

RUNOFF ESTIMATION IN THAMIRABARANI RIVER BASIN USING ARCGIS

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering in Civil Engineering
by

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SATHYABAMA**

INSTITUTE OF SCIENCE AND TECHNOLOGY(DEEMED TO BE UNIVERSITY)

Accredited with Grade “A” by NAAC

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APRIL – 2023



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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **JOE PRAKASH L (Reg. No. 39200021)**, **NITHISH SAMUEL J (Reg. No. 39200029)**, who carried out the project entitled **“RUNOFF ESTIMATION IN THAMIRABARANI RIVER BASIN USING ARCGIS”** under our supervision from September 2022 to April 2023.

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DECLARATION

We **JOE PRAKASH L** (Reg. No. 39200021), **NITHISH SAMUEL J** (Reg. No. 39200029), hereby declare that the Project Report entitled **RUNOFF ESTIMATION IN THAMIRABARANI RIVER BASIN USING ARCGIS** done under the guidance of Mrs. **P. ESHANTHINI** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Civil Engineering.

DATE : 13.04.2023

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SIGNATURE OF THE CANDIDATE

ACKNOWLEDGEMENT

We are pleased to acknowledge our sincere thanks to Board of Management of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. We are grateful to them.

We convey our thanks to **Dr. Devyani Gangopadhyay, B.Arch., M.T.P., Ph.D.**, Dean, School of Building and Environment and **Dr. S. Packialakshmi, M.E., Ph.D.**, and **Dr. R. Padmapriya, M.E., Ph.D.**, Head of the Department, Dept. of Civil Engineering for providing us necessary support and details at the right time during the progressive reviews.

We would like to express our sincere and deep sense of gratitude to our Project Guide **Mrs. P. ESHANTHINI, M.E.**, for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of our project work.

We wish to express our thanks to all Teaching and Non-teaching staff members of the Department of Civil Engineering who were helpful in many ways for the completion of the project.

ABSTRACT

One crucial component in hydrological studies is surface runoff. Any hydraulic construction must be designed with an estimation of surface runoff in order to determine flood risk. The goal of the current study is to model runoff using ARCGIS and the SCS curve approach. The study site was the Thamirabarani River Basin in Tamilnadu's Tirunelveli district. The overall area used for this investigation is roughly 5662 square kilometres. Using ARCGIS software, maps of soil, land use, and land cover were produced. The availability and use of water fully depend on the distribution and pattern of rainfall, according to metric values gathered from the local public works department in Tirunelveli in India. Assessment of water availability due to concerns like climate, land use characteristics, and watershed change due to continuous urbanisation and industrialization should be done in order to overcome issues linked to water availability and its delivery. By comparing the total area at various scales and the usual empirical formula for the Thamirabarani river basin, GIS-based software called soil and water assessment tool (ARCGIS) and runoff estimation are compared. The adequacy of the method is then determined. Rainfall serves as an essential supply of water, and it is employed as one of the primary factors to estimate the runoff process for the majority of hydrological aspects. A watershed's runoff estimation allows for the estimation of the likely volume of water that will be drained by the watershed.

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LIST OF SYMBOLS AND ABBREVIATIONS

ACRONYMS

EXPANSIONS

'	Minutes
"	Seconds
%	Percentage
GIS	Graphical Information System
SCS	Soil Conservation System
LU	Land Use
AMC	Antecedent Moisture Condition
LC	Land Cover
HSG	Hydrological Soil Group

CHAPTER 1

INTRODUCTION

1.1 GENERAL

Understanding the hydrologic characteristics of an area, including the soil types, land cover/use dynamics, and rainfall runoff behavior, is crucial for effective water resource management and planning. The hydrologic soil groups A, B, C, and D are used to classify soils based on their infiltration capacity, which affects the amount of runoff generated during rainfall events. The SCS-CN technique is a commonly used method for modeling rainfall runoff and involves assigning a curve number to each unique land use soil group polygon within a drainage basin. The curve number is then used to estimate the amount of runoff generated during a rainfall event. By studying the rainfall runoff behavior of an area over time, it is possible to identify trends and patterns in hydrological phenomena and develop strategies to manage water resources sustainably

Hydrologic models rely on input data related to various physical parameters, such as rainfall, soil properties, topography, vegetation, air temperature, and land use/land cover. To estimate runoff, several methods have been developed, including the Green-Ampt method, rational method, and SCS-CN method. The SCS-CN method is particularly useful as it incorporates land use/land cover information, which can be generated using Geographic Information Systems (GIS).

Using GIS for runoff estimation offers several advantages over traditional methods as it allows for efficient storage, interpretation, and display of data. With GIS, land use/land cover information can be generated without the need for extensive field investigations, which can be time-consuming and costly. Additionally, GIS enables the integration of different types of data, such as remote sensing data, to improve the accuracy of runoff estimates. Overall, the use of GIS in hydrologic modeling can lead to more accurate and efficient estimation of surface runoff and can help inform decision-making related to water management and planning. The study utilized the SCS-CN method in combination with GIS techniques

to estimate surface runoff in the Thamirabarani river basin. This involved the digitization and analysis of various thematic layers, including soil types, land use/cover types, and rainfall data. The results of the study can be used to inform watershed development and planning, including the construction of hydrological harvesting structures such as farm ponds, check dams, and nala bunds to effectively manage and develop water resources. Accurate runoff estimation is crucial for effective water resource management and planning.

the SCS-CN method remains the most popular and widely used method for estimating runoff from rainfall due to its simplicity and reliance on important catchment properties such as soil type, surface, land use, and antecedent moisture conditions. GIS tools have been increasingly used to study land cover/use changes and estimate runoff in watersheds, which facilitates the development of conservation strategies and identification of areas susceptible to soil erosion. Various hydrological models have been developed for the strategic management and restoration of wetlands or water resources, each with their own unique characteristics and input data requirements. The proper management of all land and water resources in a watershed is crucial for optimum production and minimum hazard to natural resources. The occurrence and quantity of runoff is dependent on various characteristics of rainfall such as intensity, duration, and distribution. This study aims to estimate runoff using GIS and the SCS-CN method, with the help of spatial analysis for decision making.

1.2 INTRODUCTION TO ARCGIS

ArcGIS is a geographic information system (GIS) software developed by Esri that allows users to create, manage, analyze, and display spatial data. ArcGIS is widely used by professionals in a range of industries, including urban planning, environmental management, public health, and transportation, to name a few.

ArcGIS offers a range of tools and capabilities for working with spatial data, including data visualization, spatial analysis, and map creation. Users can import a variety of data formats, including shapefiles, geodatabases, and raster datasets, and perform operations such as data editing, geocoding, and network analysis. ArcGIS also offers a suite of extensions and add-ons for specialized functionality, such as 3D modeling, image analysis, and geostatistics.

ArcGIS is used by organizations around the world to help make informed decisions based on spatial data. It provides a powerful toolset for exploring and understanding the world around us, and has become an essential tool for many professionals in a variety of industries.

CHAPTER 2

LITERATURE REVIEW

2.1 GENERAL

The following major research program has been taken from international journals as reference to analyze the concepts for the project.

2.2 REVIEW OF THE LITERATURE

Khasanov (2020) suggested comparing the vertical accuracy of the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER DEM) to the Shuttle Radar Topography Mission (SRTM DEM) DEM for the area recommended for the construction of the Kyzylsay and Tashtepa water reservoirs in the Tashkent region, Uzbekistan. Based on GPS data, the root mean square error (RMSE) was used to calculate the vertical disparities between SRTM and ASTER products. The Toshtepa Reservoir, which is located in the plain, has an RMSE of 3.693 m, according to the results, whereas the Kyzylsay Reservoir, which is located in the highlands, has an RMSE of 12.82 m for SRTM and 15.77 m for ASTER.

Lalitesh Sinha et al., (2015) proposed that GIS automated watershed tool can be used in the delineation of watershed and their updation. The catchment area of 402309.00 sq.m obtained during a case study of Madhya Pradesh of 38 basins with the help of GIS tool effectively and it can be used for the estimation of average surface runoff equal to 8.92 cumecs by Rational formula.

Gridhar et al., (2015) showcased the application of Digital Elevation Models and the soil and water assessment tool for efficiently obtaining elevation, stream flow, and subbasin data. They used QSWAT to delineate watersheds based on this information.

Hunegnaw and Arega,(2021) showcased the application of Digital Elevation Models and the soil and water assessment tool for efficiently obtaining elevation, stream flow, and subbasin data. They used QSWAT to delineate watersheds based on this information.

Swapnil Medhi and Dr. Arnab Sarma, (2022) demonstrated the use of HEC GeoRAS and ArcGIS 10 extension models for flood modeling of a river. Specifically, they utilized HEC-GeoRAS to organize and process geometric input data obtained from the digital elevation model (DEM), and to delineate the floodplain map.

Abdulrazaq k. Abdulwahd et al., (2020) The Soil and Water Assessment Tool (SWAT), according to Swapnil Medhi and Dr. Arnab Sarma (2022), is a physically based distributed parameter model that was created to forecast runoff, sediment, and erosion from particular watersheds under various input conditions. The SWAT hydrological model, which is organised into 188 Hydrological Response Units and 19 sub-watersheds, was used to investigate the rainfall-runoff behaviour of the basin. Three soil grades and four landuse categories make up the watershed. The study's defined area is determined to be 1754.39 cube.km. According to the study, the amount of total runoff is correlated with the amount of annual rainfall.

Xin Wang et al., (2022) The flood detention effect of LRGs in basins has been researched based on weekly long-term water storage sequences, according to a proposal made by Xin Wang et al. in 2022. The Poyang Lake watershed is divided into five basins in this research. It is examined how the upstream LRG affects flood retention and the overall effects of the LRG in the basins on hydrological changes. When managing water resources, the performance of a region's reservoirs is crucial, especially for preventing flood disasters. Thus, one of the most significant issues that hydrologists and engineering experts must solve is how to relate the water storage of the LRG to the runoff in the basins.

