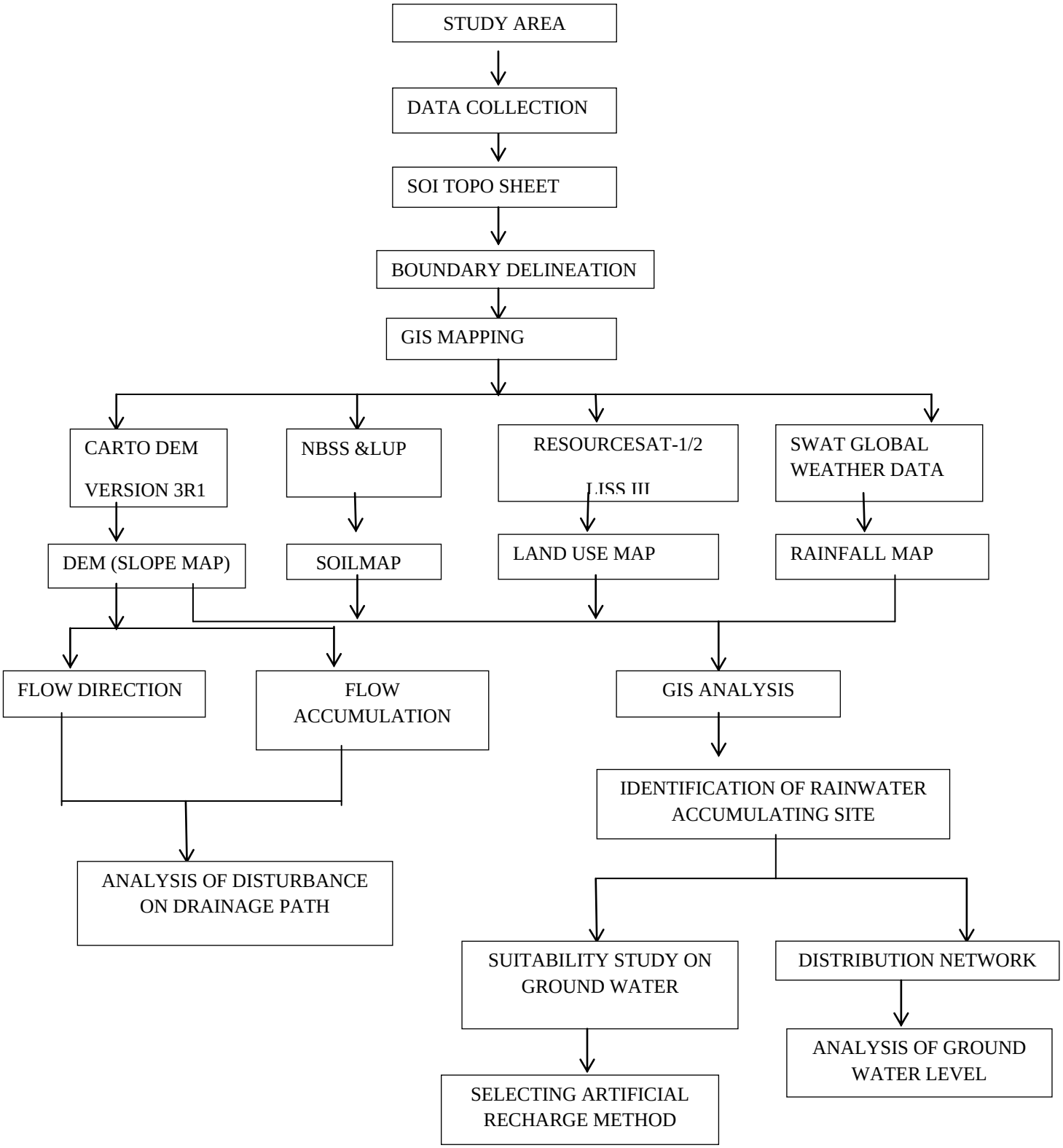


Figure 2: Methodology

3. THEMATIC MAP PREPARATION

3.1 CLIMATE AND RAINFALL

The city has a semi-bone-dry atmosphere with moderate to high temperatures consistently and generally low precipitation. Temperature ranges from 80ºF (27ºc) to 96ºF (36ºC) with a normal precipitation of 812 mm. like rest of the state, March to June are the most sweltering and December to January are the coldest months of the year. While the Southwest storm (June to August) brings sparse precipitation, main part of the precipitation is gotten during the Northeast rainstorm in October, November and December. The region covers a territory of 8.44 km2.. The region gets the downpour affected by both southwest and upper east storms. The upper east storm mainly adds to the precipitation in the locale.

