

Chapter 2

Physical Features

2.1 Geographical disposition

The river Pamba rises at an altitude of 1650 m in the Peermade Plateau in the Idukki district of Kerala and after traversing a distance of 176 km joins the Arabian Sea branching into a number of channels. The basin extends over an area of 2235 km². The entire catchment area lies in Kerala state. The basin is bounded on the east by Western Ghats and on the west by Arabian Sea. Manimala basin forms the northern boundary of the basin while Achankovil basin forms southern boundary.

The river Achankovil rises south of Devarmalai in the Western Ghats in the Pathanamthitta district of Kerala at an elevation of 700 m. The Achankovil River after flowing for 128 km joins the Pamba River at Veeyapuram. The basin extends over an area of 1484 km² and lies entirely in Kerala State. The basin is bounded on the north by Pamba basin and on the south by Kallada and Pallikkal basin. The Western Ghats form eastern boundary of the basin while the Arabian Sea forms the western boundary.

Major portion of the command area lies in Vaippar basin. The total drainage area of Vaippar basin is 5255 km². The basin is bounded on the west by the Western Ghats, on the east by the Bay of Bengal, on the north by the Vaigai basin and on the south by the ridge line separating the Vaippar and other streams south of Vaippar. The river Vaippar rises from the eastern slopes of the Varushanad hill range of the Western Ghats at an elevation of about 1500 m near Sivagiri in the Tirunelveli district of Tamil Nadu and flows generally in the easterly and south easterly direction for a length of 140 km before joining the Gulf of Mannar.

2.2 Topography of the basins, reservoirs and command area

Like all the river basins in Kerala, the Pamba and the Achankovil basins also can be divided into three natural zones based on elevation, consisting of low land or sea-board, midland and high land. The coast for a short distance along the borders of lakes is flat, retreating from it the surface roughens up into slopes which gradually combine and swell into mountains on the east. The low land area along sea coast is generally swampy and liable to be flooded during monsoon inundation. The plains/midlands succeed low land in gentle ascents and valleys interspersed with isolated low hills. The high land on the eastern portion is broken by long spurs, dense forests, extensive

ravines and tangled jungles. Towering above all their slopes are Western Ghats that form eastern boundary of the basins.

The Punnamedu dam lies in high land region while the Achankovil Kal Ar and Achankovil dams are located in midland regions.

The main canal taking off from the exit of tunnel from Achankovil Kal Ar reservoir pass through generally gently sloping land, the slope generally lying in the range of 1 in 500 in the initial reaches followed by more or less plains.

2.3 Geology of the basins, reservoirs and command area

(i) Pamba Kal Ar

As per the Geological Survey of India publication No. 30 the most prominent rock formation at the Punnamedu dam site is of Archaean age Charnockites. Their colour varies from bluish to dark. They are granulitic in texture. Charnockites with narrow bands of pyroxene granulites, magnetite, magnetite quartz rock are the most wide spread group of rocks in the area. The bed and banks of the river are of rocky formation.

The Geological Survey of India has conducted preliminary geo-technical investigation of Pamba Kal Ar dam site. Fresh Charnockite gneiss with thin weathered layer is exposed in the riverbed with the hill slopes on either banks covered by soil and scree material. The riverbed is exposed with rock in blocky to massive, moderately foliated joints.

(ii) Achankovil Kal Ar

The Achankovil Kal Ar dam site is of Archaean aged Charnockites. Fresh magnetite with granulite / amphibolite rafts, Charnockites and intrusives of granite and pegmatite are exposed in the riverbed at the dam axis. The rock exposures are confined to the riverbed and the flanks and uphill side slopes are covered with soil and boulders. The preliminary study indicates that the thickness of the overburden is around 10-15 m at the lower levels and upto 25 m at higher levels.

(iii) Achankvoil river

Moderately weathered to fresh garnetiferous biotite gneiss is exposed in the bed of Achankovil river on the right bank. Some foliation joints are also noticed along east-west direction.

(iv) Interconnecting tunnel

The inlet of the Pamba Kal Ar - Achankovil Kal Ar interconnecting tunnel is located on the left bank of Chellikkal Ar, a tributary of Pamba Kal Ar. Moderately weathered to fresh Charnockites are exposed in the riverbed at the site. Foliations in north-east and south-west direction are noticed at the site. The tunnel traverses across the ridge between Pamba and Achankovil basins. Outlet of the tunnel is located on the right flank of Muthuvantodu, tributary of Achankovil Kal Ar. At the outlet point soil and scree material and weathered charnockite exposures are existing nearby.

(v) Achankovil Kal Ar – Tamil Nadu tunnel

The inlet point of the tunnel is located on the left bank of Achankovil Kal Ar River near Pulikkayam. Massive charnockite gneiss is exposed at the inlet location. Foliation is trending in northeast to southwest direction with vertical dip and is near normal to sub-normal to the tunnel alignment. The tunnel outlet is located near Mundal Ar in Tamil Nadu side. The site is exposed with massive Charnockites and have sufficient rock cover above the tunnel.

(vi) Command area

The command area lying in the Tirunelveli, Virudhunagar and Tuticorin districts is predominantly covered by Peninsular gneisses, granites and other sedimentary and metamorphic rocks with two third area comprising rocks of Archaean origin of igneous metamorphic/ other intruded rocks and remaining area covered by rocks of sedimentary origin. There are two main groups of rocks in the area viz. Charnockites and the Khondalites. Charnockites and associated migmatites occupy the western parts of Sankarankovil taluk but occur only as thin bands and lenses in the other parts of the basin. The Khondalite group with ferrous zirconite graphite gneiss with the associated migmatite exists in the southern and western parts of the Tirunelveli district and garnetiferous biotite gneisses and quartz feldspathic gneisses with their migmatitic derivatives exist in the Tuticorin district, southern parts of Virudhunagar district and northern parts of the Tirunelveli district. Thin bands of quartzite and crystalline limestone are associated with the Tirunelveli and Kovilpatti taluks.