Rachel Olawoyin, (2017) The Thiessen polygon method's application for determining areal rainfall depths in the River Volta basin of Ghana was proved by Rachel Olawoyin in 2017. According to a regression statistic used to determine the relationship between elevation and the catchment's rainfall distribution, the former has little to no influence on the latter. According to the evaluation of the Thiessen approach and the findings of the analysis of the rainfall field using polygons, the method can be used to determine the depths of rainfall in Ghana's River Volta basin. The catchment's

rain gauge network, however, needs to be enhanced in order to provide more and smaller polygons that indicate distributions in more condensed areas.

Ibrahim and Ahmed (2014) explored the use of HEC-HMS and SCN-CN to the rainfall-runoff modelling of the Doddahalla watershed in an ungauged agricultural watershed. The investigation of the hydrology of watersheds is severely hampered by the dearth of trustworthy rainfall-runoff recorded data in the Doddahalla watershed. Only with accurate knowledge of the rainfall-runoff and other hydrological factors that affect the water resource is sustainable management of the water supply in this area possible. Taking into account the existing issue with rainfall-runoff. The HEC-HMS hydrological simulation model is used for simulation, and remote sensing and GIS are integrated into the process. For agriculture and other economic operations to continue in drought-prone areas in arid and semi-arid countries, the ability to gather rainwater is crucial.

Ashish & Patil, (2010) A review of the estimation of runoff using the SCS Curve Number Method and Arc GIS was published in 2010 by Ashish & Patil. Although estimation of direct rainfall-runoff is usually effective, it is rarely feasible at the appropriate time for most locations. The usage of GIS and remote sensing technology can help to solve the issue with current runoff estimation techniques. modified in this paper. The hydrologic modelling time is largely taken up by the laborious old SCS-CN method for determining the composite curve number. As a result, the SCS - CN technique is now employed in conjunction with geographic information systems. Runoff is estimated using the Soil Conservation System (SCS) CN technique, which takes into account factors like slope, vegetation cover, and watershed area.

Devi and Baskar, (2016) has focused on the Surface Runoff Depth by SCS Curve Number Method Integrated with Satellite Image and GIS Techniques. The goal of this study was to quantify the annual average surface runoff depth of each watershed in order to infer indirectly the possibility of groundwater recharge. For the purpose of estimating surface runoff depth in conjunction with remote sensing (RS) and geographic information system (GIS) approaches, the curve number method developed by Soil Conservation Services (SCS) has been used. The main unit of the

SCS curve number approach is the curve number (CN), which is derived from the landuse/landcover and hydrological soil categories of the specific geographic area. Using GIS methods, the landuse/landcover and hydrological soil group have been obtained from satellite picture (LISS III). The surface runoff depth results for individual watersheds.

Satheeshkumar et al.,(2017) has Rainfall-runoff estimation using SCS-CN and GIS technique in the Pappiredipatti watershed of the Vaniyar sub basin, South India, has been reviewed by Satheeshkumar et al.,(2017). The assessment of source water accessibility for planning and design of artificial recharge structures relies heavily on hydrometeorological and hydrological data. Runoff from rivers, streams, and surface water bodies provides the watershed with the surface water resources. A runoff model assessment in a watershed is a prerequisite for the design of artificial recharge structures, reservoirs, and soil erosion control. The total study area is approximately 179.4 km², of which fall in the Vaniyar subbasin. However, pappiredipatti is one of the main catchment areas of the basin.

Mamata Singh,(2017) has a study on Rainfall-Runoff Estimation Using SCS-CN and GIS Approach in the Kuakhai Watershed of the Mahanadi Basin of Bhubaneswar, Odisha, was completed by Mamata Singh in 2017. To ascertain and foretell its impacts, the same is estimated. Although estimation of direct rainfall-runoff is usually effective, it is rarely feasible at the appropriate time for most locations. The usage of GIS and remote sensing technology can help to solve the issue with current runoff estimation techniques. In this study, the modified Soil Conservation System (SCS) CN technique is employed to estimate runoff while taking into account variables such as slope, vegetation cover, and watershed area. The main contributor to the hydrologic cycle and the main source of runoff is rainfall.

Vanve Devidas & Dr.S.K.Ukaran, (2017) has concentrated on A Case Study on Bazar Watershed, Gujarat, India: Surface Runoff Estimation Using SCSCN Method. The runoff generating process is incredibly intricate, nonlinear, dynamic, and influenced by a wide range of interconnected physical elements. To manage and expand water resources effectively, accurate runoff estimation is done. There are other ways to

calculate runoff from rainfall, but the SCS-CN method is still the most widely accepted, successful, and practical approach. An important component of the SCS-CN approach is runoff curve number (CN), which depends on the soil type, antecedent soil moisture, and land use/land cover (LULC).

Arvind Chandra Pandey,(2017) has In the upper south koel river basin of Jharkhand (India), Arvind Chandra Pandey has researched the Geospatial methodology for runoff estimation based on SCS-CN method.The SCS-CN approach is used in the current study to compute run-off utilising geoinformation. The majority of the south Koel river basin, which is in the state of Jharkhand, is susceptible to drought, which frequently occurs during the monsoon season. The study suggests that in the future, for efficient ground water management, sub-watersheds with high runoff values need to have hydrological harvesting structures such farm ponds, check dams, and nala bunds constructed. The study showed how watershed management using geoinformatics might help fight drought. The application of remote sensing tools and technologies significantly improves rainfall runoff studies conducted using traditional methods.

Aghil&Rajashekhar,(2018) has discussed how this study's Estimation of Runoff Using SCS-CN Method for Yelahanka Region is useful for the development of watersheds and efficient planning of water resources. The findings indicate that the SCS-CN method is a potentially effective and trustworthy way to gauge runoff in the Yelahanka watershed basin. In Bengaluru, flooding is a common occurrence during periods of high rainfall because to the loss of wetlands and vegetation caused by urbanisation. If you think back to the recent disaster in Bengaluru, the South-West monsoon was meant to cease by the end of September but instead lingered for a few more days, causing overflowing lakes and flooding in several areas of the city.

Eshanthini P et al.,(2018) has conducted research on Estimating Rainfall Runoff Using SCS Model and ArcGIS for Micro Watershed in Cuddalore District (2018).The objective of the current study is to estimate the volume of surface runoff using the SCS curve number approach and remote sensing data from Arc GIS. The Cuddalore micro watershed in Tamilnadu's Cuddalore district was the subject of the investigation. The

region that was used for this study as a whole is 58.54 km². ArcGIS software was used to construct the soil map, as well as maps of land use and land cover. Natural Resource Conservation Service (NRCS) standard table is used to calculate the curve number values for the study region. The research area's estimated runoff is 4260 mm.

Nametso Matomela et al. (2019) has researched how to manage watersheds using the SCS-CN model and GIS to estimate rainfall and runoff in the Bojiang Lake Watershed. Data on runoff volume and distribution is essential for developing effective water management plans, including those for choosing locations for artificial water abstraction, building water storage facilities, and preventing soil erosion. To demonstrate how the Soil Conservation Service Curve Number method (SCS-CN) in conjunction with Geographic Information System (GIS) and Remote Sensing (RS) techniques was employed in the current study, Bojiang Lake Watershed was utilised. The Erdos Larus Relicts National Nature Reserve (ELRNNR), which was designated as a wetland of world significance in 2002, contains the watershed. A watershed's soil and land use/cover types, soil moisture content, rainfall, drainage density, and other factors all affect rainfall runoff.

Jaimin & Indra Prakash (2015) has concentrated on A Case Study on Bazar Watershed, Gujarat, India: Surface Runoff Estimation Using SCSCN Method. The runoff generating process is incredibly intricate, nonlinear, dynamic, and influenced by a wide range of interconnected physical elements. To manage and expand water resources effectively, accurate runoff estimation is done. There are other ways to calculate runoff from rainfall, but the SCS-CN method is still the most widely accepted, successful, and practical approach. An important component of the SCS-CN approach is runoff curve number (CN), which depends on the soil type, antecedent soil moisture, and land use/land cover (LULC).

Anil Kumar & Viswanad (2017) completed the project on a Runoff Estimation utilising the SCS Curve Number Method. Rainfall that has been precipitated and integrated into a GIS seeps into the earth as ground water and travels through streams as surface runoff and subsurface runoff to the ocean. The portion that enters the stream after rainfall is known as direct surface runoff or storm runoff. The extent and slope of

the terrain, topographic features, development levels, channel gradients, and channel inclinations all have an impact on runoff volumes and speeds. Lower runoff occurs on slopes with large flat sections or depressed areas without surface outlets than on slopes with steep slopes and clearly defined drainage patterns. It is a technique that can take land usage into account when calculating runoff from rainfall.

Patil et al J.P,(2008) has research on the Creation of a GIS Interface for Runoff Estimation from Watersheds The lack of hydrologic gauging stations in the majority of watersheds necessitates the development of precise surface runoff estimating methodologies from ungauged watersheds. One of the most popular techniques for quickly and precisely estimating surface runoff from ungauged watersheds is the Natural Resources Conservation Services Curve Number (NRCS-CN) method. Additionally, runoff prediction is automated in a timely and effective manner thanks to the combination of NRCS-CN methodologies and sophisticated Geographic Information System (GIS) capabilities. With the aid of a double ring infiltrometer, sample site infiltration rates are calculated. The models used in this study are then given all the parameters to determine the runoff characteristics.

