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Estimation of Surface Runoff Using GIS-Based NRCS-CN Method in Upper Manimuktha Subwatershed, Tamilnadu, India

Velayudha Das M¹ and Poongothai S²

Research Scholar¹ and Professor² Department of Civil Engineering, Annamalai University, Annamalainagar-608002

Abstract - Spatial and temporal runoff measurements are required for planning, developing and managing a watershed sustainably. Among the methods for estimating runoff from rainfall, the SCS (NRCS)-CN method is most used practical method due to its requirement of single parameter estimation called Curve Number (CN). In the present study, the runoff from the upper Manimuktha sub-watershed (4C1A2e), an ungauged watershed in Villupuram district of Tamilnadu, India, has been assessed. IRS 1C LISS-3 satellite images (1995, 2003 and 2012) were used to obtain land use/land cover information. Hydrologic Soil Groups (HSG) map was prepared from the soil map of the study area. After integrating land use/land cover and hydrologic soil layers, weighted curve numbers were obtained and mapped by using ArcGIS 10.5 software. The daily rainfall data were collected from Gomukhi dam and Manimuktha dam raingauge stations for 25 years (1992-2017) and converted to weighted spatial distributed rainfall by Thiessen polygon method and used to calculate the daily, monthly and annual runoff. The average annual minimum and maximum rainfall were 548.23mm (in 2016-2017) and 2151.61 mm (in 2005-2006) and the corresponding runoff were 64.28mm (in 2016-2017) and in 2005-2006). This study will be useful to estimate runoff from an ungauged watershed having same characteristics.

Keywords: Watershed, SCS(NRCS)-CN method, HSG,AMC and Land use/cover

I. INTRODUCTION

A watershed is a natural physiographic or ecological unit that contributes runoff to a common point. The runoff information is necessitated for conservation and development of natural resources management in a watershed. Majority watersheds in India have no past rainfall-runoff records [1]. Among the empirical approaches used in such situation, the Soil Conservation Service Curve Number [Soil Conservation Service (1956), Hydrology, National Engineering Handbook, USA] (renamed as Natural Resources Conservation Service Curve Number (NRCS-CN)) (USDA, 1972 and 1994) technique has been mostly applied to ungauged watershed systems to establish the rainfall-runoff relations [2-4] and proved to be accurate and fast for surface runoff estimation [5]. Although the method is designed for a single rainfall event, it can be scaled to find average runoff [6]. The CN method is a globally accepted method to estimate the direct runoff depending on land use/land cover, soil type and its Antecedent-Moisture Condition (AMC). In general, among the different land use/cover types, the crop land plays the major role for the direct surface runoff [7]. Since the data related to runoff are more, Geographical Information System (GIS) a tool which stores, manipulates, retrieves and maps the data in a real world system [8]. Remote Sensing (RS) helps in providing land use/land cover information [9] which is the input to SCS model. RS and GIS play a vital role to visualize the prevailing status of water resources of the watershed [10] and has become a critical tool in hydrological modelling in view of its capacity to handle large amount of spatial and attribute data. Earlier studies carried out from various regions of India by several researchers such as [11-14] have revealed that GIS based SCS-CN method makes the runoff estimation more accurate, fast, facility to handle extensive data set and, is an efficient tool aid in better watershed management. [15] described the development and application of the ArcCN Runoff tool, an extension of ESRI ArcGIS software which can be applied to determine curve numbers and calculate runoff for a storm event within a watershed. A simple regression of rainfall and runoff provides a means for estimating storm runoff when precipitation records are available [16]. The objective of this study is to estimate the surface runoff using GIS-based NRCS-CN method in the upper Manimukta ungauged sub-watershed (4CIA2e) for development of water management sustainably.

II. STUDY AREA

The present investigation area is Muktha river sub-watershed (4CIA2e) of upper Manimuktha watershed in the Manimuktha sub-basin of Velar basin (Fig.1). Muktha river originates in the western side of the Eastern Ghats hill range (Kalrayan hills) and join in the Manimuktha dam. It is a part of Sankarapuram and Kallakurichi taluks of Villupuram district in Tamilnadu, India. The study area extends between 78°43'9.22''-78° 59' 21.73" E and 11° 46' 12.80''-11° 53' 42.38" N with an area of 251.151 km². This rural ungauged sub watershed falls in SOI toposheets 58-I/9 and 58-I/13. It is an ephemeral river in nature and carries flood water during monsoon rainfall period. Agriculture is the main economical activity of about 80% of the population. The main sources of water are tanks and dug wells apart from rainfall. Due to over exploitation of groundwater, this area is fallen in semi-critical to critical stage (CGWB report, 2015). The western part of the study area is covered by thick forest vegetation (85.761 km²) and the rest is almost plain

terrain (165.390 km²). The elevation ranges from 130m to 987m above MSL with a gentle gradient from west to east. The study area has dendrite and a parallel drainage pattern and first to third order streams. The average annual rainfall of the study area is 1231.09mm during 1992-2017. The major dominant hard rock in the study area is Charnockite type. The soil types are clay soil, red soil, alluvial soil and red gravelly soil.



Figure 1. Index map of the study area

III. METHODOLOGY

A. NRCS-CN method

The SCS-CN method was developed by the United States of Department of Agriculture and Soil Conservation Service (USDS-SCS). Runoff is the flowing of precipitated water in the catchment area through a channel after satisfying all surface and subsurface losses [17]. It couples the water balance equation with the relationship of infiltration losses and surface storage and leads to

$$Q = \frac{(P - I_a)^2}{(P - I_a + S)} \qquad (Q \text{ is valid for } P \ge I_a) \tag{1}$$

where Q is the direct runoff (mm), P is the rainfall depth (mm), I_a is the initial abstraction (mm) and S is the potential maximum retention (mm). In practice, S is expressed in terms of the curve number (CN),

$$S = \frac{25400}{CN} - 254$$
(2)

The non-dimensional *CN* (1-100) is derived from the tables, chapter 7, SCS handbook, section 4 (1972) for catchment characteristics, such as soil type, land use, hydrologic condition, and antecedent soil moisture conditions. This method has been modified by the ministry of agriculture in India (1976) as (NRCS-CN-National Resources Conservation Service Curve Number) to suite for Indian conditions $I_a = 0.3S$ and

$$Q = \frac{(P - 0.3S)^2}{(P + 0.7S)} \tag{3}$$

Knowing the value of CN, the runoff from the watershed is computed. For large watershed, the CN values are weighted with respect to the land use / cover areas by

$$CN = \frac{\sum (CN_i \times A_i)}{A} \tag{4}$$

where *CN* is the weighted *CN*, *CN*_i is the *CN* (1-100) from the weighted area A_i , and A is the total area of the watershed. **B. Watershed Database**

In this study the following data are used

- Base map of study area (sub-watershed 4CIA2e) from SOI toposheet 58-I/9 and 58I/13 (Source: IRS, Anna University, Chennai).
- Remote sensing data (IRS 1-C, LISS III) to study the soil type and land use maps of year 1995, 2003 and 2012 (Source: IRS, Anna University, Chennai)
- Daily rainfall data of Gomuki and Manimuktha dams raingauge station from 1992 to 2017 (Source: IWS,WRO (PWD),Chennai).

Thiessen polygon method is based on the arithmetic mean approach which may account for orographic effects and storm morphology, used to calculate the spatial distribution of rainfall [18]. Gomuki dam and Manimuktha dam raingauge stations are around the study area which seems to have an influence on it are considered for the study. The Study area divided into two parts by Thiessen polygon as shown in Fig.3. As per the spatial coverage, the Gomuki and Manimuktha raingauge stations have weightage of 0.78 and 0.22 respectively. Each weight is then multiplied by the station rainfall to obtain the areal average rainfall of the study area (Table 8). The area-weighting curve numbers for AMCs are calculated from the land use-soil group polygons boundaries within the sub-watershed [19].



Figure 2. Flow chart showing the methodology of SCS(NRCS)-CN model



According to US soil conservation service, soil is divided into four Hydrologic Soil Groups (HSG A, B, C and D) with respect to rate of potential and minimum infiltration rate (Table 1). AMC is expressed in three levels (AMC I, II and III) according to rainfall limits for dormant and growing season (Table 2). The CN values for AMC II condition can be converted into CN values for AMC I and AMC III by interpolation method (Table 3 and 4). Base map, land use maps (Fig.4-6) and HSG map (Fig.7) of the study area is prepared using remote sensing and PC ARC/INFO (Version 10.5) GIS package. By overlaying these thematic maps, a new PAT (Polygon Attribute Table) was obtained using Arc GIS. This PAT was used to compute the spatial area and information of each unit and also total area weighted curve number of the study area to calculate the AMC II for the year 1995, 2003 and 2012 (Tables 5-7). The slope of the soil surface is not considered when assigning HSG (SCS, 1956, Handbook). The SCS-CN is a purpose of the ability of soils to allow infiltration of water with respect to land use/land cover and antecedent soil moisture condition [20]. [21] pointed out that there was not much difference between runoff depth before and after applying slope factor. It is concluded that the SCS-CN method runoff in a particular location mainly depends upon rainfall, land use, soil property, and doesn't take into

account flow processes due to topographical variations [13]. A high curve number means high runoff and low infiltration, whereas a low curve number means little runoff and high infiltration [15].

Character of soil	Hydrologic Soil Group									
Character of soli	A	В	С	D						
	High	Moderate	Slow	Very slow						
Infiltration Rate	7.81 to 11.43mm	3.81 to 7.81mm	1.24 to 3.81mm	0.00 to 1.24 mm						
Texture	Sand or Gravel	Moderately Coarse to Fine	Moderately Fine to Fine	Clay						
Drainage	Well to excess	Moderately drained	Moderately slow drained	Slow						
Soil Group	Entisols	Inceptisols	Alfisols	Vertisols						
Runoff	Low	Moderate	Moderate	High						
Recharge	High	Moderate	Moderate	Low						

Table 1. Hydrologic Soil Groups of the study area

Table 2. Antecedent soil Moisture Conditions

AMC		Total 5-day Antecedent Rainfall in mm					
Group	Characteristics of soil	Dormant Season	Growing Season				
Ι	Lowest runoff potential. The watershed soils are dry enough for satisfactory cultivation	Less than 12.7	Less than 35.6				
II	The average conditions.	12.7-27.9	35.6- 53.3				
III	Highest runoff potential.	Over 27.9	Over 53.3				

Table 3. Curve Numbers for AMC II for Indian Conditions (Source: from literature review)

I and was/seven	Tuastin out (una stie og	Hydrologic Soil Group							
Lana use/cover	Treatment / practices	A	B	С	D				
	Plantation	41	55	69	73				
A anioultural land	Dry crops	72	81	88	91				
Agricultural lana	Wet crops	95	95	95	95				
	Fallow	49	69	79	84				
Build up land		77	86	91	93				
	Deciduous	28	44	60	64				
	Scrub	33	47	64	67				
Forest land	Unnotified/Plantation	26	40	58	61				
	Barren/stony	71	80	85	88				
	With scrub	39	55	67	77				
Wasteland	Without scrub	41	55	69	73				
	Salt affected	71	80	85	88				
	Water logged	85	85	85	85				
Water hadies	Reservoir/Tanks	100	100	100	100				
water bodies	River/Stream	97	97	97	97				

Table 4. Corrections	for Curve	Numbers fo	or different AMCs
	<i>joi cuiie</i>	1.0000000000000000000000000000000000000	

	CN values for conditions												
11	T	111	11	T	111								
100	100	100	65	45	82								
95	87	98	60	40	78								
90	78	96	55	35	74								
85	70	94	50	31	70								
50	63	92	45	26	65								
75	57	88	40	22	60								
70	51	85											



Figure 4. Land use and Land cover map of the study area in 1995







Figure 6. Land use and Land cover map of the study area in 2012

IV. RESULTS AND DISCUSSION

The area of HSG A, B, C, and D of the sub-watershed were obtained through GIS as 26.383, 29.698, 83.631 and 111.439 km² respectively. The computed monthly and annual rainfall and runoff values are presented in table 10. The maximum and the minimum annual rainfall of the study area for the past 25 water years (1992-2017) range from 2151.61mm (in 2005-2006) to 548.23mm (in 2016-2017). Usually a heavy rainfall is noticed during the northeast monsoon season (52.85%) during October to December months compared to other monsoon seasons (Table 10). Monthly maximum runoff of 477.67mm is noted during November 2005 and minimum of 1mm (0.96mm) in May 2001 and (0.98mm) in July 2008. The annual runoff is more during 2005-2006 (1134.02mm) and less during 2016-2017 (64.28mm). A rainfall-runoff regression model is developed using the sub-watershed database as shown in Fig.8. A straight line equation y=0.598x-303.6, where *x* represents rainfall (mm) and y represents runoff (mm) is obtained. The correlation coefficient r^2 is found to be 0.89, which is highly satisfactory. Compare the land use/land cover maps of 1995 and 2012, the agricultural land area has increased 10.19 % and forest area has reduced 3.09 % resulting in increased CN values in 2012.



Figure 7. Hydrologic Soil Groups map of the study area



As the input parameters of NRCS-CN method is based on ground truth data, this method is used to estimate the direct runoff of this ungauged Muktha sub-watershed (4C1A2e). The estimated runoff showed that the semi-arid watershed has a very good surface runoff potential and is very important in various activities of water resource planning and management in the hard rock regions. The correlation between rainfall and runoff can be estimated by obtaining a linear regression line between these two variables. From the monthly values of runoff, the irrigation scheduling and crop rotation can be carried out successfully and also develop the water management of the watershed sustainably.



