PRE-PROJECT STUDY OF PERINGAMKULAM POND REVIVAL PROGRAMME: REPORT

APOLLO TYRE FOUNDATION

TROPICAL INSTITUTE OF ECOLOGICAL SCIENCES (TIES)
www.ties.org.in

Report on

Pre-project study of Peringamkulam Pond Revival Programme

Peringamkulam, a pond located on the side of NH-47 at Perambra, near Apollo Plant, Thrissur, Kerala, India.

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Preface

Conservation of water bodies are utmost important in India due to increasing demand of water requirements, and water shortage is an emerging scenario especially during summer season. Rivers, lakes, ponds, streams and wells are the sources of freshwater. Ponds are amongst the most diverse freshwater habitats that support many species including more uncommon, rare and even threatened species. Furthermore, pond is an ecosystem itself and it is formed from the cohabitation of plants, animals, microorganisms and its surrounding environment. Apart from the water requirements for domestic purposes, most of the manufacturing is also heavily depended on water. Many of the small water bodies in our surrounding have already disappeared leading to water shortage and biodiversity loss in the region. Therefore, initiatives must be undertaken to protect the existed ponds to safeguard the environment as well as the human well being. Generally, corporate companies require huge amounts of water for their production; therefore, they perceive a responsibility to conserve the water bodies in their surrounding areas. Hence, Corporate Social Responsibility (CSR) departments of many companies involve in various conservation activities that improves the quality and quantity of water. Similarly, CSR team of Apollo Tyres Limited, a leading global tyre dealer, fully understands the significance of water and biodiversity conservation in their operating area. They approached Tropical Institute of Ecological Sciences (TIES), Kottayam, to perform a pre-study to retrieve Peringamkulam pond in Marathampilly Ward, Kodakara Panchayat and to propose specific pond management activities that will ensure sustainable conservation of the Peringamkulam pond. As upon the request, a three month research study has been conducted, and this report contains detailed information on history, geography, biodiversity and environmental issues of the Peringamkulam pond. A sustainable conservation approach to retain the cultural, social, and ecological significance of Peringamkulam pond through transforming the pond bank as a wayside eco-tourism spot with the participation of local community is also proposed in the report.

Acknowledgement

We would like to express our deepest gratitude to Corporate Social Responsibility (CSR) team of Apollo Tyres Limited, for entrusting Tropical Institute of Ecological Sciences (TIES) with the responsibility of conducting the Pre-Project study of Peringamkulam Pond Revival Programme. TIES take this opportunity to individually thank Ms. Harshitha Pande, Head CSR, Ms. Kanika Pal, Group Manager CSR, Ms. Smitha R Specialist CSR of Apollo Tyres Limited, Cochin plants, for their continuous assistance in carrying out the pre-project study. Additionally, we convey our sincere gratitude to Kodakara Grama Panchayat Officials especially Panchayat President, Srimathi Rosely Varghese, Marathampilly Ward Member Sri. Krishnankutty P. M, and other Panchayat Staffs who extended their cooperation and support throughout the study period.

Further, we appreciate the cooperation shown by Panchayat Public Library in-charge Person Mr. Jayaprakashan, Kodakara Agricultural Officer Ms. Dhanya .V and other staffs, Kodakara Village Office staffs, Puthukkad Block Panchayat Office, National Highways Development Office (NHDP), Chembukavu, Thrissur and Guruvayoor Infrastructure Private Limited Toll Office at Amballoore in providing us with the necessary secondary documents that we have requested. Finally and most importantly, we would like to extend our sincere gratitude to all local community members including residents, farmers, traditional livelihood communities, prominent socio-religious members, and Kudumbashree units for their willingness to take part in the Peringamkulam historical pond survey and for sharing their knowledge, views and experiences with regards to the pond.

We highly appreciate each and every individual's contribution to the study, and we expect your continued support in the future.

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Peringamkulam Pond before the cleaning drive, November 2014

1. INTRODUCTION

Ponds are the simplest surface water bodies which are closest to the heart of human being and of considerable ecological, social and cultural significance in every locality. On a world scale, ponds and small lakes dominate both the area of freshwaters and the number of basins too. Collectively, they have an overwhelmingly greater significance in human affairs than large lakes, and contribute greatly to the freshwater storage of organic matter (Gioria, Margherita and Feehan, John. 2009).