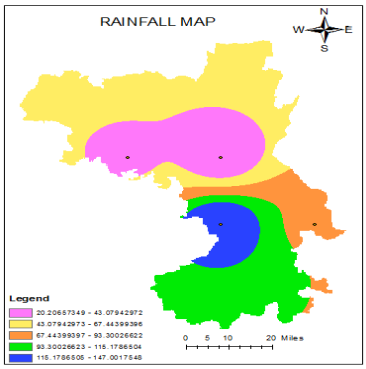


Figure 3:Rainfall change map

3.2 LAND USE / LAND COVER MAP

The land use map was prepared from Resource sat - 1/2 linear imaging self-scanning sensor (LISS III) 2018. The steps are to be followed to obtain land use/ land cover map of the study area using ARCGIS software, First of all, LISS – III imageries are downloaded from the USGS website by selecting appropriate tiles corresponding to the study area. The influence of land use on storm runoff generation is very complicated. In

this regard, the percentage of coverage of different land uses over the erode district is classified restricted zone, Buffer zone, Agricultural zone, Urbanized zone, Urbanisable zone.

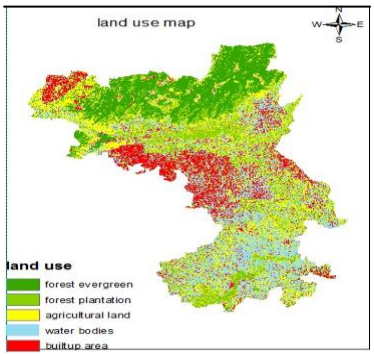


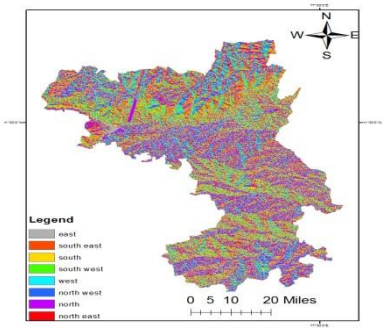
Figure 4: land use/land cover change map

3.3 DRAINAGE NETWORKS AND PATTERNS

A seepage framework that creates on a provincial surface is constrained by the incline of the surface and the sorts and perspectives of the fundamental rocks. Seepage designs, which are effectively obvious on space photos and pictures, reflect to shifting degrees the lithology and structure of a district. Waste examples in a zone rely chiefly upon the sort dissemination and disposition of the surface rocks, courses of action of zones or lines of shortcoming, and so forth. No normal asset study is finished without an investigation of the seepage attributes of the territory. The waste example really mirrors the shrouded auxiliary qualities and brings up the structural history of a zone. Different landforms and bed rocks portray six most regular seepage designs like Dendritic, Rectangular, Trellis, Radial, Centripetal and Deranged. The dendritic waste example is a very much coordinated example framed by a standard with its tributaries fanning and re-expanding uninhibitedly every which way and happens on moderately homogeneous materials, for example, level lying sedimentary stone and rock. The rectangular waste is fundamentally a dendritic example, adjusted by a basic bed rock substance to such an extent that the tributaries meet at right edges and is with level lying huge sandstone with all around created joint framework. The centripetal seepage is the

converse of the spiral example and happens in zones of limestone frigid locale. The unhinged example is a disarranged example of randomly coordinated short pressure, lakes and icy till regions. The investigation territories are seen in dendritic, sub-dendritic and rectangular sort of seepage.