Figure 8. Correlation of Rainfall and Runoff



Figure 9. Rainfall and Runoff vs. Water year

Built-up Land Soil A Soil B Soil B Fallow Soil A Soil C Soil C S	Land us	se/cover 1995	HSG	Area (sq.km)	CN	Area (%)	Area X CN	Weighted CN
Buil-up Land Water bodies Soil D Soil S Soil S Soil S Soil S Soil S Soil S Soil S Soil S S S S S S S S S S S S S S S S S S S			Soil A	0.442	72	0.176	31.824	
Built-up Soil C 4.585 88 1.826 403.80 Agricultural Land Soil A 1.611 49 0.641 78.939 Agricultural Land Soil A 1.212 246.480 793.345 Soil D 3.120 79 1.242 246.480 Soil D 3.120 79 1.242 246.480 Plantanion Soil A 2.755 44 1.097 112.996 Soil D 3.813 60 1.518 263.007 Met crop Soil A 73 5.722 1049.155 Soil D 5.301 C 3.813 60 1.518 263.007 Built-up Land Met crop Soil A 0.730 77 736.315 Built-up Land Marol settlements Soil A 0.003 44 0.811 89.072 Soil A 0.002 6.7 0.009 1.507 3.467 0.201 5.517 Built-up Land Deciduous Soil A 0.0022 67		Dry grop	Soil B	2.153	81	0.857	174.393	
Agricultural Land Fallow Soil A Soil B Soil B Soil B Soil C Soil		Drycrop	Soil C	4.585	88	1.826	403.480	
Agricultural Land Fallow Soil A 1.611 49 0.641 78.939 Agricultural Land Soil B 2.805 60 1.117 193.545 Soil D 2.155 84 0.898 181.020 Planitation Soil A 2.756 44 0.097 112.996 Planitation Soil A 1.945 55 0.774 106.907 wet crop Soil A 1.827 95 3.467 823.005 wet crop Soil A 0.750 7.77 1736.315 Soil D 0.5399 95 21.477 152.4305 Soil D 501D 0.730 77 705 143.495 Built-up Land Boil C 0.730 77 0.291 52.10 152.27 Built-up Land Pacciduous Soil D 0.129 93 0.493 115.227 Built-up Land Pacciduous Soil D 0.208 0.490 2.800 2.800 Forest Land Deciduou			Soil D	6.341	91	2.525	577.031	
Agricultural Land Fallow Soil B C.3.120 7.90 1.242 246.480 Agricultural Land Soil D 2.155 84 0.885 181.020 Plantation Soil B 1.945 55 0.774 106.975 Plantation Soil B 1.945 55 0.774 106.975 Soil D 1.4372 73 5.722 1049.156 Soil D 5.010 5.3017 95 7.277 1736.315 Soil D Soil D 5.010 5.399 95 5.260 1493.495 Soil D 5.010 5.399 93 0.433 115.227 Built-up Land Raral settlements Soil A 0.730 77 0.201 5.3210 Soil D 5.399 93 0.433 115.227 84.994 Villages Soil A 0.732 84.994 0.372 84.994 Soil D 0.739 93 0.433 0.732 84.994 Soil D <td< td=""><td></td><td></td><td>Soil A</td><td>1.611</td><td>49</td><td>0.641</td><td>78.939</td><td></td></td<>			Soil A	1.611	49	0.641	78.939	
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Wasteland Wast		villages	Soll C	1 220	91	0.372	04.994	
Forest Land Deciduous Soil A 0.100 28 0.001 2.000 Forest Land Scrub forest Soil C 3.164 60 1.260 189.840 Scrub forest Soil A 0.0060 33 0.024 1.973 Scrub forest Soil C 0.493 64 0.196 31.552 Soil A 0.0022 67 0.009 1.501 Munotified forest area Soil B 5.225 40 2.080 209.000 Soil D 13.455 61 5.337 820.755 MC I=62.52 Muste Soil B 5.225 40 2.080 209.000 MC II=91.68 Soil C 0.102 2.059 MC I=62.52 Munotified forest area Soil B 0.268 80 0.022 4.001 Waste Soil A 0.029 71 0.012 2.059 Soil A 0.526 88 0.209 46.288 Soil D 0.526 88 0.209			Soll D	0.100	93	0.495	2 800	
Deciduous Joid D 20.06 47 0.01 0.022 Forest Land Soil D 5.442 64 2.167 348.288 Scrub forest Soil A 0.060 33 0.024 1.973 Scrub forest Soil A 0.0493 64 0.196 31.552 Munotified forest area Soil B 5.225 40 2.080 209.000 Munotified forest area Soil A 0.023 58 12.723 1853.274 Soil A 0.029 71 0.012 2.059 AMC I=62.52 Munotified forest area Soil B 0.022 67 0.009 AMC I=62.52 Munotified forest area Soil B 0.025 4.960 AMC I=62.52 AMC I=62.52 Munotified forest area Soil D 13.455 61 5.357 820.755 Soil D 0.022 71 0.012 2.059 AMC I=62.52 Maree Soil C 0.026 80 0.025 4.960 Soil D <td></td> <td></td> <td>Soil R</td> <td>2.038</td> <td>20</td> <td>0.040</td> <td>2.800</td> <td></td>			Soil R	2.038	20	0.040	2.800	
$ Wasteland \\ Wasteland \\ Water bodies \\ Water bod$		Deciduous	Soil C	2.038	44 60	1.260	180.840	
Forest Land Sorid A 0.060 33 0.024 1.973 Scrub forest Soil C 0.493 64 0.196 31.532 Soil D 0.022 67 0.009 1.501 Unnotified forest area Soil B 5.225 40 2.080 209.000 AMC II=79.60 Soil D 13.455 60 5.357 820.755 820.755 820.755 Barren rocky / Stony Soil A 0.022 71 0.012 2.059 Waste Soil A 0.029 71 0.012 2.059 Soil D 13.455 60 5.357 820.755 Waste Soil A 0.022 80 0.025 4.960 Soil D 0.526 88 0.209 40.288 31.590 Soil D 0.526 88 0.209 40.288 32.57 Soil D 0.523 41 0.208 21.443 50.81 Land with scrub Soil D 0.533 41			Soil D	5.104	64	2 167	3/8 288	
Forest Land Scrub forest Soil C 0.493 64 0.196 31.52 $Soil D$ 0.022 67 0.009 1.501 $Marcel Marcel $			Soil A	0.060	33	0.024	1 073	
Wasteland Water bodies Water	Forest Land	Scrub forest	Soil C	0.000	55 64	0.024	31.552	
Wasteland Soil A 0.332 0.302 0.302 0.302 0.303 10.300 AMC 1=62.52 Wasteland Soil A 0.393 58 12.723 1853.274 AMC I=62.52 Soil D 13.455 61 5.377 820.755 AMC II=79.60 Soil D 13.455 61 5.377 820.755 AMC II=62.52 Barren rocky / Stony waste Soil D 0.002 71 0.012 2.059 Soil D 0.526 88 0.029 4.052 4.960 Waste Soil D 0.526 88 0.029 46.288 Land with scrub Soil B 2.689 55 1.071 147.895 Soil D 8.502 41 0.208 21.443 192.290 Wasteland Soil B 0.715 55 0.285 39.325 Soil D 0.039 73 0.016 2.718 Soil D 0.039 73 0.016 2.847 Soil C 0.0	I Oresi Lana	Seruo joresi	Soil D	0.022	67	0.009	1 501	
$ Wasteland \\ Wasteland \\ Water bodies \\ Variation (V - Tank) \\$			Soil A	0.022	26	0.159	10 360	AMC 1-62 52
Unnotified forest area Data Soil D			Soil R	5 225	40	2.080	209.000	AMC II=02.52
Soil D 13.455 61 5.357 820.755 Barren rocky / Stony waste Soil A 0.029 71 0.012 2.059 Soil D 0.501 B 0.062 80 0.025 4.960 waste Soil C 0.104 85 0.041 8.840 Soil D 0.526 88 0.209 46.288 Land with scrub Soil A 0.810 39 0.323 31.590 Soil C 2.870 67 1.143 192.290 $50il$ D $50il$ D $50il$ D 0.523 41 0.208 21.443 Soil D 0.039 73 0.016 2.718 $50il$ D 0.323 39.325 Soil D 0.039 73 0.016 2.847 $50il$ D 0.232 71 0.99 16.478 Soil D 0.039 73 0.016 2.847 $50il$ D $50il$ D 0.223 80.089 9.944 <		Unnotified forest area	Soil C	31.953	.58	12.723	1853.274	AMC III=91.68
Barren rocky / Stony waste Soil A 0.029 71 0.012 2.059 Soil B 0.062 80 0.025 4.960 Soil C 0.104 85 0.411 8.840 Soil D 0.526 88 0.209 46.288 Soil A 0.810 39 0.323 31.590 Land with scrub Soil A 0.810 39 0.323 31.590 Soil A 0.810 39 0.323 31.590 Soil A 0.810 39 0.323 31.590 Soil B 2.689 55 1.071 147.895 Soil C 2.870 67 1.143 192.290 Soil B 0.715 55 0.285 39.325 Soil A 0.523 41 0.208 21.443 Soil A 0.232 71 0.092 16.478 Soil A 0.232 71 0.092 16.478			Soil D	13.455	61	5.357	820.755	
Barren rocky / Stony waste Soil B 0.062 80 0.025 4.960 Waste Soil C 0.104 85 0.041 8.840 Soil D 0.526 88 0.209 46.288 Land with scrub Soil B 2.689 55 1.071 147.895 Soil C 2.870 67 1.143 192.290 Soil D 8.524 71 3.394 605.204 Land without scrub Soil A 0.523 41 0.208 21.443 Soil D 0.039 69 0.016 2.718 Soil C 0.039 69 0.016 2.847 Soil D 0.0232 71 0.092 16.478 Soil A 0.232 71 0.092 16.478 Soil D 0.232 88 0.089 19.624 Waterlogged Soil C 0.105 85 0.042 8.943 Water bodies			Soil A	0.029	71	0.012	2.059	
waste Soil C 0.104 85 0.041 8.840 Soil D 0.526 88 0.209 46.288 Land with scrub Soil A 0.810 39 0.323 31.590 Land with scrub Soil B 2.689 55 1.071 147.895 Soil D 8.524 71 3.394 605.204 Soil D 8.524 71 3.394 605.204 Land without scrub Soil B 0.715 55 0.285 39.325 Soil D 0.039 69 0.016 2.718 Soil D 0.039 73 0.016 2.847 Soil D 0.032 71 0.092 16.478 Soil D 0.023 73 0.016 2.847 Soil D 0.223 88 0.089 19.624 Waterlogged Soil C 0.105 85 0.42 8.943 Soil D 0.223 88 0.089 19.624 8.943 <tr< td=""><td></td><td>Barren rocky / Stony</td><td>Soil B</td><td>0.062</td><td>80</td><td>0.025</td><td>4.960</td><td></td></tr<>		Barren rocky / Stony	Soil B	0.062	80	0.025	4.960	
Soil D 0.526 88 0.209 46.288 Land with scrub $Soil A$ 0.810 39 0.323 31.590 Wasteland $Soil B$ 2.689 55 1.071 147.895 Soil C 2.870 67 1.143 192.290 Soil D 8.524 71 3.394 605.204 Land without scrub $Soil A$ 0.523 41 0.208 21.443 Soil D 0.039 69 0.016 2.718 Soil D 0.039 73 0.016 2.847 Soil D 0.039 73 0.016 2.847 Soil D 0.039 73 0.016 2.847 Soil D 0.223 88 0.089 19.624 Waterlogged Soil C 0.105 85 0.042 8.943 Water bodies Reservoir / Tank Soil A 0.481 100 0.306 90.400		waste	Soil C	0.104	85	0.041	8.840	
WastelandSoil A 0.810 39 0.323 31.590 WastelandSoil B 2.689 55 1.071 147.895 Soil C 2.870 67 1.143 192.290 Soil D 8.524 71 3.394 605.204 Land without scrubSoil A 0.523 41 0.208 21.443 Soil B 0.715 55 0.285 39.325 Soil C 0.039 69 0.016 2.718 Soil D 0.039 73 0.016 2.847 Salt affected landSoil A 0.232 71 0.092 Soil C 6.081 85 2.421 516.885 Soil C 0.015 85 0.042 8.943 Water loggedSoil C 0.105 85 0.042 8.943 Water bodiesReservoir / TankSoil B 0.904 100 0.360 90.400 Soil D 3.038 100 1.210 303.800 Soil D 3.038 100 1.210 303.800 Soil D 0.655 97 0.612 2.813 Soil D 0.655 97 0.282 726.530 Soil D 0.655 97 0.261 63.535 Total 251.51 100 1992.177			Soil D	0.526	88	0.209	46.288	
WastelandSoil B 2.689 55 1.071 147.895 WastelandSoil C 2.870 67 1.143 192.290 Soil D 8.524 71 3.394 605.204 Land without scrubSoil B 0.715 55 0.285 Soil C 0.039 69 0.016 2.718 Soil D 0.039 73 0.016 2.847 Soil A 0.232 71 0.092 16.478 Salt affected landSoil B 0.641 80 0.255 51.280 Soil C 0.015 85 2.421 516.885 Soil D 0.223 88 0.089 19.624 WaterloggedSoil C 0.105 85 0.042 Water bodiesReservoir / TankSoil B 0.904 100 0.360 Soil D 3.038 100 1.210 303.800 Soil D 3.038 100 1.210 303.800 Soil D 3.038 100 1.210 303.800 Soil D 0.655 97 0.615 25.421 Soil D 0.655 97 0.515 125.421 Soil D 0.655 97 0.616 63.535 Soil D 0.655 97 0.616 63.535 Soil D 0.655 97 0.616 63.535			Soil A	0.810	39	0.323	31.590	
WastelandSoil C 2.870 67 1.143 192.290 Soil D 8.524 71 3.394 605.204 Masteland A 0.523 41 0.208 21.443 Land without scrubSoil B 0.715 55 0.285 39.325 Soil C 0.039 69 0.016 2.718 Soil D 0.039 73 0.016 2.847 Soil D 0.039 73 0.016 2.847 Salt affected landSoil B 0.641 80 0.255 51.280 Soil D 0.223 88 0.089 19.624 WaterloggedSoil C 0.105 85 0.042 8.943 Soil D 0.223 88 0.042 8.943 Soil D $Soil B$ 0.904 100 0.360 90.400 Soil C 4.485 100 1.786 448.500 Soil D 3.038 100 1.210 303.800 Soil D 3.038 100 1.210 303.800 Soil D 3.038 100 1.210 303.800 Soil C 7.490 97 2.982 726.530 Soil D 0.655 97 0.261 63.535 Total 251.151 100 1992.177		I and with some	Soil B	2.689	55	1.071	147.895	
WastelandSoil D 8.524 71 3.394 605.204 WastelandSoil A 0.523 41 0.208 21.443 Land without scrubSoil B 0.715 55 0.285 39.325 Soil C 0.039 69 0.016 2.718 Soil D 0.039 73 0.016 2.847 Soil a 0.232 71 0.092 16.478 Salt affected landSoil C 6.081 85 2.421 Soil D 0.223 88 0.089 19.624 WaterloggedSoil C 0.105 85 0.042 WaterloggedSoil C 0.105 85 0.042 Soil D 0.223 88 0.089 19.624 Water bodiesReservoir / TankSoil B 0.904 100 0.360 Soil D 3.038 100 1.210 303.800 Soil D 3.038 100 1.210 303.800 Soil C 7.490 97 0.515 125.421 Soil C 7.490 97 2.982 726.530 Soil D 0.655 97 0.261 63.535 Total 251.151 100 19992.177		Lana wiin scrub	Soil C	2.870	67	1.143	192.290	
WastelandSoil A 0.523 41 0.208 21.443 Land without scrub $Soil B$ 0.715 55 0.285 39.325 $Soil C$ 0.039 69 0.016 2.718 $Soil D$ 0.039 73 0.016 2.847 $Salt affected land$ $Soil A$ 0.232 71 0.092 16.478 $Salt affected land$ $Soil B$ 0.641 80 0.255 51.280 $Soil D$ 0.223 88 0.089 19.624 Waterlogged $Soil C$ 0.105 85 0.042 8.943 $Soil A$ 0.481 100 0.192 48.100 $Soil B$ 0.904 100 0.360 90.400 $Soil C$ 4.485 100 1.786 448.500 $Soil D$ 3.038 100 1.210 303.800 $Soil D$ 3.038 100 1.210 303.800 $Soil C$ 7.490 97 0.515 125.421 $Soil D$ 0.655 97 0.261 63.535 $Total$ 251.151 100 1992.177			Soil D	8.524	71	3.394	605.204	
	Wasteland		Soil A	0.523	41	0.208	21.443	
Land without seriesSoil C 0.039 69 0.016 2.718 Soil D 0.039 73 0.016 2.847 Soil A 0.232 71 0.092 16.478 Salt affected landSoil B 0.641 80 0.255 51.280 Soil D 0.223 88 0.089 19.624 WaterloggedSoil C 0.105 85 0.042 8.943 Water bodiesReservoir / TankSoil B 0.904 100 0.360 90.400 Soil D 3.038 100 1.210 303.800 Soil D 3.038 100 1.210 303.800 Soil C 7.490 97 2.982 726.530 Soil D 0.655 97 0.261 63.535 Total 251.151 100 19992.177		Land without scrub	Soil B	0.715	55	0.285	39.325	
Soil D 0.039 73 0.016 2.847 Soil A 0.232 71 0.092 16.478 Salt affected land $Soil B$ 0.641 80 0.255 51.280 Soil C 6.081 85 2.421 516.885 Soil D 0.223 88 0.089 19.624 WaterloggedSoil C 0.105 85 0.042 8.943 Water bodiesReservoir / TankSoil A 0.481 100 0.192 48.100 Soil D 3.038 100 1.210 303.800 Soil D 3.038 100 1.210 303.800 Soil B 0.029 97 0.012 2.813 RiverSoil B 1.293 97 0.515 125.421 Soil D 0.655 97 0.261 63.535 Total 251.151 100 19992.177		Lana winou seruo	Soil C	0.039	69	0.016	2.718	
Salt affected landSoil A 0.232 71 0.092 16.478 Salt affected landSoil B 0.641 80 0.255 51.280 Soil C 6.081 85 2.421 516.885 Soil D 0.223 88 0.089 19.624 WaterloggedSoil C 0.105 85 0.042 8.943 Water bodiesReservoir / TankSoil A 0.481 100 0.192 48.100 Soil D 3.038 100 1.786 448.500 Soil D 3.038 100 1.210 303.800 Soil D 3.038 100 1.210 303.800 Soil C 7.490 97 2.982 726.530 Soil D 0.655 97 0.261 63.535 Total 251.151 100 19992.177			Soil D	0.039	73	0.016	2.847	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $			Soil A	0.232	71	0.092	16.478	
Soil C 6.081 85 2.421 516.885 Soil D 0.223 88 0.089 19.624 WaterloggedSoil C 0.105 85 0.042 8.943 Water bodiesReservoir / TankSoil A 0.481 100 0.192 48.100 Soil C 4.485 100 1.786 448.500 Soil D 3.038 100 1.210 303.800 Soil D 3.038 100 1.210 303.800 Soil B 0.299 97 0.612 2.813 Soil C 7.490 97 2.982 726.530 Soil D 0.655 97 0.261 63.535 Total 251.151 100 19992.177		Salt affected land	Soil B	0.641	80	0.255	51.280	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$			Soil C	6.081	85	2.421	516.885	
Waterlogged Soil C 0.105 85 0.042 8.943 Water bodies Reservoir / Tank Soil A 0.481 100 0.192 48.100 Soil B 0.904 100 0.360 90.400 Soil C 4.485 100 1.786 448.500 Soil D 3.038 100 1.210 303.800 River Soil A 0.029 97 0.012 2.813 Soil C 7.490 97 2.982 726.530 Soil D 0.655 97 0.261 63.535 Total 251.151 100 19992.177			Soil D	0.223	88	0.089	19.624	
Water bodiesSoil A 0.481 100 0.192 48.100 Reservoir / TankSoil B 0.904 100 0.360 90.400 Soil C 4.485 100 1.786 448.500 Soil D 3.038 100 1.210 303.800 Soil B 1.293 97 0.012 2.813 Soil C 7.490 97 2.982 726.530 Soil D 0.655 97 0.261 63.535 Total 251.151 100 19992.177		Waterlogged	Soil C	0.105	85	0.042	8.943	
Water bodies Reservoir / Tank Soil B 0.904 100 0.360 90.400 Soil C 4.485 100 1.786 448.500 Soil D 3.038 100 1.210 303.800 River Soil A 0.029 97 0.012 2.813 Soil B 1.293 97 0.515 125.421 Soil C 7.490 97 2.982 726.530 Soil D 0.655 97 0.261 63.535 Total 251.151 100 19992.177			Soil A	0.481	100	0.192	48.100	
$\frac{Sou C}{Soil D} = \frac{4.485}{3.038} = \frac{100}{1.780} = \frac{1.780}{448.500}$ $\frac{Soil D}{Soil D} = \frac{3.038}{3.038} = \frac{100}{1.210} = \frac{1.780}{303.800}$ $\frac{Soil A}{Soil B} = \frac{1.293}{97} = \frac{97}{0.515} = \frac{125.421}{125.421}$ $\frac{Soil C}{Soil C} = \frac{7.490}{7.490} = \frac{97}{97} = \frac{2.982}{726.530}$ $\frac{Soil D}{Soil D} = \frac{0.655}{0.655} = \frac{97}{0.261} = \frac{63.535}{63.535}$	Water bodies	Reservoir / Tank	Soil B	0.904	100	0.300	90.400	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			Soll C	4.485	100	1.780	448.500	
River $500 A$ 0.029 97 0.012 2.313 Soil B 1.293 97 0.515 125.421 Soil C 7.490 97 2.982 726.530 Soil D 0.655 97 0.261 63.535 Total 251.151 100 19992.177			Sou D	3.038	100	1.210	203.800	
River $500 B$ 1.293 97 0.513 123.421 Soil C 7.490 97 2.982 726.530 Soil D 0.655 97 0.261 63.535 Total 251.151 100 19992.177			Soll A	1 202	97	0.012	2.013	
Soil C 7.490 97 2.962 720.530 Soil D 0.655 97 0.261 63.535 Total 251.151 100 19992.177		River	Soil C	1.293 7.400	97	2 0.515	726 530	
Source October October <th< td=""><td></td><td></td><td>Soil D</td><td>0.655</td><td>97 97</td><td>0.261</td><td>63 535</td><td></td></th<>			Soil D	0.655	97 97	0.261	63 535	
			Total	251.151	//	100	19992.177	