Sameer shaded & Mohammad almasri (2010) The most fundamental hydrologic issues are the forecast and quantification of catchment surface runoff, as has been discussed about the Application of GIS based SCS-CN approach in West Bank Catchments, Palestine. The SCS (Soil Conservation Service) based hydrologic modelling method relies on the runoff curve number (CN) to predict runoff. The composite curve number is typically calculated using the arduous SCS-CN approach, which takes up a significant amount of the hydrologic modelling time. As a result, the SCS-CN approach is currently combined with geographic information systems (GIS). In this research, the GIS-based SCS-CN approach is used to evaluate the modelling of flow in West Bank catchments. Their primary drawback is that they need a great deal of skill, effort, and time to utilise efficiently. between two opposites

VassiliosA.Tsihrintzis et al.,(1996) has performed Water resource use of geographic information systems (GIS) The management of water resources frequently requires the storage, management, and display of spatial data. Geographic Information

Systems (GIS) are a useful tool for this. The use of GIS for water resource management is constantly expanding. Applications in this field are discussed and appraised for effective future research and development in order to emphasise the significance of GIS in water resource management. The basics of GIS are outlined, and the development of GIS in the context of water resources is examined throughout history. The ability to create computer applications to handle the issue of storing, manipulating, and analysing massive volumes of spatial data connected to water has been made possible and even made easier by the recent expansion in computer technology.

Chatterjee et al. has C, outlined GIS and SCS are used to estimate the number of runoff curves in a basin. The management of water resources frequently requires the storage, management, and display of spatial data. Geographic Information Systems (GIS) are a useful tool for this. The use of GIS for water resource management is constantly expanding. Applications in this field are discussed and appraised for effective future research and development in order to emphasise the significance of GIS in water resource management. The basics of GIS are outlined, and the development of GIS in the context of water resources is examined throughout history. The recent development in computer technology has made it possible and even simpler to create computer programmes to deal with the issue of storing, manipulating, and analysing massive amounts of spatial data relating to a lack of water resources. Geographic Information Systems (GIS) are widely used today by many organisations to forecast consequences related to spatial variability of data. When working with map and non-graphic attribute data, GIS offers tools to increase productivity and effectiveness. Although the capabilities of various GIS programmes may differ, the most of them have the following elements. The government was the primary client of the initial GIS development work, as a result of its data handling requirements.

Zahraa Mahmood Klari and Saryan Ahmed Ibrahim (2021) had provided ideas for the widely-used Soil Conservation Curve Number (SCS-CN) approach, which produces accurate results when compared to other methods. The goal of the current study is to use a GIS to compute the surface runoff depth based on the SCS-CN approach.

Viji et al.,(2015) R the Green - Ampt and SCS-CN Methods in Surface Runoff
Two methods are used to model the runoff of the research area: the modified Soil Conservation Curve Number (SCS-CN) and the Green-Ampt loss method. By employing ARCGIS and IDRISI image processing software, the associated thematic variables on runoff characteristics are created with satellite pictures. Based on the Soil Wetness Index (SWI), curve numbers are assigned. For the purposes of determining hydraulic conductivity, moisture content, wetting front capillary pressure, bulk density, porosity, etc., sixteen soil samples were collected from various locations. With the aid of a double ring infiltrometer, sample site infiltration rates are calculated. The runoff characteristics of the study area are then determined by assigning all the parameters to the models used in this study.

Ramakrishnan et al.,(2009) D have researched the use of SCS and GIS to locate prospective water harvesting locations in India's Mahi River Basin's Kali Watershed. This area experiences drought-like conditions from December to June practically every year because of high runoff potential, evapotranspiration, and low penetration. The development of runoff harvesting structures such check dams, percolation ponds, farm ponds, wells, and subsurface dykes is suggested as a way to increase the amount of water available in this research. Runoff potential, slope, fracture pattern, and micro-watershed area are some of the spatially variable factors that are taken into account when determining the feasibility of a site for various water collecting structures. To store, analyse, and integrate spatial and attribute data relating to runoff, slope, drainage, and fracture, GIS is used as a tool.

CHAPTER 3

AIM AND SCOPE

3.1 AIM

The aim of the project is to Estimate the Rainfall-Runoff modelling in Thamirabarani Basin Tirunelveli, Tamilnadu.

3.2 OBJECTIVES

1. To Calculate Average Rainfall using THISSEN POLYGON method using Arc GIS Software.
2. To Prepare Landuse and Land cover map using ArcGIS.
3. To Calculate Runoff using SCS Curve number method for different flood years.

3.3 SCOPE

1. To estimate the surface runoff using ArcGIS.
2. To identify flood-prone in our study area.
3. To delineate the watershed for Thamirabarani Basin.
4. This type of runoff plot facilities the measurement of runoff and soil loss
5. And both a fixed are the are value of runoff or soil loss data can be extended for large area by multiplying the unit value of measured parameter with the area.

CHAPTER 4

METHODOLOGY

4.1 STUDY AREA

The Thamirabarani River is a perennial river in southern India that originates in the Western Ghats and flows eastward through the state of Tamil Nadu before emptying into the Bay of Bengal. The river is also known as the Porunai River, and is the only major river in Tamil Nadu that flows throughout the year.

The Thamirabarani River has a total length of 125 km and a catchment area of 5,556 sq km. It is fed by several tributaries, including the Kallar, Chittar, Manimuthar, and Pachaiyar rivers. The river basin is home to several small and medium-sized dams that are used for irrigation and power generation.

The Thamirabarani River is considered sacred by the people of Tamil Nadu, and is revered as the "southern Ganges". The river has significant cultural and religious importance, and is associated with several myths and legends. It is also an important source of drinking water for the people of Tirunelveli and surrounding areas.

The river is known for its rich biodiversity, with several endemic and endangered species found in its catchment area. The river basin is home to several important wildlife sanctuaries and protected areas, including the Kalakad Mundanthurai Tiger Reserve, the Koonthankulam Bird Sanctuary, and the Courtallam Reserved Forest.

However, the Thamirabarani River is facing several environmental challenges, including pollution from agricultural and industrial activities, encroachment of its banks, and sand mining. These factors have contributed to a decline in the river's water quality and flow, and have led to concerns about the long-term sustainability of the river and its ecosystems.

4.2 LOCATION FOR STUDY AREA

The Thamirabarani River is a perennial river that flows through the Indian state of Tamil Nadu. The river originates in the Agastya Mala hills in the Western Ghats and flows for about 125 km before emptying into the Bay of Bengal.

The study area of Thamirabarani River includes the river basin, which covers an area of approximately 5,662 square kilometers. The river basin is divided into three sub-basins: the Kodayar sub-basin, the Karaiyar sub-basin, and the Thamirabarani sub-basin. The basin lies between 8°26'45"N and 9°12'00"N latitude and 77°09'00"E and 78°08'30"E longitude. The basin receives an annual rainfall of about 1,100mm during the Southwest monsoons(June-September) and the Northeast monsoons(October-December).

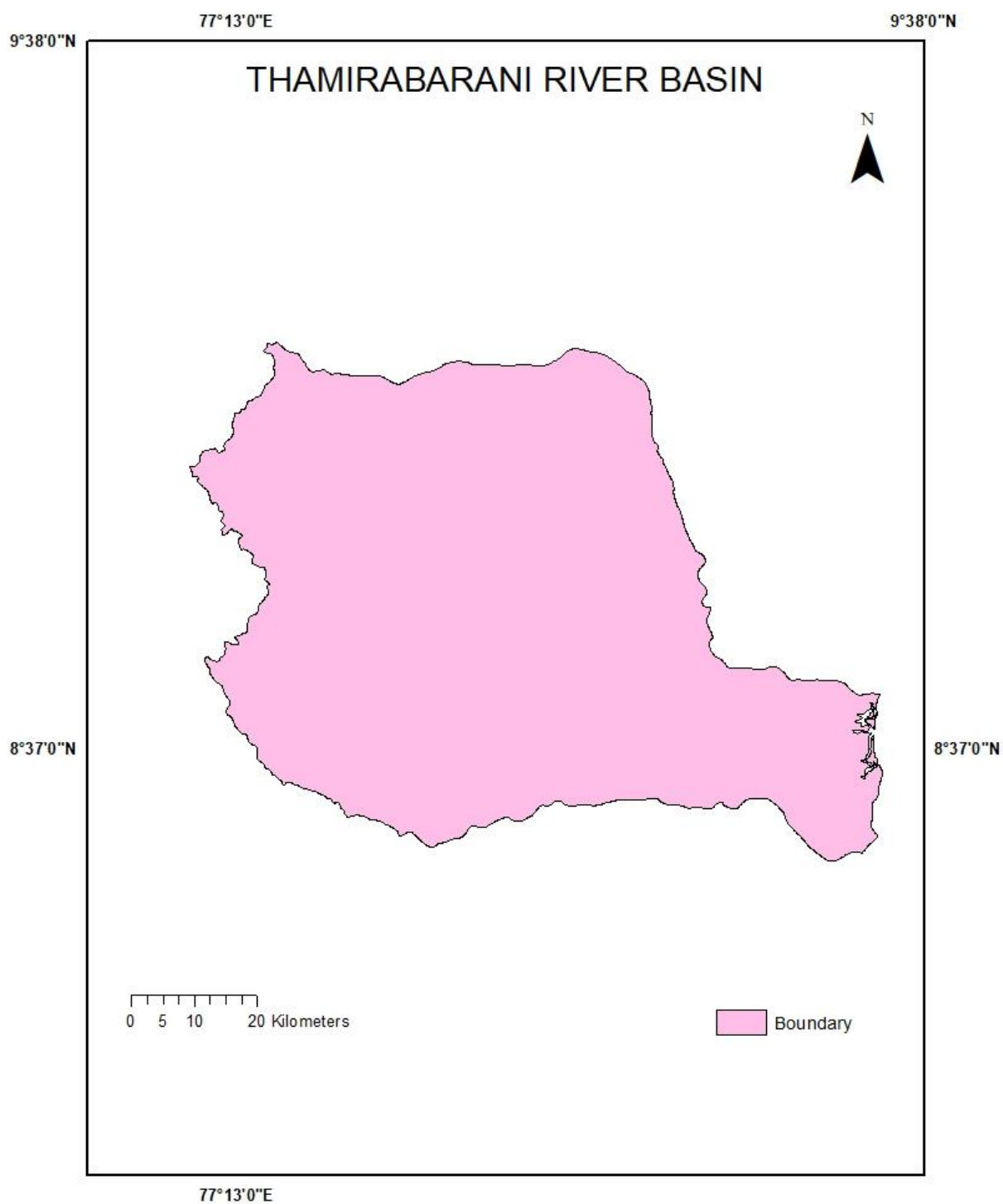


Fig: 4.1: Study Area Map

4.3 DATA USED

1. To create a land use and land cover map, Landsat-8 data was downloaded from the USGS website and processed in ARCGIS software.
2. The soil map was created using data on soil properties provided by NRCS.
3. The SRTM DEM data was obtained from USGS for topographical analysis.
4. Rainfall data was collected from the State ground and surface water resource data center for further analysis.