Ponds are built in the past to hold water for agriculture and domestic uses. These water bodies not only provide drinking water, support livelihoods and biodiversity but also control runoff and act as natural rainwater recharging structures (Khanna, D.R et.al. 2011).

Most of the surface water in India face vast quantity and quality threat. Many ponds have been degraded or lost, mainly due to anthropogenic activities such as change in agricultural activities, expansion of urban areas and pollution. Ponds have become more eutrophic owing to excessive nutrient additions and as a result they have often changed from macrophyte dominated and clear water states to turbid states, dominated by phytoplankton or floating water hyacinth or *Salvinia* (Gioria, Margherita and Feehan, John. 2009).

With about 1.2 billion people having no access to drinking water and about 2.4 billion lacking basic sanitation, the symptoms of emerging global water crisis are too obvious. It is projected that the population under water stress will rise from 450 million at present to 2.7 billion by 2025 and Indian subcontinent is already being classified as the 'water stressed' region, meaning that water needs exceed its availability (CPHEEO, 2013).

Historically, these water bodies have met water demands of the population for centuries and a community management system had sustained them for a long period of time. However, now water crisis is very severe in highly populated urban areas, and rural areas also witness water shortage during summer season.

These small water bodies are an intrinsic part of the eco system. A lake or pond is the water body which holds certain volume of water generally in all seasons of the year. They have traditionally served the function of fulfilling the water requirements of the local community for drinking, household uses like washing, agriculture, and fishing and also for religious and cultural purposes. Moreover, they also host a wide variety of flora and fauna (The Waterpage. N.D)

Therefore, it is significant to protect and conserve water bodies such as ponds, streams, lakes *etc.* not only to meet the water demands of human beings but also to protect endemic and endangered biodiversity depend on these water bodies. It is the time to initiate efforts to restore, conserve, manage and maintain water bodies in our region.

1.1. SIGNIFICANCE OF CONSERVATION OF PONDS

A pond ecosystem is a fundamental unit in ecology that is formed from the cohabitation of plants, animals, microorganisms, and a surrounding environment. It refers to a community of freshwater organisms largely dependent on each other for surviving and maintaining a life cycle (The Waterpage. N.D). Ponds are an important part of our culture also; partly because of their intrinsic historical value. Their sediment records can reveal us about our ancestors' way of life. Ponds are 'local water bodies' and play a crucial role in maintaining and encouraging the link between people and wildlife. They also provide many opportunities for education and experimental research across a wide range of subjects (Khanna, *et.al*. 2011).

Ponds are vital for many rare and endangered species, both at regional and national levels. The networks of ponds support meta-populations of many aquatic species, including amphibians, invertebrates and wetland plants. Ponds are particularly important at the landscape scale: they have shown to contribute as much as to regional biodiversity as rivers or lakes, and they provide stepping-stones and increased connectivity between other freshwater habitats (Khanna, *et.al.* 2011).

Peringamkulam pond is locating in Marathampilly Ward, Kodakara Panchayat in Thrissur district, Kerala. It was a major source of water to the local community, especially for agricultural and domestic purposes, till a few decades back. The water body had greater ecological and cultural significances in the past, and due to its existence the locality is known as Peringamkulam today. It was an important place not only for the community members, but also a major halting spot for pilgrims to Sabarimala from all across India. However, it has lost its original ecology and pristine form due to invasive aquatic weed growth and dumping of wastes. To conserve the pond, the community members as well as the Panchayath has conducted pond cleaning drive several times in the past in various years; however, most of them were found unsuccessful as a sustainable solution. The present condition of the pond is worse, and is at verge of destruction.

Fig. 1. Local Community Cleaning the pond in 2014 (File photo)

The Corporate Social Responsibility (CSR) team of Apollo tyres is particularly interested in biodiversity conservation and enhancement in their operational area, and conservation of natural resources especially water bodies is of their great interest. Apollo Tyres entrusted Tropical Institute of Ecological Sciences (TIES), an environmental research organization based at Kottayam, Kerala, to implement specific biodiversity enhancement activities and conservation programs at their campus as well as in the local community. Considering the ecological and cultural significance of Peringamkulam pond, which is very close to the Apollo Tyres Perambra unit, its conservation and restoration, is one of the target areas of Apollo's biodiversity conservation. Therefore, a pre- project study of Peringamkulam pond revival programme is conducted to gather baseline data of the pond and to propose a sustainable conservation model for the pond.