Table 5. Weighted CN of the study area (for AMC II) in 1995

Land use/cover 2003		HSG	Area (sq.km)	CN	Area (%)	Area X CN	Weighted CN
		Soil A	0.795	49	0.32	38.955	
	Fallow	Soil B	0.623	69	0.25	42.987	
	Fallow	Soil C	3.074	79	1.22	242.846	
		Soil D	2.736	84	1.09	229.824	
		Soil A	0.323	72	0.13	23.254	
	Crop land Kharif	Soil B	0.337	81	0.13	27.297	
	Crop lana Kharij	Soil C	3.014	88	1.20	265.232	
		Soil D	1.383	91	0.55	125.853	
		Soil A	15.750	84	6.27	1323.000	
A ani aultural I and	Crop land double	Soil B	13.006	88	5.18	1144.528	
Agricultural Lana	cropped	Soil C	9.477	92	3.77	871.884	
		Soil D	62.182	93	24.76	5782.926	
		Soil A	0.132	41	0.05	5.412	
	Dimension	Soil B	0.546	55	0.22	30.030	
	Planlations	Soil C	0.075	69	0.03	5.180	
		Soil D	0.056	73	0.02	4.113	
		Soil A	7.238	95	2.88	687.610	
	Course law d Data	Soil B	2.471	95	0.98	234.745	
	Crop lana Kabi	Soil C	11.505	95	4.58	1092.975	
		Soil D	12.515	95	4.98	1188.925	
		Soil A	0.686	77	0.27	52.822	
	V'11 1 T	Soil B	0.649	86	0.26	55.814	
Built-up Land	Villages and Town	Soil C	0.681	91	0.27	61.971	
		Soil D	2.351	93	0.94	218.643	
	5	Soil A	0.018	28	0.01	0.504	
	Deciduous	Soil C	3.461	60	1.38	207.663	
	(Moist/Dry) closed	Soil D	0.245	64	0.10	15.665	AMC I-64 71
		Soil A	0.244	26	0.10	6.344	AMC II=81.22
	-	Soil B	5.573	40	2.22	222.920	AMC III=92.49
Forest Land	Forest Plantations	Soil C	33.431	58	13.31	1938.998	
		Soil D	15.977	61	6.36	974.597	
		Soil A	0.005	33	0.00	0.150	
	Deciduous	Soil B	1.601	47	0.64	75.247	
	(Moist/Drv) scrub	Soil C	1.550	64	0.62	99.200	
	()/	Soil D	4.691	67	1.87	314.297	
		Soil A	0.186	71	0.07	13.211	
	Barren	Soil B	0.010	80	0.00	0.800	
	Rocky/Stony waste	Soil C	0.011	85	0.00	0.965	
		Soil D	0.353	88	0.14	31.064	
		Soil A	0.396	39	0.16	15.444	
		Soil B	1.446	55	0.58	79.530	
	Land with scrub	Soil C	1.873	67	0.75	125.491	
Wasteland		Soil D	4.264	71	1.70	302.744	
		Soil A	0.012	41	0.00	0.473	
		Soil B	0.331	55	0.13	18.205	
	Land without scrub	Soil C	4.012	69	1.60	276.828	
		Soil D	1.767	73	0.70	128.991	
		Soil A	0.309	71	0.12	21.913	
	Salt affected Land	Soil B	0.042	80	0.02	3.360	
		Soil D	0.169	88	0.07	14.872	
		Soil A	0.290	100	0.12	29,000	
		Soil R	1.575	100	0.63	157 500	
	Reservoirs/Tanks	Soil C	11 333	100	4 51	1133 300	
		Soil D	2 724	100	1.08	272.400	
Water hodies		Soil A	0.000	97	0.00	0.000	
, and bounds		Soil R	1 488	97	0.59	144 336	
	River	Soil C	0 134	97	0.05	12 998	
		Soil D	0.025	97	0.01	2.425	
			251.151		100	20398.262	

Table 6. Weighted CN of the study area (for AMC II) in 2003

Land use/cover 2003		HSG	Area	CN	Area	Area X CN	Weighted CN
		Soil B	(sq.кт) 0.032	55	(%)	1 752	
	Plantation	Soil C	0.032	60	0.013	16.008	
	1 iunianon	Soil D	0.172	73	0.072	12 556	
		Soil A	0.761	72	0.000	54 792	
		Soil R	0.701	81	0.303	38 880	
	Kharif Cron	Soil C	0.668	88	0.266	58,784	
	many crop	Soil D	2.507	91	0.998	228.137	
		Soil A	14.612	84	5.818	1227.408	
Agricultural Land	More than two	Soil B	12.061	88	4.802	1061.368	
	crop/Zaid	Soil C	17.930	92	7.139	1649.560	
		Soil D	62.024	93	24.696	5768.232	
		Soil A	5.123	95	2.040	486.685	
		Soil B	3.463	95	1.379	328.985	
	Rabi Crop	Soil C	4.569	95	1.819	434.055	
		Soil D	8.252	95	3.286	783.940	
		Soil A	2.787	49	1.110	136.563	
		Soil B	2.350	69	0.936	162.150	
	Fallow	Soil C	10.190	79	4.057	805.010	
		Soil D	9.082	84	3.616	762.888	
		Soil A	1.007	77	0.401	77.539	
Built Up Land		Soil B	0.901	86	0.359	77.460	
Duni Op Lana		Soil C	0.721	91	0.287	65.611	
		Soil D	2.054	93	0.818	190.997	
	Deciduous (Drv / Moist	Soil A	0.023	28	0.009	0.644	
	/Thorn) - Dens /	Soil B	0.740	44	0.295	32.560	
	Closed	Soil C	0.053	60	0.021	3.180	
		Soil D	7.896	64	3.144	505.344	AMC I=65.41
Forest Land	C 1	Soil B	1.012	4/	0.403	4/.564	AMC II = 81.72
	Scrub	Soll C	0.023	67	0.009	1.4/2	AMC 111=92.09
		Soll D	0.790	07	0.313	52.930	
	Tree Clad area / Dense	Soil R	3 058	20	1.576	158 320	
	/ Closed	Soil C	33 738	58	13/33	1056.804	
	/ Closed	Soil D	11 992	61	4 775	731 512	
		Soil A	0.266	71	0.106	18 890	
		Soil B	0.154	80	0.061	12.320	
	Salt affected land	Soil C	3.499	85	1.393	297.415	
	~	Soil D	0.013	88	0.005	1.144	
		Soil A	0.214	39	0.085	8.346	
Wastelands	Scrub land - Dense /	Soil B	1.043	55	0.415	57.365	
	Closed	Soil C	0.005	67	0.002	0.326	
		Soil D	0.057	71	0.023	4.047	
		Soil A	1.073	41	0.427	43.993	
		Soil B	0.484	55	0.193	26.620	
	Scrub land - Open	Soil C	0.535	69	0.213	36.915	
		Soil D	1.451	73	0.578	105.923	
		Soil A	0.321	100	0.128	32.100	
		Soil B	0.712	100	0.283	71.200	
	Reservoirs/Tanks	Soil C	10.882	100	4.333	1088.200	
		Soil D	4.355	100	1.734	435.500	
Water bodies		Soil B	2.309	97	0.919	223.973	
	D:	Soil C	0.586	97	0.233	56.842	
	River	Soil D	0.794	97	0.316	77.018	
			251.151		100	20522.924	