4.4 METHODOLOGY

The methodology of this project includes data collection, preparation of maps and calculation of runoff. Fig 4.3 shows the methodology of the work. ARCGIS requires various input data for simulation of watershed. The data required are land use/ land cover, soil cover, precipitation. Then the software is run by giving these data as inputs.

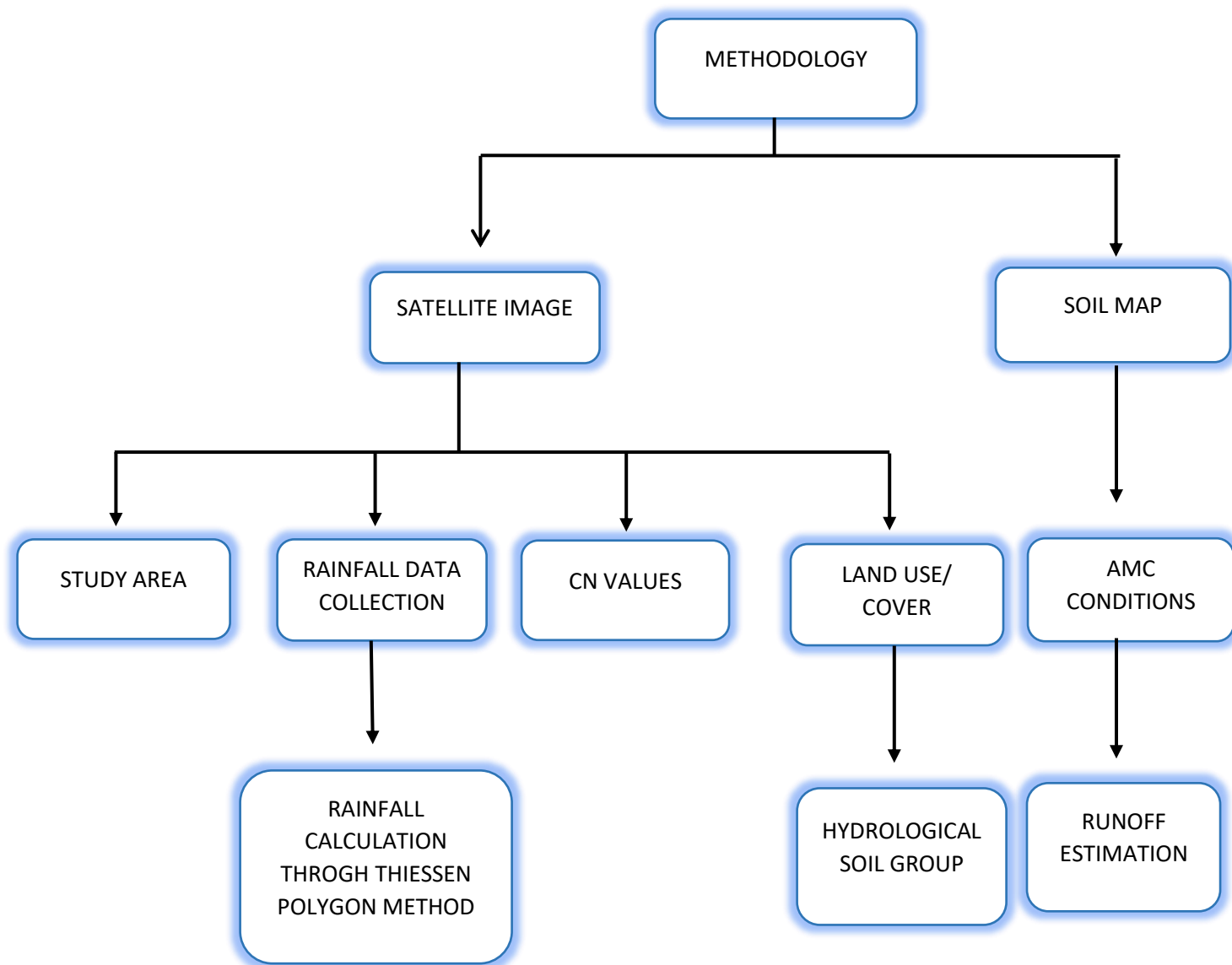


Fig: 4.2: Methodology

4.5 ANTECEDENT MOISTURE CONDITION (AMC)

It alludes to the amount of moisture in the soil at the start of the aforementioned rainfall-runoff event. It is well established that AMC controls early abstraction and penetration. Three degrees of AMC are recognised for practical application purposes. SCS recognises AMC in the following ways:

1. AMC-I: The soil is dry but not to the point of wilting. Successful cultivation has occurred.
2. AMC-II stands for average condition.
3. AMC-III: Within the previous five days, there has been sufficient precipitation. The dirt is mostly saturated.

Table: 4.1 Classification of AMC condition

AMC Type	Total Rain in previous 5 days	
	Dormant Season	Growing Season
I.	Less than 13 mm	Less than 36 mm
II.	13 to 28 mm	36 to 53 mm
III.	More than 28 mm	More than 53 mm

4.6 THESSIEN POLYGON METHOD

The Thessien polygon method is a hydrological model used for estimating the flood discharge from small and medium-sized watersheds. The Thessien polygon method is a hydrological model used for estimating the flood discharge from small and medium-sized watersheds. It was developed in Japan by the River Bureau of the Ministry of Construction in the 1970 and is named after the chief engineer who led the development team. The Thessien polygon method is based on the assumption that the flood discharge from a watershed is proportional to the effective rainfall, which is the rainfall that contributes to the runoff. The effective rainfall is estimated using a rainfall-runoff coefficient, which is a function of the watershed characteristics such as slope, soil type, land use, and drainage density. The Thessien polygon method divides a watershed into subareas and calculates the effective rainfall for each subarea based on its characteristics. The effective rainfall is then aggregated for the entire watershed to estimate the total runoff volume. The model also accounts for the time lag between rainfall and runoff, which is important for flood forecasting. The Thessien polygon method has been widely used in Japan and other countries for flood control and management. It is relatively simple to apply and requires only basic data on watershed

characteristics and rainfall. However, it has some limitations, such as the assumption of proportionality between flood discharge and effective rainfall, which may not hold true for all watersheds. The model also does not account for the effects of land use changes or other factors that may affect the runoff generation process.

$$\frac{P_1A_1 + P_2A_2 + \dots + P_nA_n}{A_1 + A_2 + \dots + A_n}$$

P – Rainfall Station

A – Area of rainfall Station

Table: 4.2 Total Area of Precipitation

	A	B	C	D	E	F	G	H	I	J	K
1	Station Name	Year	Month	Day	RF in mm	Area (Squarre km)	PA				
2	Ambasamudram	2010	1	1	0	224.271	0				
3	Ambasamudram	2010	1	2	0	224.271	0				
4	Ambasamudram	2010	1	3	0	224.271	0				
5	Ambasamudram	2010	1	4	0	224.271	0				
6	Ambasamudram	2010	1	5	0	224.271	0				
7	Ambasamudram	2010	1	6	0	224.271	0				
8	Ambasamudram	2010	1	7	0	224.271	0				
9	Ambasamudram	2010	1	8	0	224.271	0				
10	Ambasamudram	2010	1	9	0	224.271	0				
11	Ambasamudram	2010	1	10	9.2	224.271	2063.2932				
12	Ambasamudram	2010	1	11	52	224.271	11662.092				
13	Ambasamudram	2010	1	12	0	224.271	0				
14	Ambasamudram	2010	1	13	1.2	224.271	269.1252				
15	Ambasamudram	2010	1	14	14.2	224.271	3184.6482				
16	Ambasamudram	2010	1	15	0	224.271	0				
17	Ambasamudram	2010	1	16	0	224.271	0				
18	Ambasamudram	2010	1	17	0	224.271	0				
19	Ambasamudram	2010	1	18	0	224.271	0				
20	Ambasamudram	2010	1	19	0	224.271	0				
21	Ambasamudram	2010	1	20	0	224.271	0				
22	Ambasamudram	2010	1	21	0	224.271	0				
23	Ambasamudram	2010	1	22	0	224.271	0				
24	Ambasamudram	2010	1	23	0	224.271	0				
25	Ambasamudram	2010	1	24	0	224.271	0				
26	Ambasamudram	2010	1	25	0	224.271	0				
27	Ambasamudram	2010	1	26	0	224.271	0				
28	Ambasamudram	2010	1	27	0	224.271	0				
29	Ambasamudram	2010	1	28	0	224.271	0				

Table: 4.4 Normal rainfall and Actual rainfall values

YEAR	NORMAL RAINFALL IN mm	ACTUAL RAINFALL IN mm
2010	710.023	784.3513
2011	710.023	716.3477
2012	710.023	664.7047
2013	710.023	690.5496
2014	710.023	759.9015
2015	710.023	1063.9960
2016	710.023	314.7081
2017	710.023	711.9841
2018	710.023	759.9015
2019	710.023	759.9015
2020	710.023	759.9015

4.7 PREPARATION OF THEMATIC MAPS

LULC Map: Using supervised classification and satellite data, the LULC map was created. Five classifications of land use and land cover were found in the research region.