1.2. OBJECTIVES

This pre-project study aims at finding out information on Peringamkulam pond regarding its geographical details, history, cultural heritage, biodiversity and major environmental threats to propose a sustainable conservation of Peringamkulam pond. The study objectives are specified as follows:

- To conduct a land survey of the Peringamkulam pond and its surrounding area (only public land) and to generate geographical data of the pond
- To assess the quantity of clay and silt in the pond and methods for their removal if possible
- To study the quantity and quality of water in the pond and also of the fauna and flora (summer season alone- rainy season data will be collected from local residents through historical survey)
- To conduct a community survey to explore various stakeholders of the pond
- To study the history, past and present usage pattern of the pond
- To study the nature of pollution of the pond and its sources
- To propose a detailed project for the retrieval and maintenance of the pond with a sustainable management and governance plan

Peringamkulam Cleaning Drive by Apollo Tyre Foundation; 12th December 2014

2. METHODOLOGY

2.1. STUDY PERIOD

The study was conducted for a period of three months from 1st January 2015 to 31st March 2013.

2.2. METHODOLOGY

Land survey: Using Total station, contours, depth and size of the pond, nature of the bottom of the pond and relevant maps were generated. Manual excavation was also done to validate the data. Depth was measured by inserting graduated steel stumps at sequential positions of 1x1 m squares.

Quantity of clay and silt: Equipments such as total station and auto level measurer were used to estimate the quantity of the clay and silt. The data on quantity of clay was estimated using the graduated steel stump inserted at 1x1 m square points covering the entire breadth and length of the pond.

Water quality studies: The quantity of water in the pond was estimated using data from the Total station and manual measurements of depth. The complete analysis (physico-chemical and biological characteristics) of the pond water was conducted at TIES' Water quality Analysis Laboratory, at Velloor, Kottayam. The following parameters were tested for four samples collected in two schedules within a period of two months; Chemical: pH, alkalinity, Total Dissolved Solids (TDS) salinity, chlorinity, iron, conductivity; Physical: colour, odour, turbidity; Microbiological: MPN (Most probable number of Coliforms); FC (faecal coliforms); TC (Total coliforms) etc. using standard procedures. Procedures used are as prescribed by American Public Health Association – APHA standards (APHA, 2000).

Biodiversity Studies: The pond area and its adjoining areas (10m radius) were thoroughly explored for floral diversity and recorded. Regular and repeated observations did in this area for a period of 3 weeks continuously, for the faunal diversity studies. Observations and studies conducted three hours a day (7.30-8.30 AM; 9.30-11.30 Noon; and 5.00-6.00 PM); three days in a week and for a period of 3weeks. A 500 m. radius to all the four sides keeping the pond as the centre were also sampled for the biodiversity estimations, considering each radii as two transects (Fig. 1). Hence, 8

transects have been chosen (3 towards the western side of the pond, three towards the eastern side of the pond, and 2 along the NH).

The land use pattern and crop distribution of the area also were recorded. Taxonomic experts from TIES visited the area thrice and assisted in identification of flora and fauna.