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Table 8.	Average	Rainfall	of the	study area	by	Thiessen	polygon	method
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Vear													
1000	Raingauge station	June	July	Augu	Septe	Octo	Nove	Dece	Janu	Febr	Marc	April	May
	Gomuki Dam	109 50	71.00	43.60	175.10	44 40	473.00	2.60	0.00	6 70	0.00	0.00	2.60
1992-	Manimulatha Dam	36.00	0.00	45.00	250.50	140.50	205.00	17.00	0.00	6.50	0.00	0.00	2.00
1993	Manimukina Dam	30.00	0.00	94.00	230.30	140.50	303.00	5.70	0.00	0.50	0.00	0.00	0.00
	Study Area Kainfall	93.70	55.74	54.44	191.31	05.00	430.88	5.70	0.00	0.40	0.00	0.00	3.70
1993-	Gomuki Dam	104.20	39.80	230.20	250.00	364.80	288.20	211.60	0.00	0.00	0.00	0.00	/4.00
1994	Manimuktha Dam	12.00	5.00	151.50	165.50	114.00	254.00	182.00	0.00	0.00	0.00	0.00	178.00
1777	Study Area Rainfall	<i>84.38</i>	32.32	213.28	231.73	310.88	280.85	205.24	0.00	0.00	0.00	0.00	96.36
100.4	Gomuki Dam	0.00	86.20	51.20	45.40	219.70	385.60	52.40	39.40	0.00	0.00	36.00	44.40
1994-	Manimuktha Dam	35.00	57.00	151.50	96.50	108.50	214.70	35.00	0.00	0.00	0.00	0.00	79.50
1995	Study Area Rainfall	7.53	79.92	72.76	56.39	195.79	348.86	48.66	30.93	0.00	0.00	28.26	51.95
	Gomuki Dam	128.00	88.40	46.50	135.10	111.10	127.20	0.00	0.00	0.00	0.00	84 40	74.80
1995-	Manimulatha Dam	72.50	75.50	168.00	199.00	102.00	144.00	0.00	0.00	0.00	0.00	25.00	10.50
1996	Steele Anna Dain	/3.30	75.50	72.00	100.00	102.00	120.01	0.00	0.00	0.00	0.00	25.00	19.50
	Study Area Kainjau	116.99	85.03	72.02	140.4/	109.14	130.81	0.00	0.00	0.00	0.00	/1.03	02.91
1996-	Gomuki Dam	83.40	11.60	228.80	335.40	140.00	144.60	487.30	15.40	0.00	0.00	39.40	15.00
1997	Manimuktha Dam	191.50	52.50	198.40	394.50	211.00	71.70	629.00	5.50	0.00	0.00	48.50	19.50
1,,,,,	Study Area Rainfall	106.64	20.39	222.26	348.11	155.27	128.93	517.77	13.27	0.00	0.00	41.36	15.97
1007	Gomuki Dam	27.60	36.20	72.00	280.60	379.60	506.40	100.70	0.00	0.00	0.00	0.00	74.60
1997-	Manimuktha Dam	109.00	28.50	131.00	232.00	150.50	305.50	163.00	0.00	0.00	0.00	0.00	20.00
1998	Study Area Rainfall	45.10	34.54	84.69	270.15	330.34	463.21	114.09	0.00	0.00	0.00	0.00	62.86
	Gomuki Dam	19.00	75.80	273.80	93.90	274.10	276.20	321.00	0.00	0.00	0.00	8.80	36.60
1998-	Manimuktha Dam	13 30	52.00	107 50	37.50	145.00	145 50	115.00	0.00	0.00	0.00	0.00	43.50
1999	Study Area Painfall	17.77	70.68	238.05	81 77	246.34	248 10	276 71	0.00	0.00	0.00	6.01	38.08
	Comulti Dom	20.20	27.40	110 10	62.40	222.60	291.00	120.40	2 70	104.60	0.00	21.20	77.00
1999-	Gomuki Dam	30.20	27.40	118.10	03.40	233.00	381.90	150.40	3.70	194.00	0.00	31.20	//.00
2000	Manimuktha Dam	28.50	13.00	91.00	88.00	72.90	192.30	166.50	0.00	39.00	0.00	23.00	92.00
	Study Area Rainfall	29.83	24.30	112.27	68.69	199.05	341.14	138.16	2.90	161.15	0.00	29.44	80.23
2000	Gomuki Dam	28.20	17.00	148.30	249.70	341.40	159.30	116.40	9.50	0.00	0.00	204.60	64.60
2000-	Manimuktha Dam	80.00	9.50	134.00	197.50	178.00	89.30	60.20	0.00	0.00	0.00	95.00	79.00
2001	Study Area Rainfall	39.34	15.39	145.23	238.48	306.27	144.25	104.32	7.46	0.00	0.00	181.04	67.70
	Gomuki Dam	59.90	236.60	83.20	209.50	254.00	116.30	71.20	11.20	20.40	0.00	0.00	107.00
2001-	Manimuktha Dam	17.00	262 50	21.50	202 50	142 50	78.50	133 50	8.00	30.00	0.00	0.00	111 50
2002	Study Area Painfall	50.68	242.50	60.03	202.00	230.03	108 17	84 50	10.51	22.46	0.00	0.00	107.07
	Camulai Dam	78 40	442.17	146.00	121.00	230.03	146.90	12.00	0.00	22.40	65.00	62.20	54.70
2002-	Gomuki Dam	/6.40	44.60	140.00	107.00	1/0.00	140.60	13.00	0.00	0.00	05.00	02.20	34.70
2003	Manimuktha Dam	69.00	57.00	54.00	107.00	190.50	184.00	43.50	0.00	0.00	0.00	44.00	0.00
	Study Area Rainfall	76.38	47.42	126.85	125.84	180.69	154.17	19.56	0.00	0.00	51.03	58.29	42.94
2003-	Gomuki Dam	74.00	166.60	464.20	144.00	324.00	293.00	122.00	0.00	0.00	0.00	22.00	686.00
2003-	Manimuktha Dam	48.50	209.50	267.00	64.00	137.50	225.80	12.50	0.00	0.00	0.00	9.00	481.00
2004													
2004	Study Area Rainfall	68.52	175.82	421.80	126.80	283.90	278.55	98.46	0.00	0.00	0.00	19.21	641.93
2004	Study Area Rainfall Gomuki Dam	68.52 43.00	175.82 224.00	421.80 20.00	126.80 643.00	283.90 590.00	278.55 208.00	98.46 0.00	0.00 0.00	0.00	0.00 4.30	19.21 74.70	641.93 90.00
2004 2004-	Study Area Rainfall Gomuki Dam Manimuktha Dam	68.52 43.00 43.50	175.82 224.00 45.50	421.80 20.00 14.50	126.80 643.00 253.00	283.90 590.00 421.00	278.55 208.00 127.50	98.46 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	0.00 4.30 38.15	19.21 74.70 32.00	641.93 90.00 112.00
2004 2004- 2005	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall	68.52 43.00 43.50 43.11	175.82 224.00 45.50 185.64	421.80 20.00 14.50 18.82	126.80 643.00 253.00 559.15	283.90 590.00 421.00 553.67	278.55 208.00 127.50 190.69	98.46 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 4.30 38.15 11.58	19.21 74.70 32.00 65.52	641.93 90.00 112.00 94.73
2004 2004- 2005	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Comuli Dam	68.52 43.00 43.50 43.11	175.82 224.00 45.50 185.64	421.80 20.00 14.50 18.82	126.80 643.00 253.00 559.15 257.00	283.90 590.00 421.00 553.67 432.00	278.55 208.00 127.50 190.69 702.00	98.46 0.00 0.00 0.00 235.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 4.30 38.15 11.58	19.21 74.70 32.00 65.52 85.00	641.93 90.00 112.00 94.73
2004 2004- 2005 2005-	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimukta Dam	68.52 43.00 43.50 43.11 9.00	175.82 224.00 45.50 185.64 183.00	421.80 20.00 14.50 18.82 183.00	126.80 643.00 253.00 559.15 257.00	283.90 590.00 421.00 553.67 432.00 267.00	278.55 208.00 127.50 190.69 702.00	98.46 0.00 0.00 235.00	0.00 0.00 0.00 10.00	0.00 0.00 0.00 0.00 0.00	0.00 4.30 38.15 11.58 100.00	19.21 74.70 32.00 65.52 85.00	641.93 90.00 112.00 94.73 82.00
2004 2004- 2005 2005- 2006	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam	68.52 43.00 43.50 43.11 9.00 11.50	175.82 224.00 45.50 185.64 183.00 110.50	421.80 20.00 14.50 18.82 183.00 193.50	126.80 643.00 253.00 559.15 257.00 256.50	283.90 590.00 421.00 553.67 432.00 267.00	278.55 208.00 127.50 190.69 702.00 497.00	98.46 0.00 0.00 235.00 196.00	0.00 0.00 0.00 10.00 5.00	0.00 0.00 0.00 0.00 0.00 0.00	0.00 4.30 38.15 11.58 100.00 15.00	19.21 74.70 32.00 65.52 85.00 57.00	641.93 90.00 112.00 94.73 82.00 81.00
2004 2004- 2005 2005- 2006	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall	68.52 43.00 43.50 43.11 9.00 11.50 9.54	175.82 224.00 45.50 185.64 183.00 110.50 167.41	421.80 20.00 14.50 18.82 183.00 193.50 185.26	126.80 643.00 253.00 559.15 257.00 256.50 256.89	283.90 590.00 421.00 553.67 432.00 267.00 396.53	278.55 208.00 127.50 190.69 702.00 4 97.00 657.93	98.46 0.00 0.00 235.00 196.00 226.62	0.00 0.00 0.00 10.00 5.00 8.93	0.00 0.00 0.00 0.00 0.00 0.00 0.00	0.00 4.30 38.15 11.58 100.00 15.00 81.73	19.21 74.70 32.00 65.52 85.00 57.00 78.98	641.93 90.00 112.00 94.73 82.00 81.00 81.79
2004 2004- 2005 2005- 2006	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00	126.80 643.00 253.00 559.15 257.00 256.50 256.89 105.00	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00	278.55 208.00 127.50 190.69 702.00 497.00 657.93 220.00	98.46 0.00 0.00 235.00 196.00 226.62 40.00	0.00 0.00 0.00 10.00 5.00 8.93 0.00	0.00 0.00 0.00 0.00 0.00 0.00 20.00	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00	19.21 74.70 32.00 65.52 85.00 57.00 78.98 100.00	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00
2004 2004- 2005 2005- 2006 2006- 2007	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00	126.80 643.00 253.00 559.15 257.00 256.50 256.89 105.00 130.00	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 380.00	278.55 208.00 127.50 190.69 702.00 4 97.00 657.93 220.00 215.00	98.46 0.00 0.00 235.00 196.00 226.62 40.00 20.00	0.00 0.00 0.00 10.00 5.00 8.93 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00 20.00 0.00	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00	19.21 74.70 32.00 65.52 85.00 57.00 78.98 100.00 105.00	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00
2004 2004- 2005 2005- 2006 2006- 2007	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 48.82	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38	126.80 643.00 253.00 559.15 257.00 256.50 256.89 105.00 130.00 110.38	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 380.00 313.28	278.55 208.00 127.50 190.69 702.00 497.00 657.93 220.00 215.00 218.93	98.46 0.00 0.00 235.00 196.00 226.62 40.00 20.00 35.70	0.00 0.00 0.00 10.00 5.00 8.93 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00 20.00 20.00 15.70	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 0.00	19.21 74.70 32.00 65.52 85.00 57.00 78.98 100.00 105.00 101.08	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60
2004 2004- 2005 2005- 2006 2006- 2007	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 48.82 20.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00	126.80 643.00 253.00 559.15 257.00 256.50 256.89 105.00 130.00 110.38 52.00	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 380.00 313.28 250.00	278.55 208.00 127.50 702.00 497.00 657.93 220.00 215.00 218.93 170.00	98.46 0.00 0.00 235.00 196.00 226.62 40.00 20.00 35.70 435.00	0.00 0.00 0.00 10.00 5.00 8.93 0.00 0.00 0.00 25.00	0.00 0.00 0.00 0.00 0.00 0.00 20.00 20.00 15.70 10.00	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 0.00 150.00	19.21 74.70 32.00 65.52 85.00 57.00 78.98 100.00 105.00 101.08 10.00	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 162.00
2004 2004- 2005 2005- 2006- 2006- 2007- 2007-	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Study Area Rainfall Gomuki Dam Manimuktha Dam	68.52 43.00 43.50 9.00 11.50 9.54 40.00 81.00 81.00 48.82 20.00 45.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 95.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00	126.80 643.00 253.00 559.15 257.00 256.50 256.89 105.00 130.00 110.38 52.00 60.00	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 380.00 313.28 250.00 255.00	278.55 208.00 127.50 702.00 497.00 657.93 220.00 215.00 215.00 218.93 170.00 180.00	98.46 0.00 0.00 235.00 196.00 226.62 40.00 20.00 35.70 435.00 267.00	0.00 0.00 0.00 10.00 5.00 8.93 0.00 0.00 0.00 25.00 15.00	0.00 0.00 0.00 0.00 0.00 0.00 20.00 0.00 15.70 10.00 10.00	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 0.00 150.00 115.00	19.21 74.70 32.00 65.52 85.00 57.00 78.98 100.00 105.00 101.08 10.00 20.00	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 162.00 93.00
2004 2004- 2005 2005- 2006 2007 2007- 2008	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 48.82 20.00 45.00 25.38	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 95.00 252.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 251.68	126.80 643.00 253.00 559.15 257.00 256.50 256.89 105.00 130.00 110.38 52.00 60.00 53.72	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 380.00 313.28 250.00 255.00 255.00	278.55 208.00 127.50 190.69 702.00 497.00 657.93 220.00 215.00 218.93 170.00 180.00 172.15	98.46 0.00 0.00 235.00 196.00 226.62 40.00 20.00 35.70 435.00 267.00 398.88	0.00 0.00 0.00 10.00 5.00 8.93 0.00 0.00 0.00 25.00 15.00 22.85	0.00 0.00 0.00 0.00 0.00 0.00 20.00 0.00 15.70 10.00 10.00 10.00	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 0.00 150.00 115.00 142.48	19.21 74.70 32.00 65.52 85.00 57.00 78.98 100.00 105.00 101.08 10.00 20.00 12.15	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 162.00 93.00 147.17
2004 2004- 2005 2005- 2006- 2007 2007- 2008	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 48.82 20.00 45.00 25.38 60.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 95.00 95.00 252.00 30.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 251.68 55.00	126.80 643.00 253.00 559.15 257.00 256.50 256.89 105.00 130.00 110.38 52.00 60.00 53.72 110.00	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 313.28 250.00 255.00 251.08	278.55 208.00 127.50 190.69 702.00 497.00 657.93 220.00 215.00 218.93 170.00 180.00 172.15 660 ,00	98.46 0.00 0.00 235.00 196.00 226.62 40.00 35.70 435.00 267.00 398.88 55.00	0.00 0.00 0.00 10.00 5.00 8.93 0.00 0.00 0.00 25.00 15.00 22.85 0.00	0.00 0.00 0.00 0.00 0.00 20.00 20.00 15.70 10.00 10.00 10.00 0.00	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 150.00 150.00 115.00 142.48 35.00	19.21 74.70 32.00 65.52 85.00 57.00 78.98 100.00 105.00 101.08 10.00 20.00 12.15 0.00	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 162.00 93.00 147.17 30.00
2004 2004- 2005 2005- 2006 2006- 2007 2007- 2008 2008-	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 63.00 44.95 295.00 95.00 252.00 30.00 233.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 251.68 55.00	126.80 643.00 253.00 559.15 257.00 256.89 105.00 130.00 110.38 52.00 60.00 53.72 110.00	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 313.28 255.00 255.00 251.08 338.00 251.08	278.55 208.00 127.50 190.69 702.00 497.00 657.93 220.00 215.00 218.93 170.00 180.00 172.15 660.00 490.00	98.46 0.00 0.00 235.00 196.00 226.62 40.00 20.00 35.70 435.00 267.00 398.88 55.00	0.00 0.00 0.00 10.00 5.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 20.00 10.00 10.00 10.00 10.00 0.00	0.00 4.30 38.15 11.58 100.00 15.00 0.00 0.00 0.00 150.00 115.00 142.48 35.00	19.21 74.70 32.00 65.52 85.00 57.00 78.98 100.00 105.00 101.08 10.00 20.00 12.15 0.00 0.00	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 162.00 93.00 147.17 30.00 5.00
2004 2004- 2005 2006- 2006- 2007- 2007- 2008 2008- 2009	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 252.00 30.00 133.00 52.15	421.80 20.00 14.50 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 251.68 55.00 55.00 55.00	126.80 643.00 253.00 559.15 257.00 256.50 256.89 105.00 130.00 110.38 52.00 60.00 53.72 110.00 45.00	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 313.28 255.00 251.08 338.00 261.08 338.00 261.08 338.00 261.08 338.00 261.08 338.00 261.08 338.00 261.08 338.00 261.08 338.00 261.08 338.00 261.08 338.00 261.08 338.00 261.08 338.00 261.08 338.00 261.08 338.00 261.08 362.08	278.55 208.00 127.50 190.69 702.00 497.00 657.93 220.00 215.00 215.00 218.93 170.00 170.00 172.15 660.00 490.00	98.46 0.00 0.00 235.00 226.62 40.00 226.62 40.00 20.00 35.70 435.00 398.88 55.00 60.00 56.09	0.00 0.00 0.00 0.00 5.00 5.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 10.00 10.00 10.00 10.00 0.	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 0.00 150.00 115.00 142.48 35.00 45.00 37.15	19.21 74.70 32.00 65.52 85.00 78.98 100.00 105.00 101.08 10.00 20.00 12.15 0.00 0.00	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 93.00 147.17 30.00 5.00
2004 2004- 2005 2006- 2006- 2007- 2008 2008- 2008- 2008-	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 62.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 95.00 95.00 30.00 133.00 52.15 50.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 55.00 55.00 55.00 55.00	126.80 643.00 253.00 257.00 256.50 256.50 256.89 105.00 130.00 110.38 52.00 60.00 53.72 110.00 45.00 96.03 170.00	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 380.00 313.28 255.00 255.00 255.00 255.00 251.08 338.00 261.00 261.00 301.45 270.45	278.55 208.00 127.50 190.69 702.00 657.93 220.00 215.00 218.93 170.00 180.00 180.00 172.15 660.00 490.00 623.45 475.00	98.46 0.00 0.00 235.00 196.00 226.62 40.00 20.00 35.70 435.00 267.00 267.00 398.88 55.00 60.00 55.00	0.00 0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 0.00 25.00 15.00 22.85 0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 15.00 15.00 15.00 15.00 15.00 142.48 35.00 45.00 37.15 0.00	19.21 74.70 32.00 65.52 85.00 78.98 100.00 105.00 101.08 10.00 20.00 101.08 10.00 20.00 12.15 0.00 0.00 0.00	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 162.00 93.00 147.17 30.00 5.00 24.63 15.00
2004 2004- 2005 2005- 2006 2006- 2007 2008 2008- 2008- 2009 2009-	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 20.00	175.82 224.00 45.50 185.64 183.00 110.50 63.00 44.95 295.00 95.00 252.00 95.00 252.00 133.00 52.15 50.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 251.68 55.00 50.00 53.93 87.00 53.93	126.80 643.00 253.00 255.915 257.00 256.50 130.00 110.38 52.00 60.00 53.72 110.00 45.00 96.03 170.00	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 313.28 250.00 255.00 255.00 251.08 338.00 261.00 321.45 79.00	278.55 208.00 127.50 190.69 702.00 497.00 215.00 215.00 218.93 170.00 180.00 172.15 660.00 490.00 623.45 475.00	98.46 0.00 0.00 235.00 226.62 40.00 20.00 35.70 435.00 267.00 398.88 55.00 60.00 56.08 153.00 102.00	0.00 0.00 0.00 0.00 0.00 0.00 8.93 0.00 0.00 0.00 25.00 15.00 22.85 0.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 10.00 10.00 10.00 0.0	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 0.00 115.00 115.00 142.48 35.00 45.00 37.15 0.00	19.21 74.70 32.00 65.52 85.00 57.00 78.98 100.00 105.00 101.08 10.00 20.00 101.08 10.00 20.00 0.00 0.00 0.00 0.00	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 162.00 93.00 5.00 5.00 24.63 155.00