Watershed Soil Map: ArcGIS was used to create the watershed soil map. In our study, we looked at four different types of soil—deep sand, mixed red and black soils, and heavy plastic clays—that fall into the hydrologic soil categories A, B, C, and D. Three groups, A, B, C, and D, according to the rate of infiltration.

4.8 HYDROLOGIC SOIL GROUP (HSG)

The NRCS curve number is related to soil type, soil infiltration capability, land use, and the depth of the seasonal highwater table. To account for different soil's ability to infiltrate, NRCS has divided soils into four hydrologic soil groups (HSGs). They are defined as follows.

HSG Group A(low runoff potential)

Soils with high infiltration rates even when thoroughly wetted. These consist chiefly of deep, well drained sands and gravels. These soils have a high rate of water transmission (final infiltration rate greater than 0.30 in (7.6mm) per hour).

HSG Group B

Soils with moderate infiltration rates when thoroughly wetted, These consists chiefly of soils that are moderately deep to deep, moderately well drained to well drain with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (final infiltration rate of 0.15-0.30 in (3.8-7.6mm) per hour).

HSG Group C:

Soils with slow infiltration rates when thoroughly wetted. These

consist chiefly of soils with a layer that impedes downward movement of water or soils with moderately fine to fine textures. These soils have a slow rate of water transmission (final infiltration rate 0.05-0.15 in (1.3-3.8mm) per hour).

HSG Group D(high runoff potential)

Soils with very slow infiltration rates when thoroughly wetted. These consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a clay pan or clay layer at or near the surface, and shallow soils over nearly impervious materials. These soils have a very slow rate of water transmission (final infiltration rate less than 0.05 in (1.3mm) per hour)

Table: 4.5: Classification of hydrological soil group

Hydrological Soil Group	Soil Name	Area (m2)	Percentage of Area (%)
Group A	SAND	142.75	2
Group B	SANDY LOAM	391.37	5
Group C	SANDY CLAY LOAM/LOAM	7275.5	87
Group D	CLAY	545.03	6
SUM		8354.65	100

Table: 4.6: Summary of HSG characteristics

HSG	Surface Runoff Potential	Final infiltration rate (mm/h)	Permeability rate (mm/h)
A	Low	25	>7.6
B	Moderately low	13	3.8 to 7.6
C	Moderately high	6	1.3 to 3.8
D	High	3	<1.3

Table: 4.7: Soil types according to soil texture

Soil Type	Soil Texture
Alfi sols	Silt, sand
Enti sols	Sandy loam
Incepti sols	Clayey loam
Reserve Forest	saline soils

4.9 SOIL MAP

Soil survey is an integral part of an effective agricultural research and advisory program. It provides complete information about soils and is an inventory of the soil resource of the area. It gives the information needed for planning land use and soil management programs. Soil map is a geographical representation showing diversity of soil types and/or soil properties (soil PH, soil textures, organic matter depths of horizons, etc.). Soil map of the study area was collected from the geological survey of India. Soil mapping is very important for the correct implementation of sustainable land use Management. Soil mapping provides important information about the characteristics and condition of the land. There are generally two levels to a soil map for land use management. The first is an inventory of soil properties, which by themselves describe the condition of the soils when they were mapped. The second level consists of interpretations. This additional information, synthesized from the soil. The soil map of the watershed is scanned, rectified and geometrically corrected. Different soil polygons representing different types of soil texture are digitized using Arc map software. Different attributes of soil such as texture, hydrologic soil groups are assigned to these polygons. The study area is covered with three different soils. Here the soil classification will be done in order to assign the soil properties to the different polygons. A user look up table containing the soil code names as in the data base of ARCGIS will be used for classification. Fig4.7 &4.8 show soil map & soil classification.