DRAINAGE DIRECTION MAP (2018)



Slope map

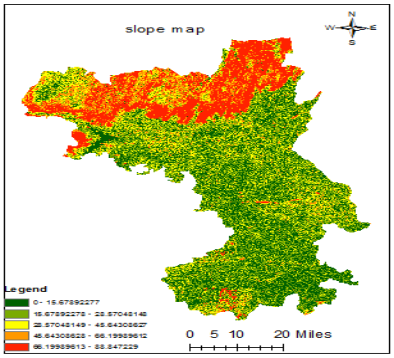


Figure 5: slope map

4. ANALYSIS OF THEMATIC MAP DATA

4.1 RAINFALL

The precipitation information of the disintegrate area for as far back as 10 years from 2007 to 2016 was acquired from SWAT model. After that the normal yearly precipitation esteem was registered and plotted a chart between the year and normal precipitation comparing to the downpour measure stations. It gets the downpour affected by both southwest and upper east storms. The upper east rainstorm essentially adds to the precipitation in the taluk. The southwest storm is likewise sensible. Throughout the winter and hot seasons, the precipitation is inadequate. The typical yearly precipitation changes from around 575 mm to around 704 mm.

RAINFALL DATA WITH STATION

YEAR: 2008-2018

STATION 1:77.5, 11.0841 STATION 2:77.8125, 11.0841

STATION 3:77.1875, 11.3964 STATION 4:77.5, 11.3964

YEAR	STATION 1	STATION 2	STATION 3	STATION 4
2008	1.4300	2.3933	5.3482	3.1813
2009	0.8632	1.7429	3.6929	2.0880
2010	0.7665	1.9428	3.8060	2.7197
2011	1.2779	3.5010	3.9794	2.4216
2012	1.7305	3.9189	3.2970	2.3851
2013	0.8164	2.9197	1.7788	0.8887
2014	63.12	22.709	37.2	24.0
2015	81.910	44.219	28.1	25.47
2016	36.015	25.00	715	73.95
2017	75.92	60.560	11.87	10.02
2018	147.02	87.45	37.2	20.2

Table no:1 rainfall with station

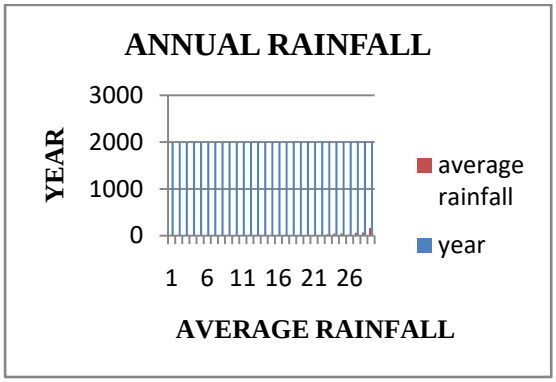


Figure 6: average rainfall level

4.2 LAND USE

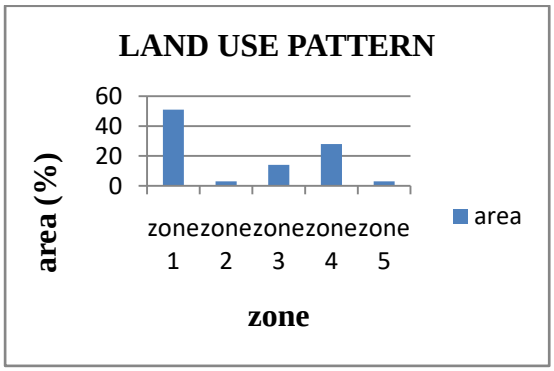


Figure 7: land use pattern

4.3 SOIL TEXTURE

The dirts of Erode area can be comprehensively grouped into 6 significant soils types viz., Red calcareous soil, Red non calcareous soil, Black Soil, Alluvial and Colluvial soils, Brown soil and Forest soil. Significant piece of the locale secured by red calcareous soils. They are for the most part sandy to loamy and described by the hard and minimized layer of lime.