2004 2004- 2005 2005- 2006 2006- 2007 2008- 2008- 2009- 2009- 2009- 2010	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 30.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 95.00 252.00 30.00 133.00 52.15 50.00 35.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 251.68 55.00 53.93 87.00 90.00 55.00	126.80 643.00 253.00 255.01 256.50 1256.50 130.00 110.38 52.00 60.00 53.72 110.00 45.00 96.03 170.00 165.00	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 313.28 250.00 251.08 338.00 261.00 321.45 79.00 55.00 25.00	278.55 208.00 127.50 190.69 702.00 497.00 657.93 220.00 215.00 180.00 172.15 660.00 490.00 633.45 475.00 380.00	98.46 0.00 0.00 235.00 196.00 226.62 40.00 20.00 35.70 435.00 267.00 398.88 55.00 60.00 56.08 153.00 105.00	0.00 0.00 0.00 0.00 5.00 5.00 0.00 0.00 25.00 15.00 22.85 0.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.70 10.00 10.00 10.00 0.	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 0.00 150.00 115.00 142.48 35.00 45.00 142.48 35.00 45.00 0.00	19.21 74.70 32.00 65.52 85.00 57.00 105.00 101.08 10.00 20.00 101.08 10.00 20.00 101.08 10.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 15.00 162.00 93.00 147.17 30.00 5.00 147.17 35.00 175.00
2004 2004- 2005 2006- 2006- 2007- 2007- 2008 2008- 2009- 2010	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 252.00 30.00 133.00 52.15 50.00 35.00 46.78	421.80 20.00 14.50 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 251.68 55.00 50.00 53.93 87.00 90.00 87.65	126.80 643.00 253.00 559.15 257.00 256.50 256.89 105.00 130.00 110.38 52.00 60.00 53.72 110.00 45.00 96.03 170.00 165.00 168.93	283.90 590.00 421.00 553.67 433.00 207.00 396.53 295.00 380.00 255.00 255.00 251.08 338.00 261.00 321.45 79.00 55.00 73.84	278.55 208.00 127.50 702.00 497.00 657.93 220.00 215.00 218.93 170.00 180.00 172.15 660.00 490.00 623.45 380.00 454.58	98.46 0.00 0.00 235.00 196.00 226.62 40.00 20.00 35.70 455.00 267.00 398.88 55.00 60.00 56.08 153.00 105.00 142.68	0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 0.00 0.00 15.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 10.00 10.00 10.00 10.00 0.	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 0.00 150.00 150.00 150.00 142.48 35.00 45.00 37.15 0.00 0	19.21 74.70 32.00 65.52 85.00 78.98 100.00 105.00 101.08 10.00 20.00 101.09 10.00 20.00 101.09 0.00 0.00 0.00 0.00 0.00	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 93.00 147.17 30.00 5.00 147.17 30.00 5.00 155.00 170.00 158.23
2004 2004- 2005- 2006- 2006- 2007- 2008- 2008- 2008- 2009- 2010 2010-	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 95.00 252.00 30.00 133.00 52.15 50.00 35.00 35.00 46.78 18.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 251.68 55.00 55.00 55.00 55.00 53.93 87.00 90.00 87.65 208.00	126.80 643.00 253.00 255.915 257.00 256.50 256.89 105.00 130.00 110.38 52.00 60.00 53.72 110.00 45.00 96.03 170.00 165.00 165.00	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 380.00 313.28 255.00 255.00 251.08 338.00 261.00 321.45 79.00 55.00 73.84 96.00	278.55 208.00 127.50 190.69 702.00 657.93 220.00 215.00 215.00 215.00 170.00 180.00 172.15 660.00 490.00 623.45 475.00 380.00 454.58 616.00	98.46 0.00 0.00 235.00 196.00 226.62 40.00 20.00 35.70 435.00 267.00 398.88 55.00 60.00 56.08 153.00 105.00 105.00 105.00 105.00 105.00 323.00	0.00 0.00 0.00 0.00 10.00 5.00 8.93 0.00 0.00 0.00 25.00 22.85 0.00 0.00 0.00 0.00 0.00 0.00 15.00 3.23 0.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 10.00 10.00 10.00 0.0	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 0.00 150.00 142.48 35.00 142.48 35.00 45.00 37.15 0.00 0.00 0.00 0.00 0.00 0.00	19.21 74.70 32.00 65.52 85.00 78.98 100.00 105.00 101.08 10.00 20.00 12.15 0.00 0.00 0.00 0.00 0.00 0.00 0.00 105.00	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 162.00 93.00 147.17 30.00 5.00 24.63 155.00 170.00 158.23 68.00
2004 2004- 2005 2005- 2006 2007- 2008 2007- 2008 2009- 2010 2010- 2011	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00	175.82 224.00 45.50 185.64 183.00 110.50 63.00 44.95 295.00 95.00 252.00 30.00 133.00 52.15 50.00 35.00 46.78 18.00 95.00	421.80 20.00 14.50 188.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 251.68 55.00 50.00 55.00 50.00 55.00 50.00 55.00 50.00 55.00 55.00 50.00 55.00 50.00 55.00 50.00 55.00 50.0	126.80 643.00 253.00 257.00 256.50 105.00 130.00 110.38 52.00 60.00 110.38 52.00 60.00 45.00 96.03 170.00 168.93 196.00 125.00	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 380.00 313.28 255.00 255.00 251.08 338.00 261.00 321.45 79.00 55.00 73.84 96.00 40.00	278.55 208.00 127.50 190.69 702.00 657.93 220.00 215.00 215.00 218.93 170.00 180.00 490.00 623.45 475.00 380.00 454.58 6616.00 505.00	98.46 0.00 0.00 235.00 235.00 226.62 40.00 20.00 35.70 435.00 267.00 398.88 55.00 60.00 56.08 153.00 105.00 142.68 323.00 175.00	0.00 0.00 0.00 0.00 0.00 0.00 8.93 0.00 0.00 0.00 0.00 15.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 10.00 10.00 0.00	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 0.00 115.00 115.00 115.00 37.15 0.00	19.21 74.70 32.00 65.52 85.00 78.98 100.00 105.00 101.08 10.00 20.00 101.08 10.00 20.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.000 0.00 0.00 0.000 0.000 0.000 0.00000000000000	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 162.00 93.00 5.00 24.63 155.00 170.00 158.23 68.00 6.00
2004 2004- 2005 2005- 2006 2006- 2007 2008 2008- 2009 2009- 2010 2010- 2011	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 95.00 252.00 30.00 133.00 52.15 50.00 35.00 46.78 18.00 95.00 95.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 251.68 55.00 55.00 55.00 55.00 55.00 87.00 90.00 87.65 208.00 92.00 183.06	126.80 643.00 253.00 559.15 257.00 256.50 256.89 105.00 130.00 110.38 52.00 60.00 53.72 110.00 45.00 168.93 170.00 165.00 168.93 196.00 125.00 180.74	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 313.28 250.00 255.00 251.08 338.00 261.00 251.08 338.00 261.00 55.00 73.84 96.00 40.00 40.00 83.96	278.55 208.00 127.50 190.69 702.00 497.00 657.93 220.00 215.00 218.93 170.00 180.00 172.15 660.00 490.00 633.45 475.00 380.00 454.58 616.00 505.00	98.46 0.00 0.00 235.00 196.00 226.62 40.00 20.00 35.70 267.00 398.88 55.00 60.00 398.88 55.00 60.00 105.00 142.68 323.00 175.00 291.18	0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 0.00 25.00 15.00 22.85 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.00 22.85 0.00 0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.70 10.00 10.00 10.00 0.	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 0.00 150.00 150.00 150.00 142.48 35.00 142.48 35.00 0.00	19.21 74.70 32.00 65.52 85.00 78.98 100.00 101.08 10.00 20.00 101.09 10.00 20.00 12.15 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 162.00 93.00 147.17 30.00 5.00 147.17 30.00 5.00 147.17 30.00 5.00 170.00 158.23 68.00 6.00 54.64
2004 2004- 2005- 2006- 2007- 2007- 2008- 2009- 2009- 2010- 2010- 2011- 2011-	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.50 43.11 9.00 11.50 9.54 40.00 81.00 81.00 81.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43 15.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 252.00 30.00 133.00 52.15 50.00 35.00 46.78 18.00 95.00 34.56	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 55.00 251.68 55.00 50.00 53.93 87.00 90.00 87.65 208.00 92.00 183.06 171.00	126.80 643.00 253.00 255.00 256.50 256.89 105.00 130.00 110.38 52.00 60.00 53.72 110.00 45.00 96.03 170.00 165.00 168.93 196.00 125.00 180.74 123.00	283.90 590.00 421.00 553.67 432.00 207.00 396.53 295.00 380.00 255.00 255.00 251.08 338.00 261.00 321.45 79.00 55.00 73.84 96.00 40.00 83.96 (00) 83.96 (00) 77.00 77.	278.55 208.00 127.50 190.69 702.00 497.00 497.00 215.00 218.93 170.00 180.00 172.15 660.00 490.00 623.45 475.00 380.00 454.58 616.00 505.00 592.14	98.46 0.00 0.00 235.00 226.62 40.00 226.62 40.00 20.00 35.70 455.00 267.00 398.88 55.00 60.00 56.08 153.00 105.00 142.68 323.00 175.00 291.18 273.00	0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 0.00 0.00 15.00 22.85 0.00 0.00 0.00 0.00 0.00 15.00 3.23 0.00 5.00 15.00 15.00 0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.70 10.00 10.00 10.00 0.	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 150.00 150.00 150.00 150.00 150.00 142.48 35.00 45.00 37.15 0.00 0.0	19.21 74.70 32.00 65.52 85.00 7 8.98 100.00 105.00 101.08 10.00 20.00 101.08 10.00 20.00 12.15 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 105.00 240.00 134.03 25.00	641.93 90.00 112.00 94.73 82.00 81.00 82.00 15.00 67.60 93.00 147.17 30.00 5.00 147.17 30.00 5.00 147.17 30.00 5.00 155.00 158.23 68.00 6.00 54.64 12.00
2004 2004- 2005- 2006- 2007- 2007- 2008- 2009- 2009- 2010- 2010- 2011- 2011-	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 39.42 45.00 140.00 65.43 15.00 60.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 295.00 252.00 30.00 133.00 52.15 50.00 46.78 18.00 95.00 34.56 109.00 140.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 251.68 55.00 55.00 55.00 55.00 55.00 87.00 87.00 87.65 208.00 92.00 183.06 171.00	126.80 643.00 253.00 255.00 257.00 130.00 130.00 130.00 103.8 52.00 53.72 110.00 45.00 96.03 170.00 165.00 168.93 196.00 125.00 180.74 123.00	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 380.00 313.28 255.00 251.08 338.00 261.00 251.08 338.00 261.00 321.45 79.00 79.60 79.60 79.84 96.00 40.00 83.96 171.00	278.55 208.00 127.50 190.69 702.00 657.93 220.00 215.00 215.00 218.93 170.00 172.15 660.00 490.00 623.45 475.00 505.00 505.00 592.14 546.00 303.20	98.46 0.00 0.00 235.00 196.00 226.62 40.00 20.00 35.70 435.00 35.70 398.88 55.00 60.00 56.08 153.00 105.00 142.68 323.00 175.00 291.18 273.00 117.60	0.00 0.00 0.00 10.00 5.00 8.93 0.00 0.00 25.00 15.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 10.00 10.00 10.00 0.0	0.00 4.30 38.15 11.58 100.00 0.00 0.00 0.00 150.00 142.48 35.00 142.48 35.00 142.48 35.00 0.0	19.21 74.70 32.00 65.52 85.00 7 8.98 100.00 105.00 101.08 10.00 20.00 12.15 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 93.00 147.17 30.00 5.00 24.63 155.00 170.00 158.23 68.00 6.00 54.64 12.00
2004 2004- 2005- 2006- 2007- 2008- 2009- 2009- 2010- 2010- 2011- 2011- 2012-	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43 15.00 60.00 24.68	175.82 224.00 45.50 185.64 183.00 110.50 63.00 44.95 295.00 95.00 30.00 133.00 52.15 50.00 33.00 52.15 50.00 35.00 35.00 35.00 35.00 34.56 109.00 140.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 53.93 87.00 90.00 53.93 87.05 208.00 92.00 183.06 171.00 143.00 164.34	126.80 643.00 253.00 253.00 257.00 256.50 256.50 256.50 130.00 110.38 52.00 60.00 53.72 110.00 45.00 96.03 170.00 165.00 165.00 180.74 123.00 90.00 115.01	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 380.00 313.28 255.00 255.00 255.00 255.00 251.08 338.00 261.00 321.45 79.00 55.00 331.45 79.00 55.00 40.00 83.96 171.00 141.20 164.59	278.55 208.00 127.50 190.69 702.00 657.93 220.00 215.00 215.00 215.00 170.00 180.00 180.00 172.15 660.00 490.00 623.45 475.00 380.00 505.00 592.14 546.00 505.00	98.46 0.00 0.00 235.00 235.00 226.62 40.00 20.00 35.70 435.00 267.00 398.88 55.00 60.00 56.08 153.00 105.00 105.00 105.00 291.18 273.00 117.60 239.59	0.00 0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 0.00 25.00 15.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 10.00 10.00 10.00 0.0	0.00 4.30 38.15 11.58 100.00 0.00 81.73 0.00 0.00 150.00 150.00 150.00 155.00 155.00 142.48 35.00 45.00 37.15 0.00	19.21 74.70 32.00 65.52 85.00 78.98 100.00 105.00 101.08 10.00 20.00 101.08 10.00 20.00 12.15 0.00 0.00 0.00 0.00 0.00 0.00 0.00 105.00 240.00 134.03 25.00 21.40	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 162.00 93.00 147.17 30.00 5.00 24.63 155.00 170.00 5.00 24.63 155.00 170.00 5.00 24.63 155.00 170.00 5.00 24.63 155.00 170.00 5.00 24.63 155.00 170.00 24.64 12.00 20.20 13.76
2004 2004- 2005 2005- 2006 2007- 2007- 2008 2009- 2010 2010- 2010- 2011- 2011- 2012	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43 15.00 60.00 24.68 0.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 95.00 95.00 252.00 30.00 133.00 52.15 50.00 35.00 46.78 18.00 95.00 34.56 109.00 140.00 115.67 123.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 251.68 55.00 55.00 251.68 55.00 90.00 87.65 208.00 90.00 87.65 208.00 92.00 113.06 171.00 140.00 164.34 0.00	126.80 643.00 253.00 255.00 256.50 256.89 105.00 105.00 100.00 53.72 110.00 60.00 53.72 110.00 60.00 53.72 110.00 165.00 168.93 170.00 165.00 168.93 196.00 125.00 180.74 123.00 90.00 115.91 14.00	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 255.00 255.00 251.08 338.00 261.00 338.00 261.00 55.00 73.84 96.00 40.00 171.00 141.20 164.59 412.00	278.55 208.00 127.50 190.69 702.00 497.00 657.93 220.00 215.00 218.93 220.00 172.00 180.00 172.15 660.00 490.00 633.45 475.00 380.00 454.58 616.00 505.00 380.00 454.58 616.00 505.00 333.20 493.80 640.00	98.46 0.00 0.00 235.00 196.00 226.62 40.00 20.00 35.70 267.00 398.88 55.00 60.00 55.00 60.00 105.00 142.68 323.00 175.00 105.00 142.68 233.00 175.00 291.18 273.00 117.60 239.09 0.00	0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 0.00 25.00 15.00 22.85 0.00 0.00 0.00 0.00 0.00 0.00 15.00 3.23 0.00 15.00 15.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.70 10.00 10.00 10.00 0.	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 0.00 150.00 150.00 150.00 150.00 142.48 35.00 142.48 35.00 0.00	19.21 74.70 32.00 65.52 85.00 78.98 100.00 101.08 10.00 20.00 101.08 10.00 20.00 101.09 101.09 100.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.134.03 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.40 25.00 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.50 21.5	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 93.00 147.17 30.00 93.00 147.17 30.00 155.00 170.00 158.23 68.00 6.00 170.00 158.23 68.00 6.00 12.00 24.63
2004 2004- 2005- 2006- 2007- 2007- 2008- 2009- 2009- 2010- 2011- 2011- 2011- 2012- 2012-	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.50 43.11 9.00 11.50 9.54 40.00 81.00 81.00 81.00 25.38 60.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43 15.00 60.00 24.68 0.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 252.00 30.00 133.00 52.15 50.00 35.00 46.78 18.00 95.00 34.56 109.00 140.00 115.67 123.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 251.68 55.00 50.00 53.93 87.00 90.00 87.65 208.00 92.00 183.06 171.00 140.00 164.34 0.00	126.80 643.00 253.00 255.00 256.50 256.89 105.00 130.00 100.38 52.00 60.00 53.72 110.00 45.00 96.03 170.00 165.00 168.93 196.00 125.00 180.74 123.00 90.00 115.91 14.00	283.90 590.00 421.00 553.67 432.00 207.00 295.00 205.00 255.00 255.00 255.00 251.08 338.00 261.00 321.45 79.00 55.00 73.84 96.00 40.00 83.96 171.00 141.20 164.59 412.00 164.59 141.20 164.59 141.20 164.59 141.20 164.59 141.20 164.59 141.20 164.59 141.20 164.59 141.20 164.59 141.20 164.59 164.59 165.50 165.50 165.50 165.50 165.50 175.	278.55 208.00 127.50 702.00 497.00 657.93 220.00 215.00 218.93 170.00 180.00 172.15 660.00 490.00 623.45 660.00 490.00 623.45 8616.00 505.00 592.14 475.00 303.20 493.80 69.00 454.58	98.46 0.00 0.00 235.00 196.00 226.62 40.00 20.00 35.70 267.00 398.88 55.00 60.00 56.08 153.00 105.00 142.68 323.00 175.00 291.18 273.00 117.60 239.59 0.00	0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 0.00 0.00 15.00 22.85 0.00 0.00 0.00 0.00 15.00 15.00 15.00 15.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 10.00 10.00 10.00 10.00 0.	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 150.00 150.00 150.00 150.00 142.48 35.00 45.00 37.15 0.000 0.00	19.21 74.70 32.00 65.52 85.00 7 8.98 100.00 105.00 101.08 10.00 20.00 101.08 10.00 20.00 101.09 10.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	641.93 90.00 112.00 94.73 82.00 81.00 81.00 81.79 82.00 15.00 67.60 93.00 93.00 147.17 30.00 5.00 155.00 155.00 170.00 158.23 68.00 6.00 54.64 12.00 20.20 13.76 0.00 0.00