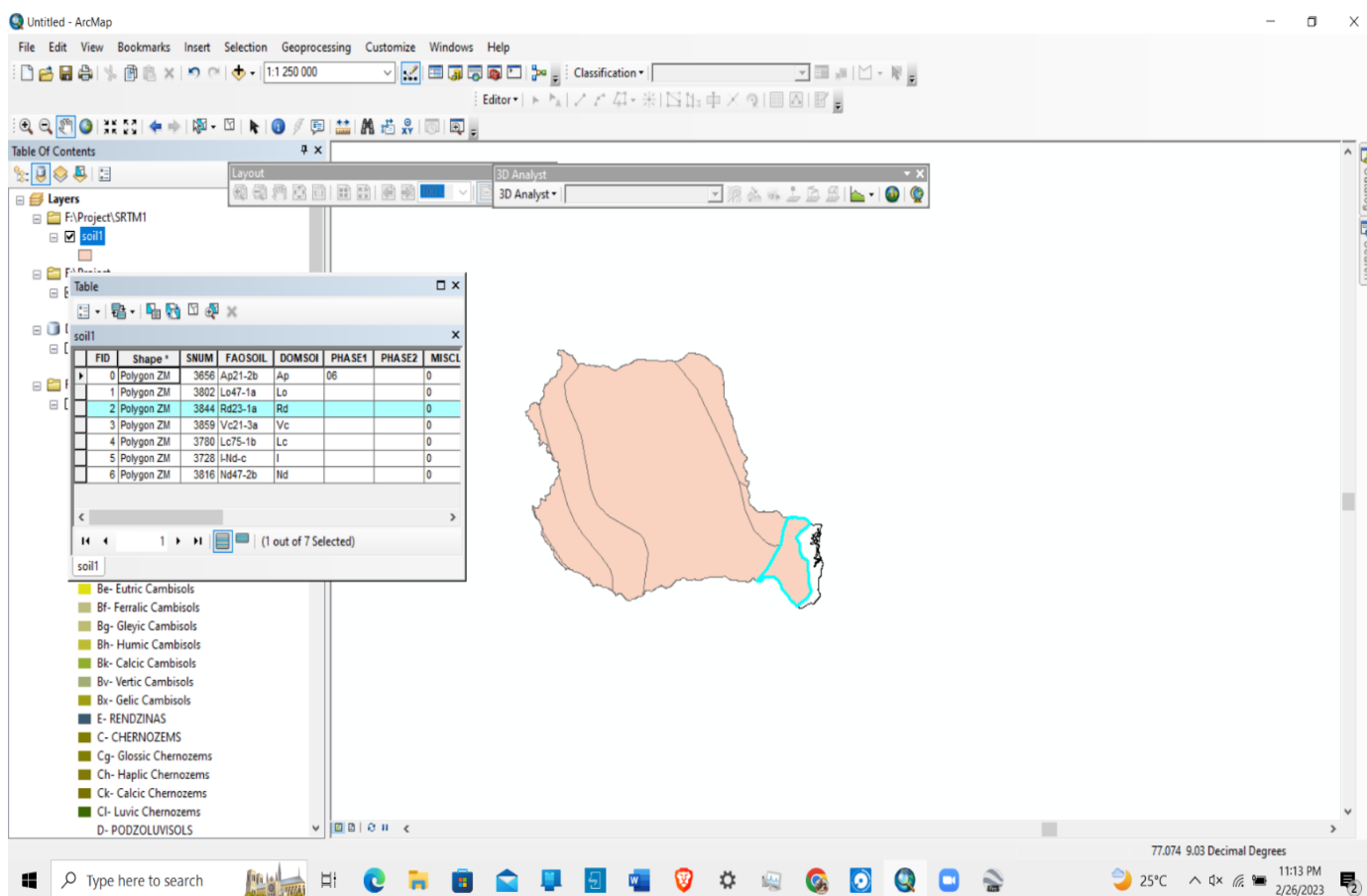


Fig:4.: Soil Classification in Arcmap

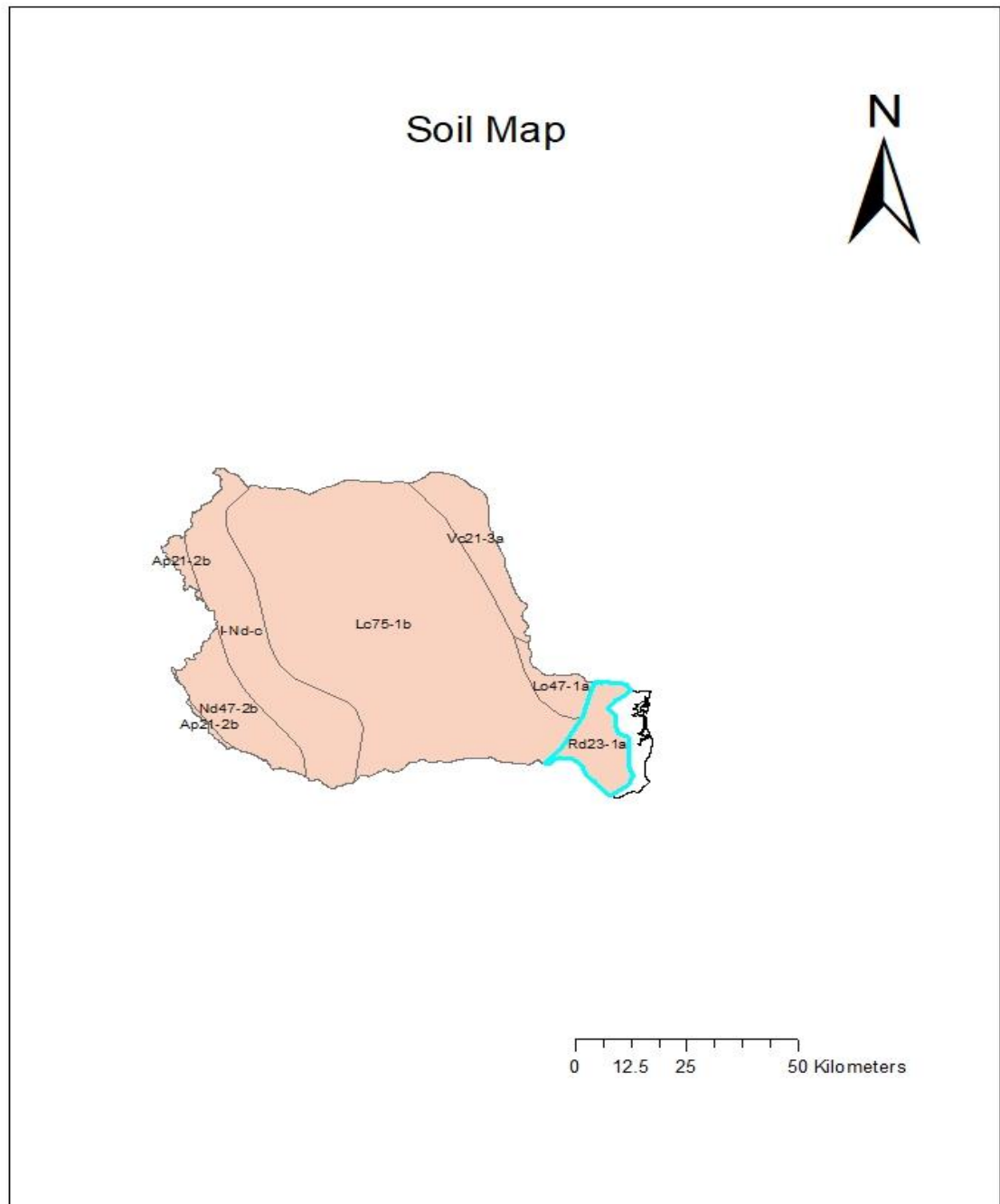


Fig:4.4: Soil Map

4.10 LAND COVER/USE CLASSIFICATION

Land use land cover (LULC) Land use land cover (LULC) is a term used to describe the physical and functional characteristics of land surfaces on the earth. It refers to the way that humans utilize and manage land for different purposes, and the resulting changes in the natural and built environment. Land use refers to the human activities and functions that occur on the land, such as agriculture, urban development, mining, forestry, and recreation. Land cover refers to the physical and biological features of the land surface, such as forests, grasslands, wetlands, water bodies, and barren areas. Land use and land cover are closely related and can be used to understand the interactions between human activities and the natural environment. For example, changes in land use can lead to changes in land cover, such as deforestation, urbanization, or agricultural expansion. Conversely, changes in land cover can also affect land use, such as changes in soil quality or water availability. LULC information is important for many applications, such as land management, resource planning, environmental monitoring, and disaster response. Remote sensing and geographic information systems (GIS) are commonly used to map and analyse land use and land cover over large areas, using data from satellites or aerial surveys. This information can then be used to inform decision making and support sustainable land use practices.

4.10.1 Data Acquisition

Download the Landsat 8 images for bands 3, 4, and 5 for the Thamirabarani river basin for the year 2020 in USGS. United States Geological Survey (USGS) The United States Geological Survey (USGS) is a scientific agency of the United States government that studies natural resources, natural hazards, and the impacts of climate and land-use changes. It was established in 1879 as a federal agency within the Department of the Interior, and is headquartered in Reston, Virginia. The USGS provides a wide range of scientific information and services to support resource management, environmental quality, and public health and safety. It conducts research and monitoring programs in areas such as geology, hydrology, biology, geography, and

mapping. The USGS also operates a variety of data collection networks and instruments, including stream gauges, seismic stations and water quality sensors.

Some of the key functions of the USGS include:

1. Conducting scientific research on natural resources, hazards, and environmental issues.
2. Monitoring and assessing natural resources, hazards, and environmental changes.
3. Providing geospatial and mapping data and tools
4. Developing and maintaining scientific models and tools to support decision making.
5. Providing scientific information and technical assistance to government agencies, industry, and the public
6. The USGS also plays an important role in supporting disaster response and recovery efforts, providing scientific information and expertise to help communities prepare for, respond to, and recover from natural disasters such as earthquakes, hurricanes, and wildfires. Overall, the USGS is a key resource for scientific information and expertise related to natural resources and the environment in the United States.

4.10.2 Land Use Land Cover (LULC) Process

Then use in ARCMAP software that is ESRI developed software and use GIS related analysis and modelling and manipulating software. To create a land use land cover map using Landsat-8 bands 3, 4, and 5 in ARCMAP.

1. Open ArcGIS and add the Landsat 8 images to the map. It can do this by clicking on the "Add Data" button and selecting the images from your local files.
2. Create a composite image: To create a False colour composition(FCC) using the Landsat-8 bands, go to the "Image Analysis" tab and select "Composite Bands".

Choose bands 4, 3, and 2 as your red, green, and blue channels, respectively. This will create a true colour composite image.

3. Apply image classification: To classify the land use land cover, use image classification tools in ArcGIS, such as the Maximum Likelihood Classification tool. Need to select training samples from the composite image, and assign them to different classes, such as barren land, build-up area, agriculture area, forest, and water body. The tool will then classify the entire image based on these classes.
4. Refine the classification: Once classified the image then find the area of class use Accuracy Assessment tools to evaluate the accuracy of your classification and area of the class.
5. Create a land use land cover map by assigning different colours or symbols to each land use class.

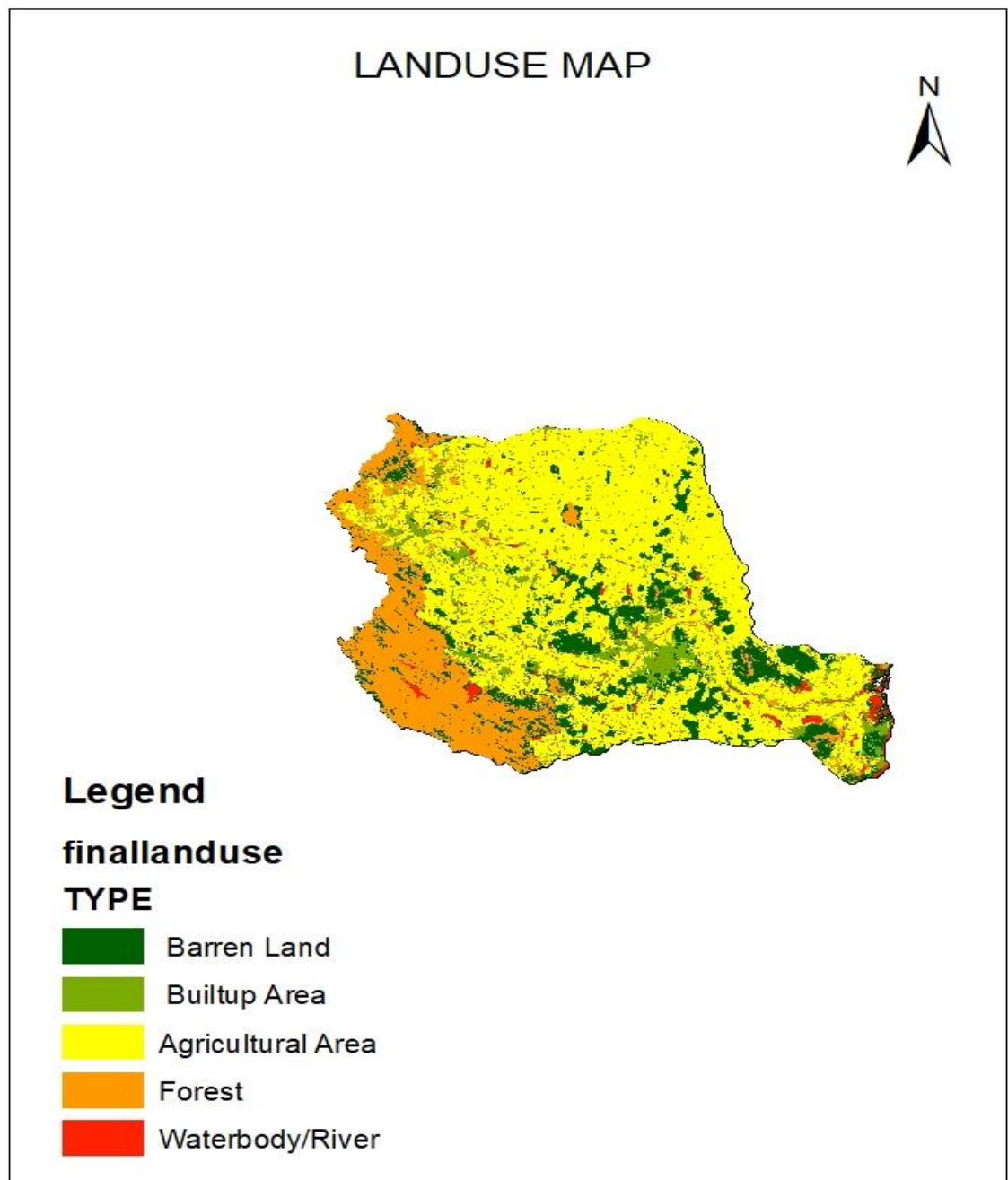


Fig:4.5 :Class of LU/LC of the study area (2020)

4.10.3 Land Use Calculation (2020):

Land use land cover classification refers to the process of categorizing the physical characteristics of land areas. Land use refers to the human activities that take place on the land, such as agriculture, urbanization, forestry, and mining. Land cover, on the other hand, refers to the physical features of the land, such as vegetation, water bodies, and barren land.