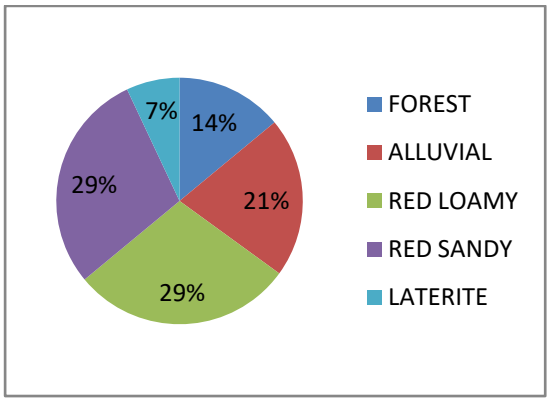


Figure 8: soil texture

4.4 PRE&POST MONSOON GROUND WATER LEVEL

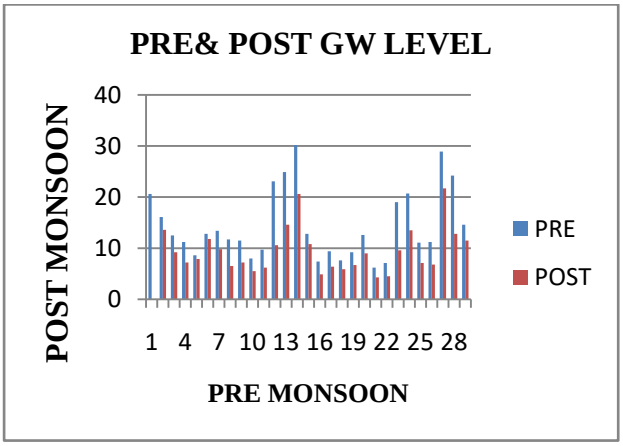


Figure 9: Pre &Post monsoon ground water level

4.5 AVERAGE FLUCTUATION LEVEL (YEAR)

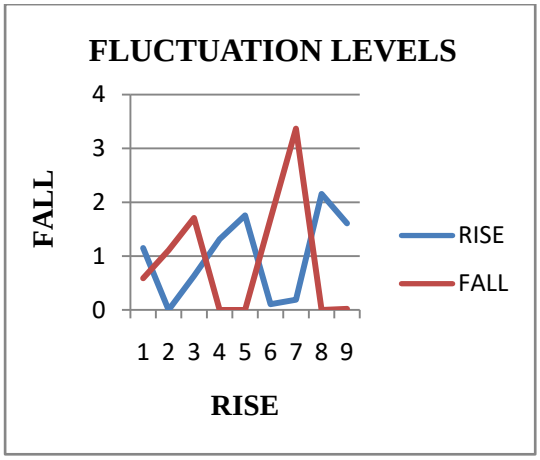


Figure 10: Average fluctuation level

5. SUMMARY AND CONCLUSION

Ground water is a most significant characteristic hotspot for water system, drinking, and other motivation behind water prerequisites in numerous pieces of India. Over 90% of country and 30% of urban populace rely upon it for drinking water. The examination territory chiefly chose to depict the potential ground water zones through investigation of IRS P6 LISS III satellite information and field examination. Section 1, brief presentation about the examination zone, atmosphere and vegetation, extent of the work, Objectives and procedure are talked about. In any examination study, it is important to survey the past and progressing work specifically field of specialization. In comparable design, a nutty gritty writing review was completed in the field of conventional methods embraced for ground water investigation, the job of groundwater study , remote detecting and GIS in groundwater contemplates. This has given a diagram of examination work in the different precipitation boundaries were talked about the water table and their vacillation were basically surveyed in this investigation .The job of remote detecting

strategy and age of different topical maps are examined . from remote detecting information , the topical maps like ,precipitation , land use and land spread , waste heading, soil surface and incline map were produced. The diverse topical maps were renamed and coordinated for age of groundwater expected guide through GIS procedure and renaming of different topical guide. The conclusive outcome is acquired through GIS overlay examination. The yearly normal precipitation is 575mm to about 704mm.The greater part of the territory is portrayed by dendritic example of waste so there is no collection are available in the investigation region. The kind of land spread which the impacted the overflow age of the examination region was recognized dependent on soil properties. The development zone with sandy soil had created high overflow profundity and waste land with loamy sand had produced low profundity spillover in the examination territory. The expanding region of development region gives more overflow to the investigation territory and low penetration profundity. The development region with sandy topsoil had created high overflow profundity and waste land with loamy sand had produced low profundity spillover in the examination territory. The expanding zone of development zone gives more overflow to the examination region and low invasion profundity .Piezometer areas were discovered utilized on the fake revive technique, utilizing initiated infusion strategy to build the ground water level without any problem. The groundwater potential and energize zones Indicate that the watershed has experienced huge changes in accessibility. Also, the groundwater reflection has just arrived at more than exploitable groundwater deliberation has just arrived at more than exploitable groundwater assets in the examination zone which requires quick consideration on groundwater the board.

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