2004 2004- 2005- 2006- 2007- 2007- 2008- 2009- 2009- 2010- 2010- 2011- 2011- 2011- 2012- 2013	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 39.42 45.00 140.00 65.43 15.00 60.00 24.68 0.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 252.00 30.00 133.00 52.15 50.00 46.78 18.00 95.00 34.56 109.00 140.00 140.00 145.67 123.00 44.30	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 251.68 55.00 55.00 55.00 201.00 87.60 90.00 87.65 208.00 92.00 183.06 171.00 140.00 140.00 164.34 0.00 0.0	126.80 643.00 253.00 255.00 256.50 256.89 105.00 130.00 103.8 52.00 60.00 53.72 110.00 45.00 96.03 170.00 165.00 168.93 196.00 125.00 180.74 123.00 99.00 115.91 14.00 115.91	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 380.00 313.28 255.00 251.08 338.00 261.00 251.08 338.00 261.00 321.45 79.00 79.60 79.60 79.84 96.00 40.00 83.96 171.00 164.59 412.00 224.10	278.55 208.00 127.50 190.69 702.00 657.93 220.00 215.00 218.93 170.00 172.15 660.00 490.00 623.45 475.00 505.00 505.00 592.14 546.00 505.00 592.14 546.00 505.00 592.14 546.00 505.00 592.14 546.00 505.00 592.14 546.00 505.00 592.14 546.00 505.00 592.14 546.00 505.00 592.14 546.00 505.00 592.14 546.00 505.00 50	98.46 0.00 0.00 235.00 226.62 40.00 226.62 40.00 20.00 35.70 435.00 55.00 60.00 56.08 153.00 162.00 153.00 175.00 291.18 273.00 291.18 273.00 291.18 273.00 291.18 273.00 291.59 0.00 3.20 0.00 3.20 0.00 3.20 0.00	0.00 0.00 0.00 0.00 10.00 5.00 8.93 0.00 0.00 0.00 25.00 15.00 22.85 0.00 0.00 0.00 0.00 0.00 15.00 3.23 0.00 5.00 1.08 0.00 0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.70 10.00 10.00 0.0	0.00 4.30 38.15 11.58 100.00 0.00 0.00 0.00 150.00 142.48 35.00 142.48 35.00 142.48 35.00 0.0	19.21 74.70 32.00 65.52 85.00 78.98 100.00 105.00 101.08 10.00 10.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 105.00 24.00 134.03 25.00 21.40 24.23 0.00 0.00	641.93 90.00 112.00 94.73 82.00 81.00 82.00 15.00 67.60 93.00 147.17 30.00 5.00 24.63 155.00 158.23 68.00 6.00 54.64 12.00 54.64 12.00 13.76 0.00 0.00 0.00
2004 2004- 2005- 2006- 2007- 2008 2009- 2010 2010- 2011- 2011- 2011- 2012 2012	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43 15.00 24.68 0.00 0.00 0.00 0.00 0.00	175.82 224.00 45.50 185.64 183.00 110.50 63.00 44.95 295.00 95.00 30.00 133.00 52.15 50.00 33.00 52.15 50.00 35.00 46.78 18.00 95.00 34.56 109.00 140.00 115.67 123.00 43.30	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 53.93 87.00 90.00 53.93 87.65 208.00 92.00 183.06 171.00 140.00 164.34 0.00 0.00 0.00 0.00	126.80 643.00 253.00 255.00 256.50 105.00 130.00 110.38 52.00 60.00 130.00 110.38 52.00 60.00 53.72 110.00 45.00 96.03 170.00 165.00 165.00 168.93 196.00 125.00 180.74 123.00 90.00 115.91 14.00 17.20 14.69	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 380.00 313.28 255.00 255.00 255.00 251.08 338.00 261.00 321.45 79.00 55.00 331.45 79.00 55.00 40.00 83.96 171.00 141.20 164.29 412.00 224.10 371.60	278.55 208.00 127.50 190.69 702.00 657.93 220.00 215.00 215.00 218.93 170.00 180.00 490.00 623.45 475.00 380.00 490.00 633.45 616.00 505.00 592.14 546.00 303.20 493.80 69.00 65.40 68.23	98.46 0.00 0.00 235.00 196.00 225.62 40.00 226.62 40.00 235.70 435.00 267.00 398.88 55.00 60.00 398.88 55.00 60.00 105.00 1	0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 25.00 15.00 22.85 0.00 0.00 0.00 0.00 0.00 15.00 3.23 0.00 0.	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.70 10.00 15.70 10.00 10.00 0	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 150.00 115.00 142.48 35.00 45.00 142.48 35.00 0	19.21 74.70 32.00 65.52 85.00 78.98 100.00 105.00 101.08 10.00 20.00 101.08 10.00 20.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 134.03 25.00 21.40 24.23 0.00 0.00 0.00 0.00	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 15.00 162.00 93.00 147.17 30.00 5.00 24.63 155.00 170.00 24.63 155.00 170.00 5.00 5.00 5.00 5.00 5.00 5.00 5.00
2004 2004- 2005 2005- 2006 2007- 2008 2007- 2008 2009- 2010 2010- 2010- 2011- 2011- 2012- 2013 2012- 2013	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43 15.00 60.00 24.68 0.00 0.00 0.00 0.00 0.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 95.00 95.00 252.00 30.00 133.00 52.15 52.15 50.00 35.00 46.78 18.00 95.00 34.56 109.00 140.00 115.67 123.00 43.30	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 251.68 55.00 55.00 55.00 251.68 55.00 90.00 87.65 208.00 90.00 87.65 208.00 92.00 143.06 171.00 143.40 0.00 0.00 0.00 0.00 0.00	126.80 643.00 253.00 255.00 256.50 256.89 105.00 105.00 100.00 53.72 110.00 60.00 53.72 110.00 60.00 53.72 110.00 165.00 168.93 170.00 165.00 168.93 196.00 125.00 180.74 123.00 90.00 115.91 14.00 17.20	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 255.00 255.00 251.08 338.00 251.00 251.00 338.00 261.00 338.00 55.00 73.84 96.00 40.00 171.00 141.20 164.59 412.00 224.10 83.00 83.00	278.55 208.00 127.50 702.00 497.00 657.93 220.00 215.00 218.93 170.00 180.00 172.15 660.00 490.00 623.45 475.00 380.00 454.58 616.00 505.00 380.00 454.58 616.00 505.20 493.80 69.00 65.40	98.46 0.00 0.00 235.00 196.00 226.62 40.00 20.00 35.70 267.00 398.88 55.00 60.00 55.08 153.00 105.00 142.68 323.00 175.00 105.00 142.68 233.00 175.00 291.18 273.00 117.60 291.18 273.00 117.60 291.60 201.60 2	0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 0.00 25.00 15.00 22.85 0.00 0.00 0.00 0.00 0.00 0.00 15.00 3.23 0.00 15.00 3.23 0.00 0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 10.00 10.00 10.00 0.0	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 0.00 150.00 150.00 150.00 150.00 142.48 35.00 142.48 35.00 0.00	19.21 74.70 32.00 65.52 85.00 78.98 100.00 105.00 101.08 10.00 20.00 12.15 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 240.00 240.00 240.00 240.00 240.00 240.00 240.00 240.00 21.40 24.23 0.00 0.00 0.00	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 93.00 147.17 30.00 93.00 147.17 30.00 155.00 170.00 188.23 68.00 6.00 13.76 0.00 0.00 86.00
2004 2004- 2005- 2006- 2007- 2008- 2009- 2009- 2010- 2010- 2011- 2011- 2011- 2012- 2013- 2013- 2013-	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 9.54 40.00 81.00 81.00 81.00 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43 15.00 60.00 24.68 0.00 0.00 0.00 0.00 0.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 252.00 30.00 133.00 52.15 50.00 35.00 46.78 18.00 95.00 34.56 109.00 140.00 115.67 123.00 43.30 105.86 0.00	421.80 20.00 14.50 18.20 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 251.68 55.00 50.00 53.93 87.00 90.00 87.65 208.00 90.00 183.06 171.00 140.00 164.34 0.00 0.00 0.00 0.00 0.00 0.00	126.80 643.00 253.00 255.00 256.50 256.89 105.00 130.00 105.00 52.00 53.72 110.00 53.72 110.00 45.00 96.03 170.00 165.00 168.93 196.00 125.00 180.74 173.00 90.00 115.91 14.00 172.00 127.00 127.00	283.90 590.00 421.00 553.67 432.00 207.00 295.00 396.53 295.00 255.00 255.00 255.00 251.08 338.00 261.00 321.45 79.00 55.00 73.84 96.00 40.00 83.96 171.00 141.20 164.59 412.00 224.10 371.60 129.50	278.55 208.00 127.50 190.69 702.00 497.00 657.93 220.00 215.00 218.93 170.00 180.00 172.15 660.00 172.15 660.00 172.15 660.00 172.15 660.00 172.15 660.00 172.15 660.00 172.00 490.00 623.45 8616.00 505.00 592.14 475.00 303.20 493.80 69.00 65.40 68.23 185.10 138.80	98.46 0.00 0.00 235.00 196.00 226.62 40.00 20.00 35.70 267.00 398.88 55.00 60.00 56.08 133.00 105.00 142.68 323.00 175.00 291.18 273.00 117.60 239.59 0.00 3.20 0.69 103.00 65.10	0.00 0.00 0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 22.85 0.00 0.00 0.00 0.00 0.00 5.00 15.00 3.23 0.00 5.00 10.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.70 10.00 10.00 10.00 0.	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 150.00 150.00 150.00 150.00 142.48 35.00 45.00 37.15 0.00	19.21 74.70 32.00 65.52 85.00 78.98 100.00 101.08 10.00 20.00 101.08 10.00 20.00 12.15 0.00 0.00 0.00 0.00 0.00 0.00 134.03 25.00 21.40 24.23 0.00 0.00 0.	641.93 90.00 112.00 94.73 82.00 81.00 82.00 15.00 67.60 93.00 147.17 30.00 93.00 147.17 30.00 5.00 147.17 30.00 5.00 147.17 30.00 5.00 147.17 30.00 5.00 147.17 30.00 5.00 147.17 30.00 5.00 158.23 68.00 20.20 13.76 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0
2004 2004- 2005- 2006- 2007- 2008- 2009- 2009- 2010- 2010- 2011- 2011- 2011- 2012- 2013- 2013- 2014	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43 15.00 65.43 15.00 60.00 24.68 0.00 0.0	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 252.00 30.00 133.00 52.15 50.00 35.00 46.78 18.00 95.00 34.56 109.00 115.67 123.00 43.30 105.86 0.00 0.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 251.68 55.00 50.00 251.68 55.00 50.00 251.68 55.00 87.00 90.00 87.65 208.00 92.00 183.06 171.00 140.00 164.34 0.00 0	126.80 643.00 253.00 255.00 256.50 256.89 105.00 130.00 103.8 52.00 60.00 53.72 110.00 45.00 96.03 170.00 165.00 168.93 196.00 125.00 180.74 123.00 99.00 115.91 14.00 17.20 14.69 127.00	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 313.28 255.00 251.08 338.00 261.00 251.08 338.00 261.00 251.08 338.00 261.00 321.45 79.00 79.00 79.00 79.00 79.00 79.00 251.08 338.00 261.00 255.00 251.08 338.00 261.00 255.00 255.00 255.00 255.00 255.00 251.08 338.00 261.00 255.00 251.08 338.00 261.00 255.00 251.08 338.00 261.00 255.00 255.00 251.08 338.00 261.00 255.	278.55 208.00 127.50 190.69 702.00 657.93 220.00 215.00 218.93 170.00 17	98.46 0.00 0.00 235.00 226.62 40.00 226.62 40.00 20.00 35.70 435.00 35.70 398.88 55.00 60.00 56.08 153.00 165.00 175.00 291.18 273.00 291.18 273.00 291.75 0.00 320 0.69 103.00 65.10 94.85	0.00 0.00 0.00 0.00 10.00 5.00 8.93 0.00 0.00 25.00 15.00 22.85 0.00 0.00 0.00 0.00 0.00 15.00 3.23 0.00 5.00 15.00 3.23 0.00 5.00 1.08 0.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.70 10.00 10.00 0.0	0.00 4.30 38.15 11.58 100.00 0.00 0.00 0.00 150.00 142.48 35.00 142.48 35.00 142.48 35.00 0.0	19.21 74.70 32.00 65.52 85.00 78.98 100.00 105.00 101.08 10.00 100.00 101.08 10.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 24.00 24.23 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	641.93 90.00 112.00 94.73 82.00 81.00 82.00 15.00 67.60 93.00 147.17 30.00 5.00 24.63 155.00 158.23 68.00 6.00 54.64 12.00 0.00 54.64 12.00 0.00 0.00 0.00 86.00 0.00 86.00 0.00 86.00 201.30
2004 2004- 2005- 2006- 2007- 2008 2009- 2009- 2010 2010- 2011- 2011- 2011- 2012 2013- 2014	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43 15.00 0.	175.82 224.00 45.50 185.64 183.00 110.50 63.00 44.95 295.00 95.00 30.00 133.00 52.15 50.00 33.00 52.15 50.00 35.00 35.00 35.00 34.56 109.00 140.00 115.67 1123.00 43.30 105.86 0.00 0.00 0.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 53.93 87.00 90.00 143.06 171.00 146.36 171.00 164.34 0.00 0.	126.80 643.00 253.00 255.00 256.50 256.50 256.89 105.00 130.00 110.38 52.00 60.00 53.72 110.00 45.00 96.03 170.00 165.00 165.00 125.00 180.74 123.00 90.00 115.91 14.00 17.20 14.69 127.00 150.20 131.99	283.90 590.00 421.00 553.67 432.00 306.53 295.00 380.00 313.28 255.00 255.00 255.00 255.00 255.00 255.00 255.00 255.00 255.00 79.00 55.00 255.00	278.55 208.00 127.50 190.69 702.00 657.93 220.00 215.00 218.93 170.00 172.15 660.00 490.00 172.15 660.00 490.00 623.45 475.00 380.00 505.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 592.14 546.00 557.00 577.00 57	98.46 0.00 0.00 235.00 196.00 225.62 40.00 226.62 40.00 235.70 435.00 435.00 267.00 398.88 55.00 60.00 398.88 55.00 60.00 105.00 1	0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 25.00 15.00 22.85 0.00 0.00 0.00 0.00 0.00 0.00 15.00 3.23 0.00 0.	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.70 10.00 15.70 10.00 10.00 0.00	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 150.00 150.00 150.00 150.00 115.00 142.48 35.00 45.00 0.00	19.21 74.70 32.00 65.52 85.00 78.98 100.00 105.00 101.08 10.00 20.00 0.00 0.00 0.00 0.00 0.00 0.	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 15.00 162.00 93.00 147.17 30.00 5.00 24.63 155.00 170.00 24.63 155.00 170.00 5.00 5.00 24.63 155.00 170.00 5.00 5.00 5.00 5.00 5.00 5.00 5.00
2004 2004- 2005- 2006- 2007- 2008 2007- 2008 2009- 2010 2010- 2010- 2011- 2011- 2011- 2012- 2013- 2014- 2014-	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43 15.00 60.00 24.68 0.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 95.00 95.00 95.00 95.00 95.00 95.00 252.00 30.00 133.00 52.15 50.00 35.00 46.78 18.00 95.00 34.56 109.00 140.00 115.67 123.00 43.30 105.86 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 251.68 55.00 55.00 251.68 55.00 50.00 53.93 87.00 90.00 87.65 208.00 90.00 87.65 208.00 92.00 140.00 140.00 164.34 0.00	126.80 643.00 253.00 255.00 256.50 256.89 105.00 105.00 100.00 52.00 60.00 53.72 110.00 60.00 53.72 110.00 168.93 170.00 168.93 196.00 125.00 106.00 125.00 180.74 123.00 90.00 115.91 14.00 17.20 130.20 131.99 135.80 51.20 131.99 135.80 132.00	283.90 590.00 421.00 553.67 432.00 267.00 295.00 336.53 295.00 255.00 255.00 251.08 338.00 251.00 251.00 338.00 261.00 338.00 55.00 73.84 96.00 40.00 171.00 141.20 164.59 412.00 224.10 83.90 129.50 93.00 129.50 93.00 129.50 93.00 129.50 93.00 129.50 93.00 129.50 93.00 129.50 93.00 129.50 93.00 129.50 93.00 129.50 93.00 129.50 93.00 129.50 93.00 129.50 93.00 129.50 93.00 129.50 93.00 129.50 93.00 129.50 93.00 129.50 129.	278.55 208.00 127.50 702.00 497.00 657.93 220.00 215.00 218.93 220.00 172.00 180.00 172.15 660.00 490.00 633.45 475.00 380.00 454.58 616.00 505.00 380.00 454.58 616.00 505.00 303.20 493.80 69.00 65.40 65.40 138.80 175.15 102.40 138.80 175.15	98.46 0.00 0.00 235.00 196.00 225.62 40.00 226.62 40.00 20.00 35.70 267.00 398.88 55.00 60.00 55.08 153.00 105.00 142.68 323.00 175.00 105.00 142.68 233.00 175.00 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 103.00 5.50 20.00 2	0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 0.00 25.00 15.00 22.85 0.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 10.00 10.00 10.00 0.0	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 150.00 150.00 150.00 150.00 150.00 142.48 35.00 142.48 35.00 0.	19.21 74.70 32.00 65.52 85.00 78.98 100.00 105.00 101.08 10.00 20.00 20.00 12.15 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	641.93 90.00 112.00 94.73 82.00 81.00 82.00 15.00 67.60 93.00 147.17 30.00 93.00 147.17 30.00 155.00 170.00 188.23 68.00 6.00 24.63 155.00 170.00 188.23 68.00 6.00 24.64 12.00 20.20 13.76 0.00 0.00 0.00 86.00 201.30 110.79
2004 2004- 2005- 2006- 2007- 2008- 2009- 2009- 2010- 2010- 2011- 2011- 2011- 2011- 2012- 2013 2013- 2014- 2014- 2014- 2014- 2014- 2015	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam	68.52 43.00 43.50 43.11 9.00 11.50 9.54 40.00 81.00 81.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43 15.00 60.00 24.68 0.00 0.	175.82 224.00 45.50 185.64 183.00 63.00 63.00 63.00 63.00 63.00 295.00 252.00 30.00 133.00 52.15 50.00 35.00 46.78 18.00 95.00 34.56 109.00 140.00 115.67 123.00 44.30 105.86 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 251.68 55.00 50.00 251.68 55.00 90.00 87.00 90.00 87.65 208.00 90.00 183.06 171.00 140.00 164.34 0.00 0.00 0.00 0.00 0.00 0.00 148.60 175.90 155.90	126.80 643.00 253.00 255.00 256.50 256.89 105.00 130.00 100.38 52.00 60.00 53.72 110.00 45.00 96.03 170.00 165.00 168.93 196.00 165.00 168.93 196.00 125.00 180.74 172.00 180.74 123.00 90.00 115.91 14.00 172.00 150.20 131.99 135.80 51.20 125.00 135.80 51.20 125.00 135.80 51.20 125.00 135.80 51.20 125.00 135.80 51.20 125.00 125.00 135.80 51.20 125.00 135.80 51.20 125.00 125.00 125.00 125.00 138.74 123.00 125.00 138.74 123.00 125.00 135.80 51.20 125.00 135.80 51.20 125.00 125.00 135.80 125.00	283.90 590.00 421.00 553.67 432.00 207.00 295.00 205.00 255.00 255.00 255.00 251.08 338.00 251.00 321.45 79.00 55.00 73.84 96.00 40.00 83.96 171.00 141.20 164.59 412.00 224.10 371.60 129.50 93.00 276.20 172.00 253.00	278.55 208.00 127.50 702.00 497.00 657.93 220.00 215.00 218.93 170.00 180.00 172.15 660.00 490.00 623.45 660.00 490.00 623.45 616.00 303.20 495.00 303.20 493.80 69.00 65.40 68.23 185.10 138.80 175.15 102.40 89.00	98.46 0.00 0.00 235.00 226.62 40.00 226.62 40.00 20.00 35.70 267.00 398.88 55.00 60.00 56.08 153.00 105.00 142.68 323.00 175.00 291.18 273.00 117.60 239.59 0.00 329.59 0.00 329.59 0.00 329.59 0.00 320.69 103.00 65.10 94.85 81.10 74.90 74.70 74.70 74.70 75.	0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.00 15.00 15.00 0.0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.70 10.00 10.00 10.00 0.	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 150.00 150.00 150.00 150.00 142.48 35.00 142.48 35.00 142.48 35.00 0.00	19.21 74.70 32.00 65.52 85.00 78.98 100.00 105.00 101.08 10.00 20.00 20.00 101.08 10.00 20.00 12.15 0.00 0.00 0.00 0.00 0.00 0.00 134.03 25.00 21.40 24.23 0.00	641.93 90.00 112.00 94.73 82.00 81.00 82.00 15.00 67.60 93.00 147.17 30.00 5.00 147.17 30.00 5.00 147.17 30.00 5.00 147.17 30.00 5.00 147.17 30.00 5.00 147.17 30.00 5.00 147.17 30.00 5.00 147.17 30.00 5.00 147.17 30.00 5.00 147.17 30.00 5.00 147.17 30.00 5.00 158.23 68.00 155.00 158.23 68.00 20.20 13.76 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0