LAND USE	AREA (%)	SOIL GROUP(A)			SOIL GROUP(B)			SOIL GROUP(C)			SOIL GROUP(D)		
		%	CN	Product	%	CN	Product	%	CN	Product	%	CN	Product
Agriculture	56	0.41	72	29.52	3	81	243	47.6	88	4188.8	5.12	91	465.92
Forest	18	0.1	25	2.5	0.46	55	25.3	17.1	70	1199.8	0.02	77	1.54
Barren land	14	0.7	71	49.7	0.68	80	54.4	12.2	85	1037	0.32	88	28.16
Buildup Area	9	0.39	57	22.23	0.59	72	42.48	7.87	81	637.47	0.27	86	23.22
Waterbody	3	0.4	97	38.8	0.27	97	26.19	2.16	97	212.43	0.27	97	26.19
SUM	100%			142.75			391.37			7275.5			545.03

Classification of Soil Data Type:

Table: 4.10: Classification of Soil Data Type

SAND	A
Sandy loam	B
Sandy clay loam/loam	C

Clay	D
------	---

Soil Group A:

That is find the product and curve number of the soil group A from land use land cover area

Table: 4.11: Soil Group A

Class	%	Curve number	Product
Agricultural Land	0.41	72	29.52
Forest	0.1	25	2.5
Bare land	0.7	71	49.7
Buildup Areas	0.39	57	22.23
Waterbody	0.4	97	38.8
Sum	2		142.75

Soil Group B:

That is find the product and curve number of the soil group B from land use land cover area

Table: 4.12: Soil Group B

Class	%	Curve Number	Product
Agricultural Land	3	81	243
Forest	0.46	55	25.3
Bare land	0.68	80	54.4
Buildup Areas	0.59	72	42.48
Waterbody	0.27	97	26.19
Sum	5		391.37

Soil Group C:

That is find the product and curve number of the soil group C from land use land cover area

Table: 4.13: Soil Group C

Class	%	Curve Number	Product
Agricultural Land	47.6	88	4188.8
Forest	17.14	70	1199.8
Bare land	12.2	85	1037
Buildup Areas	7.87	81	637.47
Waterbody	2.19	97	212.43
Sum	87		7275.5

Soil Group D:

That is find the product and curve number of the soil group D from land use land cover area

Table: 4.14: Soil Group D

Class	%	Curve Number	Product
Agricultural Land	5.12	91	465.92
Forest	0.02	77	1.54
Bare land	0.32	88	28.16
Buildup Areas	0.27	86	23.22
Waterbody	0.27	97	26.19
Sum	6		545.03

4.11 CURVE NUMBER

The curve number is based on the research area's land use and land cover patterns, as well as the soil type and antecedent moisture condition. The soil conservation service (SCS) of the USA has expressed S (in mm) in terms of a dimensionless parameter CN (the curve number), where CN is used for moderate antecedent moisture condition (AMCII) and is regarded as the base CN. It can be changed to calculate CN_{III}, which is used for antecedent moisture conditions that are almost saturated (AMCIII), or CN_I, which is used for conditions when antecedent moisture is dry (AMCI).

- CN_{II} is the curve number for normal condition,
- CN_I is the curve number for dry condition, and
- CN_{III} is the curve number for wet condition.

$$CN_I = \frac{CN_{II}}{2.281 - 0.01281CN_{II}}$$

$$CN_{III} = \frac{CN_{II}}{0.427 + 0.005373CN_{II}}$$

$$CN = \frac{\sum A_i * CN_i}{\sum A_i}$$

Where, CN is the composite curve number, A_i is the area for each curve number.

Fig: 4.15: Curve Number for Three AMC

YEAR	AMC	I	II	III
2020	CN	70	84	92

Table: 4. 16: CN_{II} Values for Suburban and Urban Land Uses

Cover and Treatment	Hydrologic soil group			
	A	B	C	D
1. In good condition, grass cover in more than 75% area	39	61	74	80
2. In fair condition, grass cover on 50 to 75% area	49	69	79	84
3. Commercial and business areas (85% impervious)	89	92	94	95
4. Industrial districts (72% impervious)	81	88	91	93
5. Residential, average 65% impervious	77	85	90	92
6. Paved parking lots, paved roads with curbs, roofs, driveways, etc.	98	98	98	98
7. Streets and roads, gravel	76	85	89	91
8. Dirt	72	82	87	89

Fig: 4.17: Runoff curve numbers for hydrologic soil cover complexes

SI No	LAND USES	Hydrologic Soil Group			
		A	B	C	D
1	Agriculture land without conservation (Khari f)	72	81	88	91
2	Double crop	62	71	88	91
3	Agriculture plantation	45	53	67	72
4	Land with scrub	36	60	73	79
5	Land without scrub(stony waste/rock outcrops)	45	66	77	83
6	Forest(degraded)	25	55	70	77
7	Forest plantation	25	55	70	77
8	Grass land/pasture	39	61	74	80
9	Settlement	57	72	81	86
10	Road/railway line	98	98	98	98
11	River stream	97	97	97	97
12	Tanks	96	96	96	96
13	Tank with water	100	100	100	100

4.11.1 Curve Number (CN) Calculation For 2020 Year

$$CN_{II} = \frac{\text{Product value(Soil group(A) + Soil group(B) + Soil group(C) + Soil group(D))}}{100}$$

$$CN_{II} = \frac{(142.75 + 391.37 + 7275.5 + 545.03)}{100}$$

$$CN_{II} = 84$$

$$1. \quad CN_I = \frac{84}{2.281 - 0.01281(84)} = 70$$

$$2. \quad CN_{III} = \frac{84}{0.427 + 0.005373(84)} = 92$$

$$3. \quad CN = \frac{142.75 + 391.37 + 7275.5 + 545.03}{100} = 83.5465$$

4.12 THE SCS CURVE NUMBER METHOD

The SCS curve number approach, also known as the Hydrologic Soil Cover Complex approach, was developed by the U.S. Department of Agriculture's Soil Conservation Service (SCS) for use in rural areas (SCS, 1972). It is a versatile and popular runoff estimation technique. Low, amount of rainfall, and curve number are necessary for this method. The curve number is established based on the hydrologic soil group, land use treatment, and hydrologic condition. The SCS curve number method is a simple, well-liked, and reliable way to predict how much rain will flow off at a specific place. The method can be scaled to obtain average annual runoff numbers even though it was designed for a single storm event.

$$S = \frac{25400}{CN} - 254$$

4.12.1 SCS-CN Calculation for 2020 Year

$$S = \frac{25400}{CN} - 254$$

Table: 4.18: CN and S value

CN-Value	70	84	92
S-Value	108.8571	48.3809	22.0869

For CN =70,

$$S = \frac{25400}{70} - 254$$

$$\mathbf{S = 108.8571}$$

For CN=84,

$$S = \frac{25400}{84} - 254$$

$$\mathbf{S = 48.3809}$$

For CN=92,

$$S = \frac{25400}{92} - 254$$

$$\mathbf{S = 22.0869}$$

4.13 RUNOFF

Runoff is the portion of the water cycle where surface water flows over land as opposed to being absorbed into groundwater. The portion of precipitation known as runoff is the water that enters unregulated surface streams, rivers, drains, or sewers. A watershed is a piece of land that produces runoff that flows to a single location. Overland flow is another name for runoff that happens on surfaces prior to reaching a canal. Rainfall that doesn't evaporate, transpire, or reach the ground to form groundwater is known as runoff. The SCS uses the following equation to determine the depth of direct runoff from storm rainfall:

$$Q = \frac{(P - 0.3S)^2}{(P + 0.7S)^2}$$

Where, S is the watershed storage mm,

Q is the actual direct runoff mm and

P is the Total rainfall mm.

The equation has one variable P and one parameter S . S is related to curve number (CN) by:

$$S = \frac{25400}{CN} - 254$$

Table: 4.19: Annual Rainfall and Runoff of study Area

YEAR	Rainfall (mm)	Runoff (mm)
2010	784.3513	84.1260
2011	716.3477	68.0395
2012	664.7047	94.5265
2013	690.5496	20.3351
2014	759.9015	163.8231
2015	1063.9960	90.21447
2016	314.7081	0
2017	711.9841	117.4822
2018	759.9015	25.1677
2019	759.9015	51.0979
2020	759.9015	51.0979

4.13.1 Runoff Depth Calculation

Table: 4.20: Monthly Q Value Find 2010 to 2020

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	S	T
1	year	month	date	Original Rainfall	CN	New rainfall	.3S			0.7S			p-0.3s	p+0.7	Q	runoff			
32	2010	1	31	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
60	2010	2	28	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
91	2010	3	31	0	CN1	33	33	0	0	76	109	76	0	76.41439486	0				
121	2010	4	30	1	CN1	33	33	0	0	76	109	77	0	77.22189798	0				
152	2010	5	31	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
182	2010	6	30	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
213	2010	7	31	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
244	2010	8	31	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
274	2010	9	30	19	CN1	33	33	0	0	76	109	95	0	94.91744522	0				
305	2010	10	31	5.584804177	CN3	7	7	0	0	15	22	21	0	21.04567374	0				
335	2010	11	30	9.098687148	CN3	9	7	2	4	15	25	25	4	24.55955671	0.179339				
366	2010	12	31	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
397	2011	1	31	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
425	2011	2	28	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
456	2011	3	31	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
486	2011	4	30	3	CN1	33	33	0	0	76	109	79	0	78.79324853	0				
517	2011	5	31	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
547	2011	6	30	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
578	2011	7	31	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
609	2011	8	31	0	CN1	33	33	0	0	76	109	76	0	76.24882096	0				
639	2011	9	30	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
670	2011	10	31	41.55881016	CN3	42	7	35	1194	15	57	57	1194	57.01967973	20.9456				
700	2011	11	30	4.531088688	CN3	7	7	0	0	15	22	20	0	19.99195825	0				
731	2011	12	31	14	CN1	33	33	0	0	76	109	90	0	90.38338747	0				
762	2012	1	31	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
791	2012	2	29	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
822	2012	3	31	0	CN1	33	33	0	0	76	109	76	0	76.2	0				
852	2012	4	30	0	CN1	33	33	0	0	76	109	76	0	76.2	0				

CHAPTER 5

RESULT AND DISCUSSION

5.1 COMPARISION OF RAINFALL

Here is the graphical representation of the rainfall volume data in various years, according to the verified data, there is a huge difference between the year of 2010 and 2015 years. The recorded value in the year 2010 is 784.35131 mm³ and 2011 is 716.34773 mm³ and 2012 is of 664.70470 mm³ and 2013 is 690.54960 mm³ and 2014 is 759.90150 mm³ and 2015 is 1063.9960 mm³ and 2016 314.70812 mm³ and 2017 is 711.984115 mm³ and 2018 is 759.90150 mm³ and 2019 is 759.9015 mm³ and 2020 is 759.9075 mm³. The highest value November and December months recorded maximum rainfall.