The soils in the command area can be broadly classified as Grayish brown clayey soils, Yellowish brown to reddish brown soil and grayish brown to light brownish grey soils. Grayish brown soil extends over 65% area of the project command and are developed from weathered classic gneiss and schist's. Texture of this soil varies from sandy loam to sandy clay loam and sandy clay

loam to clay loam in surface, clay loam to clay in sub-surface horizon. Yellowish brown to reddish brown soils are derived from weathered quartzite gneisses. Texture of the soil is mostly coarse loam in surface and sub-surface is sandy clay to gravely clay. Grayish brown to light brownish grey soils are developed from calcareous quartzite gneiss and cover 16% area of command.

2.4 River system and Basin characteristics:

2.4.1 Basins

(i) The Pamba

The Pamba is the third longest river in Kerala. It is formed by the confluence of Pamba Ar, Kakki Ar, Arudai Ar, Kakkad Ar and Kall Ar. The Pamba Ar in turn is formed by several streams having their origin in the Pullichimalai, Nagamalai and Sundaramalai in the Peermade plateau at an altitude of +1650 m. The river flows downwards in a north-westerly direction till it receives some more streams from Maruvattapara Malai. It then flows in southwesterly direction till its confluence with Kakki Ar. The Pamba after receiving Kakki Ar flows in a westerly direction till Arudai Ar joins it near Udumpara Malai. The river then flows in a southwesterly direction till Ponachi and in southeasterly course until the Kakkad Ar joins the river near Perunad. The river then flows in a southern direction upto Vadasserikkara where it is joined by the Kall Ar. It then flows in northwest upto Panni before taking southwestern course. The river is known as Panni Ar here. The river flows in western course upto Kuriannur and in southern direction upto Kozhencherry and takes a westerly direction upto Pandanad. The river splits into two branches near Pandanad. One branch flows in southwesterly direction and is joined by a branch of Achankovil River. The Manimala River joins the Pamba near Nirettupuram. The river thereafter flows northward and falls into Vembanad lake.

The Pamba Kal Ar on which the Punnamedu dam is located originates from Peermade plateau in Idukki district at an altitude of +1050 m. The river flows for about 67 km in northwesterly direction before joining Pamba near Vadasserikkara.

(ii) The Achankovil

The Achankovil River is formed by joining of several small streams originating from the Pasukida Mettu, Pamakkal Teri and Rishi Malai at altitudes ranging between +700 m and +160 m. The river follows a north westerly course till Kumbazha and in this portion it is joined by Kal Ar about 1 km upstream of Turai forests. The river follows a generally western direction till Idappamon. Here it turns northwest upto Thazakkara and thereafter flows westwards. At Tharaimukku, the Kuttanperoor canal branches from the main river and joins

Pamba. The river then splits up in several branches and the main branch flows in a north westerly direction to join Pamba river near Veeyapuram.

The Achankovil Kal Ar on which the Achankovil Kal Ar dam is located rises in Western Ghats near Devarmalai at an elevation of +1200 m and flows for 30 km in generally east-west direction before taking southern turn to join Achankovil river.

2.4.2 Basin characteristics

(i) Rainfall

Like many parts of India, the Pamba and Achankovil basins receive major portion of rainfall during south-west monsoon period (June – September). The south-west monsoon forms around 80 per cent of annual rainfall. The north-east monsoon constituting remaining portion of rainfall strikes in October and continues till November.

The rainfall distribution in the Pamba basin is mainly influenced by the geographical disposition and the physical features of the area within the basin. The Western Ghats forming eastern boundary of the basin receives fairly high rainfall ranging from 4307 mm to 3659 mm. The areas west of Western Ghats receive lesser rainfall with the increasing distance from Western Ghats. The average annual rainfall down of Western Ghats ranges from 3324 mm in the reaches near Western Ghats to 2900 mm near coast. The rainfall in Achankovil basin on the other hand is distributed fairly uniformly through out the basin varying from 3346 mm to 2317 mm except for an isolated case of 6556 mm. The average annual rainfall of the Pamba Kal Ar and Achankovil Kal Ar catchments is around 2600 mm.

The command area receives major portion of the rainfall during north-east monsoon i.e., during October-December. The average rainfall in the command area is 772 mm. This area experiences a maximum and minimum of 184 mm and 14.5 mm so far during November and June in monsoon period.

(ii) Climate

Both the Pamba and Achankovil basins enjoy tropical climate without much variation in temperature. Good rainfall, moderate temperature and a humid atmosphere throughout the year are the characteristic features of these basins. The climate along the coastal areas of the basin is generally hot with a high degree of humidity. The temperatures in the mountainous regions are generally low. The south-west monsoon which is dependable, sets in June

and lasts till September. The north-east monsoon which is uncertain sets in October and continues till November.

(iii) Temperature

There is no observatory located with in the catchments of diversion points. However, there is an IMD observatory at Alleppey in the vicinity of these basins. The mean daily temperature observed at Alleppey varies from 26.1°C to 29.1°C. During April, which can be taken as representative of summer months, the mean daily minimum temperature is about 25.5°C and mean daily maximum temperature is about 32.7°C. During July, which can be taken as representative of monsoon months, the mean daily minimum temperature is 23.3°C, while the mean daily maximum temperature is 28.8°C. During October, which can be taken as representative of post monsoon months, the mean daily minimum temperature is 23.8°C and the mean daily maximum temperature is 29.7°C.

(iv) Humidity

Except during monsoon months, the relative humidity is low in the basins. The relative humidity varies from 91% to 68%.