2004 2004- 2005- 2006- 2007- 2008- 2009- 2009- 2010- 2010- 2011- 2011- 2011- 2012- 2013- 2014- 2014- 2014- 2014- 2014- 2014- 2014- 2014- 2014- 2015- 2015- 2015- 2015- 2015- 2015- 2015- 2015- 2015- 2015- 2007- 2007- 2010- 2010- 2011- 2	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam	68.52 43.00 43.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 9.54 40.00 81.00 81.00 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43 15.00 60.00 24.68 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 252.00 30.00 133.00 52.15 50.00 252.00 35.00 46.78 18.00 95.00 34.56 109.00 140.00 115.67 123.00 43.30 105.86 0.00 0.00 0.00 0.00 0.00 41.10	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 251.68 55.00 50.00 251.68 55.00 50.00 251.68 55.00 87.00 90.00 87.65 208.00 92.00 171.00 164.34 0.00 0.00 0.00 0.00 0.00 0.00 185.68 197.60 194.68 195.68 1	126.80 643.00 253.00 255.00 256.50 256.89 105.00 130.00 103.8 52.00 60.00 53.72 110.00 45.00 96.03 170.00 165.00 168.93 196.00 125.00 168.93 196.00 125.00 180.74 123.00 90.00 115.91 14.00 17.20 14.69 125.00 131.99 135.80 51.20 135.80 51.20	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 313.28 255.00 251.08 338.00 251.08 338.00 251.00 251.00 79.00 251.00 79.00 79.00 79.00 73.84 96.00 40.00 83.96 171.00 141.20 164.59 412.00 224.10 371.60 83.00 129.50 93.00 93.00 276.20 172.00 253.80	278.55 208.00 127.50 190.69 702.00 657.93 220.00 215.00 218.93 170.00 180.00 172.15 660.00 490.00 623.45 475.00 505.00 505.00 505.00 505.00 505.14 546.00 505.00 505.00 592.14 546.00 547.00 505.00 592.14 546.00 547.00 54	98.46 0.00 0.00 235.00 226.62 40.00 226.62 40.00 226.62 40.00 20.00 35.70 435.00 60.00 55.00 60.00 56.08 153.00 142.68 323.00 175.00 291.18 273.00 105.00 142.68 323.00 175.00 291.18 273.00 105.00 142.68 323.00 175.00 291.88 273.00 6.00 3.20 0.69 103.00 5.10 94.85 81.10 74.90 79.77 79.77	0.00 0.00 0.00 0.00 5.00 5.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.70 10.00 10.00 0.0	0.00 4.30 38.15 11.58 100.00 0.00 0.00 0.00 150.00 142.48 35.00 142.48 35.00 142.48 35.00 142.48 35.00 0.00	19.21 74.70 32.00 65.52 85.00 78.98 100.00 105.00 101.08 10.00 10.00 10.00 0.00 <td< td=""><td>641.93 90.00 112.00 94.73 82.00 81.00 82.00 15.00 67.60 93.00 147.17 30.00 5.00 24.63 155.00 170.00 158.23 68.00 6.00 54.64 12.00 0.00 54.64 12.00 0.00 54.64 12.00 0.00 0.00 0.00 0.00 0.00 86.00 201.30 110.79 67.10 155.80 86.17</td></td<>	641.93 90.00 112.00 94.73 82.00 81.00 82.00 15.00 67.60 93.00 147.17 30.00 5.00 24.63 155.00 170.00 158.23 68.00 6.00 54.64 12.00 0.00 54.64 12.00 0.00 54.64 12.00 0.00 0.00 0.00 0.00 0.00 86.00 201.30 110.79 67.10 155.80 86.17
2004 2004- 2005- 2006- 2007- 2008- 2009- 2009- 2010- 2010- 2011- 2011- 2011- 2012- 2013- 2014- 2014- 2015-	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 9.54 40.00 81.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43 15.00 60.00 24.68 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 95.00 30.00 133.00 52.15 50.00 33.00 52.15 50.00 35.00 35.00 35.00 34.56 109.00 140.00 46.78 18.00 95.00 34.56 109.00 145.67 1123.00 43.30 105.86 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 50.00 53.93 87.00 90.00 143.06 171.00 164.34 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 148.69 175.468 107.40	126.80 643.00 253.00 255.00 257.00 256.50 256.50 105.00 130.00 110.38 52.00 60.00 53.72 110.00 45.00 96.03 170.00 165.00 165.00 165.00 180.74 123.00 90.00 125.00 180.74 123.00 90.00 115.91 14.00 17.20 114.69 135.80 135.90 135.	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 231.08 338.00 255.00 251.08 338.00 261.00 55.00 79.00 55.00 73.84 96.00 40.00 83.96 171.00 141.20 164.59 412.00 83.00 124.10 371.60 83.00 129.50 93.00 223.80 74.60 74.60	278.55 208.00 127.50 190.69 702.00 497.00 657.93 220.00 215.00 180.00 172.15 660.00 490.00 623.45 475.00 380.00 454.58 616.00 505.00 505.00 505.214 546.00 303.20 493.80 69.00 65.40	98.46 0.00 0.00 235.00 196.00 226.62 40.00 226.62 40.00 235.70 435.00 267.00 398.88 55.00 60.00 398.88 55.00 60.00 105.00 1	0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 25.00 15.00 22.85 0.00 0.00 0.00 0.00 0.00 0.00 15.00 3.23 0.00 0	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.70 10.00 15.70 10.00 10.00 0.00	0.00 4.30 38.15 11.58 11.58 100.00 15.00 81.73 0.00 0.00 150.00 150.00 115.00 142.48 35.00 45.00 142.48 35.00 0.0	19.21 74.70 32.00 65.52 85.00 57.00 78.98 100.00 101.08 10.00 20.00 101.08 0.00 <t< td=""><td>641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 162.00 93.00 147.17 30.00 5.00 165.00 155.00 170.00 155.00 170.00 54.64 12.00 20.20 13.76 0.000 0.00 0.000 86.00 201.30 110.79 67.10 155.80 155.80 155.00 170.00 13.76 0.00 86.00 20.130 110.79 67.10 155.80</td></t<>	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 162.00 93.00 147.17 30.00 5.00 165.00 155.00 170.00 155.00 170.00 54.64 12.00 20.20 13.76 0.000 0.00 0.000 86.00 201.30 110.79 67.10 155.80 155.80 155.00 170.00 13.76 0.00 86.00 20.130 110.79 67.10 155.80
2004 2004- 2005- 2006- 2007- 2007- 2008- 2009- 2010- 2010- 2011- 2011- 2011- 2011- 2012- 2013- 2014- 2014- 2015- 2015- 2015- 2015- 2015- 2015- 2015- 2015- 2015- 2015- 2015- 2015- 2016- 2017- 2016- 2017- 2016- 2017- 2	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.50 43.50 43.50 43.50 43.50 43.50 9.00 11.50 9.54 40.00 81.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43 15.00 60.00 24.68 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 <	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 95.00 95.00 95.00 95.00 95.00 95.00 95.00 95.00 95.00 95.00 30.00 133.00 52.15 50.00 35.00 46.78 18.00 95.00 34.56 109.00 140.00 115.67 123.00 44.30 105.86 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 251.68 55.00 50.00 53.93 87.00 90.00 87.65 208.00 90.00 87.65 208.00 90.00 183.06 171.00 164.34 0.00 0.00 0.00 0.00 0.00 0.00 0.00 174.860 175.468 107.40 87.00 87.00 87.00 107.40 107.40 87.00 87.00 107.40	126.80 643.00 253.00 253.00 257.00 256.50 256.89 105.00 130.00 110.38 52.00 60.00 53.72 110.00 60.00 53.72 110.00 165.00 168.93 196.00 125.00 168.93 196.00 125.00 180.74 123.00 90.00 115.91 14.09 127.00 150.20 131.99 135.80 51.20 117.61 191.70 40.80	283.90 590.00 421.00 553.67 432.00 267.00 295.00 336.53 295.00 255.00 255.00 251.08 338.00 251.08 338.00 261.00 321.45 79.00 55.00 73.84 96.00 40.00 171.00 141.20 164.59 412.00 224.10 83.96 171.00 141.20 164.59 412.00 224.10 83.00 129.50 93.00 276.20 172.00 253.80 93.00 276.20 172.00 253.80 93.00 276.20 172.00 253.80 172.00 253.80 172.00 253.80 74.60 152.60	278.55 208.00 127.50 190.69 702.00 497.00 657.93 220.00 215.00 218.93 220.00 172.05 660.00 172.15 660.00 172.15 660.00 490.00 633.45 616.00 308.00 454.58 616.00 303.20 493.80 65.40 303.20 493.80 65.40 303.20 493.80 65.40 138.80 175.15 102.40 89.00 99.52 354.70 354.70 354.70 354.70	98.46 0.00 0.00 235.00 196.00 225.62 40.00 235.70 26.62 40.00 25.00 26.700 398.88 55.00 60.00 55.08 153.00 105.00 142.68 323.00 175.00 105.00 142.68 233.00 175.00 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 273.00 117.60 291.18 213.00 117.60 291.18 273.00 117.60 291.25 117.60 10	0.00 0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 0.00 0.00 0.00 0.00 0.00 22.85 0.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 10.00 10.00 0.00	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 150.00 150.00 150.00 150.00 142.48 35.00 142.48 35.00 0.0	19.21 74.70 32.00 65.52 85.00 78.98 100.00 78.98 100.00 101.08 10.00 20.00 101.08 0.00 20.00 12.15 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 240.00 0.00 0.00 240.00 240.00 134.03 25.00 21.40 24.23 0.00 0	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 93.00 147.17 30.00 93.00 147.17 30.00 15.00 147.17 30.00 155.00 170.00 188.23 68.00 6.00 13.76 0.00 0.00 0.00 86.00 201.30 110.79 67.10 155.80 86.17
2004 2004- 2005- 2006- 2007- 2008- 2009- 2009- 2010- 2010- 2011- 2011- 2011- 2012- 2013 2013- 2014- 2015- 2016	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam	68.52 43.00 43.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 9.54 40.00 81.00 81.00 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43 15.00 60.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 252.00 30.00 133.00 52.15 50.00 35.00 46.78 18.00 95.00 34.56 109.00 140.00 115.67 123.00 44.78 18.00 95.00 34.56 109.00 140.00 105.86 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	421.80 20.00 14.50 18.20 183.00 193.50 185.26 55.00 80.00 60.38 285.00 251.68 55.00 50.00 251.68 55.00 90.00 251.68 55.00 90.00 87.00 183.06 171.00 140.00 164.34 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 148.60 176.90 154.68 107.40 87.00 103.01	126.80 643.00 253.00 253.00 255.00 256.50 256.89 105.00 130.00 100.38 52.00 60.00 53.72 110.00 45.00 96.03 170.00 165.00 168.93 196.00 168.93 196.00 175.00 180.74 172.00 180.74 173.00 90.00 115.91 14.00 172.00 150.20 131.99 135.80 51.20 177.61 191.70 195.26	283.90 590.00 421.00 553.67 432.00 207.00 295.00 205.00 255.00 255.00 255.00 251.08 338.00 251.08 338.00 261.00 55.00 79.00 55.00 79.00 55.00 79.00 55.00 79.00 100 55.00 79.00 111.00 141.20 164.59 412.00 224.10 371.60 129.50 93.00 276.20 172.00 253.80 74.60 91.37	278.55 208.00 127.50 190.69 702.00 497.00 215.00 215.00 218.93 170.00 180.00 172.15 660.00 490.00 623.45 660.00 490.00 623.45 616.00 303.20 495.00 592.14 380.00 65.00 592.14 546.00 303.20 493.80 69.00 65.40 68.23 185.10 138.80 175.15 102.40 89.00 99.52 354.70 357.70 357.70 359.62	98.46 0.00 0.00 235.00 225.00 226.62 40.00 20.00 35.70 267.00 398.88 55.00 60.00 56.08 55.00 105.00 142.68 323.00 175.00 291.18 273.00 117.60 239.59 0.00 329.59 0.00 3.50 103.00	0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 0.00 25.00 15.00 22.85 0.00 0.00 0.00 0.00 15.00 3.23 0.00 5.00 15.00 15.00 0.00 15.00 15.00 15.00 15.00 0.	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.70 10.00 10.00 10.00 0	0.00 4.30 38.15 11.58 100.00 15.00 81.73 0.00 0.00 150.00 150.00 142.48 35.00 142.48 35.00 142.48 35.00 0.00	19.21 74.70 32.00 65.52 85.00 78.98 100.00 105.00 101.08 10.00 20.00 101.08 10.00 20.00 12.15 0.00	641.93 90.00 112.00 94.73 82.00 81.00 82.00 15.00 67.60 93.00 147.17 30.00 5.00 158.23 68.00 20.20 155.80 86.00 20.00 10.00 10.00 86.00 20.00 110.79 67.10 155.80 86.07 10.000
2004 2004- 2005- 2006- 2007- 2008- 2009- 2009- 2010- 2010- 2011- 2011- 2011- 2012- 2013- 2014- 2015- 2016- 2015- 2016- 2015- 2016- 2015- 2016- 2015- 2016- 2015- 2016- 2015- 2016- 2015- 2016- 2016- 2017- 2016- 2017- 2	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam	68.52 43.00 43.50 43.50 43.11 9.00 11.50 9.54 40.00 81.00 81.00 25.38 60.00 70.00 62.15 42.00 30.00 39.42 45.00 140.00 65.43 15.00 65.43 15.00 60.00 24.68 0.00	175.82 224.00 45.50 185.64 183.00 110.50 63.00 63.00 63.00 63.00 295.00 295.00 252.00 30.00 133.00 52.15 50.00 252.00 35.00 46.78 18.00 95.00 34.56 109.00 115.67 123.00 44.330 105.86 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 251.68 55.00 50.00 251.68 55.00 50.00 208.00 92.00 133.06 171.00 164.34 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 148.60 176.90 154.68 107.40 87.00 103.01 15.00 15.00 103.01 15.00 103.01 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 164.34 176.90 154.68 107.40 87.00 103.00	126.80 643.00 253.00 253.00 257.00 256.50 256.89 105.00 130.00 10.38 52.00 60.00 53.72 110.00 45.00 96.03 170.00 165.00 168.93 196.00 125.00 180.74 123.00 90.00 115.91 14.00 17.20 14.00 15.20 131.99 135.80 51.20 117.61 191.70 40.80 159.26 159.26 159.20 159.20 131.99 135.80 51.20 117.61 191.70 40.80 159.26 159.26 159.20 159.20 117.61 191.70 40.80 159.20 159.20 159.20 117.61 191.70 40.80 159.20 159.20 159.20 117.61 191.70 40.80 159.20 159.20 159.20 159.20 117.61 191.70 40.80 159.20 159.20 159.20 159.20 10.00 10.00 110.00 1	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 380.00 213.28 255.00 251.08 338.00 255.00 251.08 338.00 261.00 321.45 79.00 79.00 79.00 73.84 96.00 40.00 83.96 171.00 83.96 171.00 224.10 371.60 83.00 129.50 93.00 129.50 1	278.55 208.00 127.50 190.69 702.00 657.93 220.00 215.00 218.93 170.00 180.00 172.15 660.00 490.00 623.45 475.00 380.00 454.58 616.00 505.00 592.14 546.00 505.00 50	98.46 0.00 0.00 235.00 226.62 40.00 226.62 40.00 226.62 40.00 20.00 35.70 435.00 60.00 55.00 60.00 56.08 153.00 165.00 175.00 291.18 273.00 175.00 291.18 273.00 105.00 142.68 323.00 175.00 291.18 273.00 6.00 320 0.00 3.20 0.69 103.20 0.69 103.20 0.65.10 94.85 81.10 74.90 74.90 79.77 112.60 113.29 61.60	0.00 0.00 0.00 0.00 0.00 5.00 8.93 0.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.70 10.00 0.0	0.00 4.30 38.15 11.58 100.00 0.00 0.00 0.00 150.00 142.48 35.00 142.48 35.00 142.48 35.00 142.48 35.00 0.000 0.00	19.21 74.70 32.00 65.52 85.00 78.98 100.00 105.00 101.08 10.00 101.08 0.00 <t< td=""><td>641.93 90.00 112.00 94.73 82.00 81.00 82.00 15.00 67.60 93.00 147.17 30.00 5.00 24.63 155.00 170.00 155.00 170.00 155.00 170.00 155.00 170.00 158.23 68.00 6.00 54.64 12.00 0.00 0.00 20.20 13.76 0.00 20.1.30 110.79 67.10 155.80 86.17 81.00 109.00 87.02 58.00</td></t<>	641.93 90.00 112.00 94.73 82.00 81.00 82.00 15.00 67.60 93.00 147.17 30.00 5.00 24.63 155.00 170.00 155.00 170.00 155.00 170.00 155.00 170.00 158.23 68.00 6.00 54.64 12.00 0.00 0.00 20.20 13.76 0.00 20.1.30 110.79 67.10 155.80 86.17 81.00 109.00 87.02 58.00
2004 2004- 2005- 2006- 2007- 2008- 2009- 2009- 2010- 2010- 2010- 2011- 2011- 2012- 2013- 2014- 2014- 2015- 2016- 2016- 2016- 2016-	Study Area Rainfall Gomuki Dam Manimuktha Dam Study Area Rainfall Gomuki Dam Manimuktha Dam	68.52 43.00 43.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 9.54 40.00 81.00 81.00 48.82 20.00 45.00 25.38 60.00 70.00 62.15 42.00 30.00 30.00 39.42 45.00 140.00 65.43 15.00 60.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 55.20 108.60 66.68 35.10 11.80 30.09 40.80 42.00	175.82 224.00 45.50 185.64 183.00 110.50 167.41 40.00 63.00 44.95 295.00 95.00 252.00 30.00 133.00 252.00 30.00 133.00 52.15 50.00 35.00 35.00 35.00 34.56 109.00 140.00 6.00 0.00 0.00 0.00 0.00 0.00 0.00	421.80 20.00 14.50 18.82 183.00 193.50 185.26 55.00 80.00 60.38 285.00 130.00 251.68 55.00 55.00 251.68 55.00 55.00 285.00 200.00 200.00 87.65 208.000 92.00 140.00 164.34 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	126.80 643.00 253.00 253.00 255.00 256.89 105.00 130.00 110.38 52.00 60.00 53.72 110.00 45.00 168.93 170.00 165.00 168.93 170.00 165.00 168.93 170.00 165.00 168.93 170.00 172.00 180.74 123.00 90.00 115.91 14.00 125.00 90.00 115.91 14.00 172.00 115.91 14.00 17.20 14.69 127.00 115.02 131.99 135.80 51.20 131.99 135.80 51.20 131.99 135.80 51.20 135.20 132.00 13	283.90 590.00 421.00 553.67 432.00 267.00 396.53 295.00 255.00 251.08 338.00 255.00 251.08 338.00 261.00 55.00 79.00 55.00 73.84 96.00 40.00 83.96 171.00 141.20 164.59 412.00 83.90 121.50 93.00 224.10 371.60 83.00 129.50 93.00 224.10 371.60 83.00 129.50 93.00 224.10 371.60 83.00 129.50 93.00 224.10 371.60 129.50 93.00 255.00 74.60 152.60 91.37 119.60 121.50	278.55 208.00 127.50 190.69 702.00 497.00 657.93 220.00 215.00 218.93 220.00 180.00 172.15 660.00 490.00 623.45 475.00 380.00 454.58 616.00 505.00 505.00 505.00 505.214 546.00 303.20 493.80 69.00 505.40 6	98.46 0.00 0.00 2.00 235.00 196.00 226.62 40.00 226.62 40.00 235.70 435.00 267.00 398.88 55.00 60.00 398.88 55.00 60.00 105	0.00 0.00 0.00 0.00 5.00 8.93 0.00 0.00 25.00 15.00 22.85 0.00 0.	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 15.70 10.00 15.70 10.00 15.70 10.00 15.70 10.00 0.0	0.00 4.30 38.15 11.58 11.58 100.00 15.00 81.73 0.00 0.00 150.00 150.00 150.00 150.00 115.00 142.48 35.00 45.00 0.	19.21 74.70 32.00 65.52 85.00 57.00 78.98 100.00 101.08 10.00 20.00 101.08 0.00 <t< td=""><td>641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 162.00 93.00 147.17 30.00 5.00 147.17 30.00 5.00 170.00 158.23 68.00 24.63 155.00 170.00 54.64 12.00 20.20 13.76 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0</td></t<>	641.93 90.00 112.00 94.73 82.00 81.00 81.79 82.00 15.00 67.60 162.00 93.00 147.17 30.00 5.00 147.17 30.00 5.00 170.00 158.23 68.00 24.63 155.00 170.00 54.64 12.00 20.20 13.76 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0