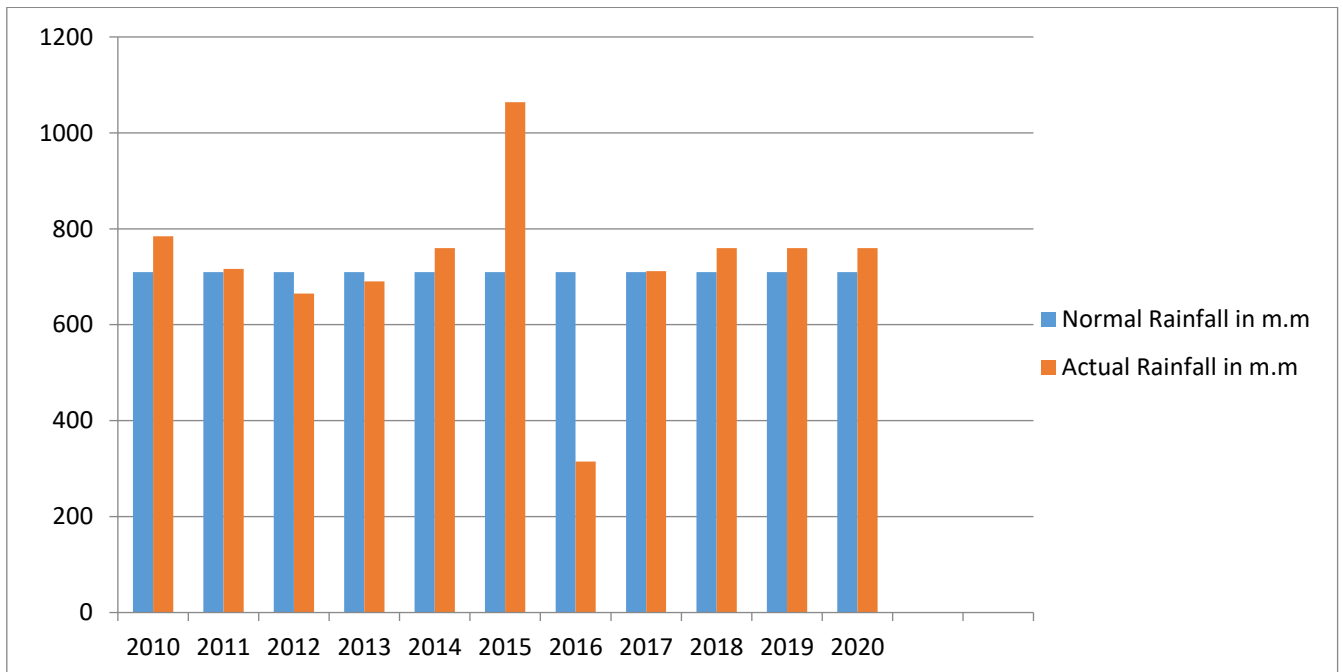


Fig: 5.1: Rainfall Volume Graph

5.2 COMPARISION OF RAINFALL AND RUNOFF

Precipitation variability on an annual basis and estimated runoff. It is clear that precipitation and runoff are low from 2010 to 2020, after which they change only significantly. The general trend is at its pinnacle right now, and it almost looks like 11 years of simulation. The two years with the most rainfall, however, were 2010 and 2015. However, the years 2014 and 2017 have the highest surface runoff values. SCS-method is used to compute the runoff for the study region during the years of 2005 and 2015. The yearly runoff for each year from 2010 through 2020, as computed in millimetres.

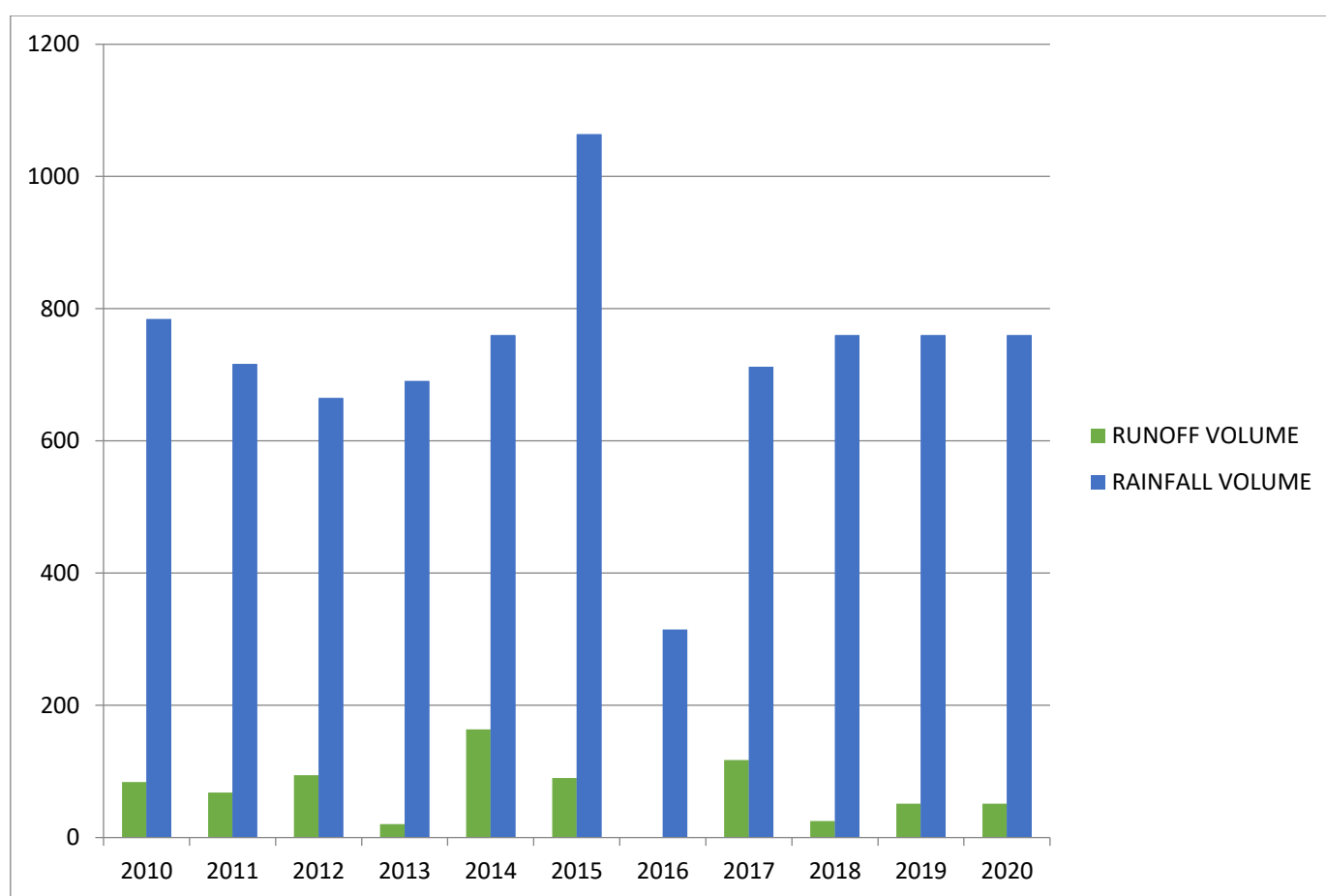


Fig: 5.2: Combined graph of rainfall and runoff

CHAPTER 6

SUMMARY AND CONCLUSION

6.1 GENERAL

In this chapter, the summary and result and conclusion of this project about the runoff estimation using ARCGIS and SCS curve method has been discussed.

6.2 SUMMARY

The land use/cover map and soil map defined in ARCGIS were used as input in the current work by the soil conservation service and curve number model. The watershed found the daily rainfall-runoff simulation to be accurate. SCN curve number technique Because the CN number changes depending on the soil and is taken into account when predicting runoff depth, the antecedent moisture condition of the soil has a significant impact. The volume of runoff is calculated.

6.3 CONCLUSION

The results of the study show that SCS-Curve Number, which is calculated using a GIS tool, is a reliable and accurate approach for calculating runoff in semi-arid watersheds for the benefit of watershed management and conservation. Thamirabarani River basin modelling using ARCGIS and SCS-CN has been completed successfully. For basin parameters, the simulation results were trustworthy. The state ground and surface water resources data centre in Chennai provided rainfall information for the 11-year period (2010-2020). Maps of land use and land cover were also employed. The basin's rainfall runoff volume for the year 2020 was determined from the outcome. The Curve Number values, which are determined based on the soil and land use/cover types, determine the rate of runoff depth.

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