Year	/ Month	June	July	Augu	Sept	Octo	Nove	Dece	Janu	Febru	Marc	April	May	Annual
1992-	Rainfall													
1993		93.70	55.74	54.44	191.31	65.06	436.88	5.70	0.00	6.46	0.00	0.00	3.76	913.05
	Runoff	44.43	0.86	0.00	28.13	0.00	69.90	0.00	0.00	0.00	0.00	0.00	0.00	143.32
1993- 1994	Runoff	84.38	32.32	213.28	231.73	310.88	280.85	205.24	0.00	0.00	0.00	0.00	96.36	1455.04
	Runojj	0.00	0.00	89.01	96.03	97.40	85.14	87.03	0.00	0.00	0.00	0.00	22.00	4//.8/
1994- 1995	Rainfall	7.53	79.92	72.76	56.39	195.79	348.86	48.66	30.93	0.00	0.00	28.26	51.95	921.05
	Runoff	0.00	30.85	0.00	0.90	24.72	166.22	0.00	0.00	0.00	0.00	0.00	0.00	222.69
1995- 1006	Rainfall	116.99	85.63	72.62	146.47	109.14	130.81	0.00	0.00	0.00	0.00	71.63	62.91	796.20
1990	Runoff	23.96	1.50	0.00	9.07	8.58	32.87	0.00	0.00	0.00	0.00	4.72	4.60	85.30
1996- 1997	Rainfall	106.64	20.39	222.26	348.11	155.27	128.93	517.77	13.27	0.00	0.00	41.36	15.97	1569.97
	Rainfall	12.08	0.00	82.84	112.73	32.47	28.36	298.78	0.00	0.00	0.00	0.00	0.00	567.26
1997- 1998	Runoff	45.10	34.54	84.69	270.15	330.34	463.21	114.09	0.00	0.00	0.00	0.00	62.86	522.02
1998-	Rainfall	17.77	70.68	238.05	81.77	246.34	248.10	276.71	0.00	0.00	0.00	6.91	38.08	1224.41
1999	Runoff	0.00	0.00	96.94	4.27	116.53	98.12	157.66	0.00	0.00	0.00	0.00	0.00	473.52
1999-	Rainfall	29.83	24.30	112.27	68.69	199.05	341.14	138.16	2.90	161.15	0.00	29.44	80.23	1187.16
2000	Runoff	0.00	0.00	3.66	1.03	13.68	188.99	14.11	0.00	48.39	0.00	0.00	3.83	273.69
2000-	Rainfall	39.34	15.39	145.23	238.48	306.27	144.25	104.32	7.46	0.00	0.00	181.04	67.70	1249.48
2001	Runoff	0.00	0.00	41.42	55.99	114.56	31.68	17.91	0.01	0.00	0.00	77.23	0.96	339.76
2001-	Rainfall	50.68	242.17	69.93	208.00	230.03	108.17	84.59	10.51	22.46	0.00	0.00	107.97	1134.51
2002	Runoff	0.00	141.48	4.28	61.08	60.90	32.35	0.15	0.00	0.00	0.00	0.00	39.68	339.92
2002- 2003	Rainfall Bunoff	76.38	47.42	126.85	125.84	180.69	154.17	19.56	0.00	0.00	51.03	58.29	42.94	883.17
2003-	Rainfall	68.52	175.82	421.80	126.80	283.90	278.55	98.46	0.00	0.00	0.00	19.21	641.93	2114.99
2004	Runoff	0.00	61.02	195.44	30.09	84.79	136.64	48.40	0.00	0.00	0.00	0.00	361.05	917.43
2004- 2005	Runoff	43.11	185.64	18.82	559.15	553.67	190.69	0.00	0.00	27.94	11.58	65.52	94.73	1750.85
2005-	Rainfall	6.32 9.54	102.34 167.41	0.00 185.26	308.86 256.89	357.86 396.53	43.07 657.93	226.62	0.00	0.00	81.73	6.57 78.98	15.02 81.79	840.04 2151.61
2006	Runoff	0.00	95.53	69.30	104.15	191.75	477.67	130.56	0.00	0.00	19.52	19.34	26.20	1134.02
2006- 2007	Runoff	48.82 6.69	44.95	4.71	1.30	98.22	54.20	0.00	0.00	0.00	0.00	35.54	0.00	205.37
2007-	Rainfall	25.38	252.00	251.68	53.72	251.08	172.15	398.88	22.85	10.00	142.48	12.15	147.17	1739.54
2008	Rainfall	0.00	112.01	107.92	0.00	92.81	47.74	299.34	0.00	0.00	10.40	1.34	22.34	694.70
2008-2009	Runoff	62.15	52.15	53.93 8 70	96.03	321.45	623.45	56.08	0.00	0.00	37.15	0.00	24.63	1327.02
2009-	Rainfall	39.42	46.78	87.65	168.93	73.84	454.58	142.68	3.23	0.00	0.00	0.00	158.23	1175.34
2010	Runoff Rainfall	0.00	0.00	16.38	83.69	0.54	194.80	47.91	0.00	0.00	0.00	0.00	68.41	411.73
2010-2011	Runoff	0.00	0.00	59.21	84.47	0.00	341.32	141.86	0.00	0.00	0.00	60.37	10.58	697.81
2011-	Rainfall	24.68	115.67	164.34	115.91	164.59	493.80	239.59	0.00	0.00	0.00	24.23	13.76	1356.57
2012	Runoff	0.00	40.65	36.10	0.00	26.15	277.07	193.99	0.00	0.00	0.00	0.00	0.00	573.96
2012- 2013	Rainfall Bunoff	0.00	105.86	0.00	14.69	371.60	68.23	0.69	0.00	0.00	0.00	0.00	0.00	561.07
2013-	Rainfall	0.00	0.00	0.00	131.99	93.00	175.15	94.85	0.00	0.00	0.00	0.00	110.79	605.78
2014	Runoff Rainfall	0.00	0.00	0.00	40.17	0.00	80.08 99.52	14.08 79.77	0.00	0.00	0.00	0.00	13.39 86.17	147.72 1044 13
2014- 2015	Runoff	0.00	15.82	46.11	54.34	106.73	35.44	16.47	0.00	0.00	0.00	33.00	7.55	315.46
2015-	Rainfall	30.09	86.53	103.01	159.26	91.37	359.62	113.29	13.74	0.00	0.00	0.00	87.02	1043.93
2016	Runoff	0.00	0.82	3.48	68.35	1.16	145.33	39.09	0.00	0.00	0.00	0.00	28.09	286.32
2016- 2017	Rainfall Runoff	41.06	101.82	16.70	30.00	120.01	44.19	58.85	76.06	0.00	2.83	0.00	56.71	548.23
	кипојј	0.00	0.50	0.00	0.00	∠4.00	0.00	4.94	54.90	0.00	0.00	0.00	0.00	04.20

Table 9. Computed Rainfall and Runoff of the study area

Description	Monsoon		Winter	Summer	A
	Southwest	Northeast	winter	Summer	Annuai
Rainfall (mm)	420.63	650.67	17.35	142.44	1231.09
% components of Rainfall	34.17	52.85	1.41	11.57	100

Table 10. Mean seasonal rainfall of the study area (1992 - 2017)

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