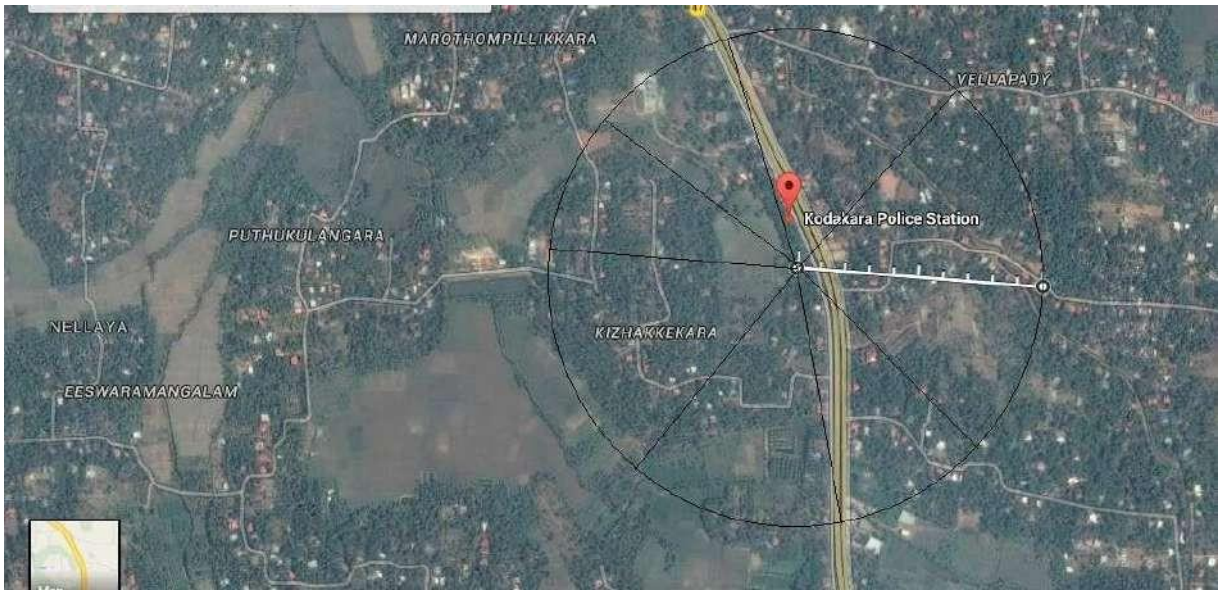


Fig. 2. Study area selected for the Biodiversity estimations- Note the 8 transect lines *(Adapted from Google Maps with modifications)*

Community survey: A survey was conducted among the local residents and other stakeholders in order to explore the history, usage pattern, other interests *etc*. using a structured interview sheet (Appendix – I).

Based on the information gathered through this survey, PRA (Participatory Rural Appraisal) meetings of five selected stakeholders also were conducted. The five stakeholder groups are; i) farmers, ii) Panchayat committee members and officials of Kodakara Grama Panchayath, iii) traditional washer community who once actively used the pond, iv) Kudumbashree members of the Ward XIII of Kodakara Panchayat and v) general public, mainly including residents around the Peringamkulam.

Pollution studies: Detailed field survey was conducted to find out the major pollutants of the pond, their source and circumstances that leads to the deposition of such wastes in the pond. The waste materials that excavated from the pond during the cleaning drive were segregated and identified. The observations of stakeholders are also included.

Categories		Percentage (%)
Survey Respondents	Male	65
	Female	35
Age	20 – 40	12
	41 – 60	41
	61 – 80	44
	81 – 100	3
Occupation	Local Community	41
	Prominent Socio-Religious Members	9
	Local Government & Non-Government Officials	17
	Farmers	17
	Laundry Community	7
	Kudumbashree	8

Table 1. Demography of Surveyed Community

Participatory Rural Appraisal (PRA) programme of Kudumbasree women at Kodakara; 5th February 2015

3. Results And Discussion

3.1 History Of Peringamkulam

3.1.1 Origin of Peringamkulam pond

During the pre-project study, it became evident that the pond has a long history, but the generations who knew about its heritage value has already deceased. The present generation has only limited knowledge regarding the origin of Peringamkulam that they have heard from their great-grand/grandparents. The claims of the existence of the pond dates back to more than 200 years.

There are different stories regarding the origin of the Peringamkulam pond. Several people connected its existence with the Ruling period of Kings in Kerala and existence of Feudalism. They claim that the pond was dug during Monarchy to benefit local community for water storage, irrigation, drinking water and sanitation purposes. The period is predicted to be during the Kochi dynasty and some has particularly stated the name of Rama Varma Kunhjipilla Thampuran (1751–1805) or Rama Varma IX, popularly known as Sakthan Thampuran. He reined Thrissur during 1790- 1805. Additionally, some has pointed out the possibilities of the pond being a temple pond as the region had several temples and associated ponds, which have been destroyed during the invasion of Tippu Sultan in Thrissur, which happened in 1789. Considering these inputs, the pond must be more than 200 years old.

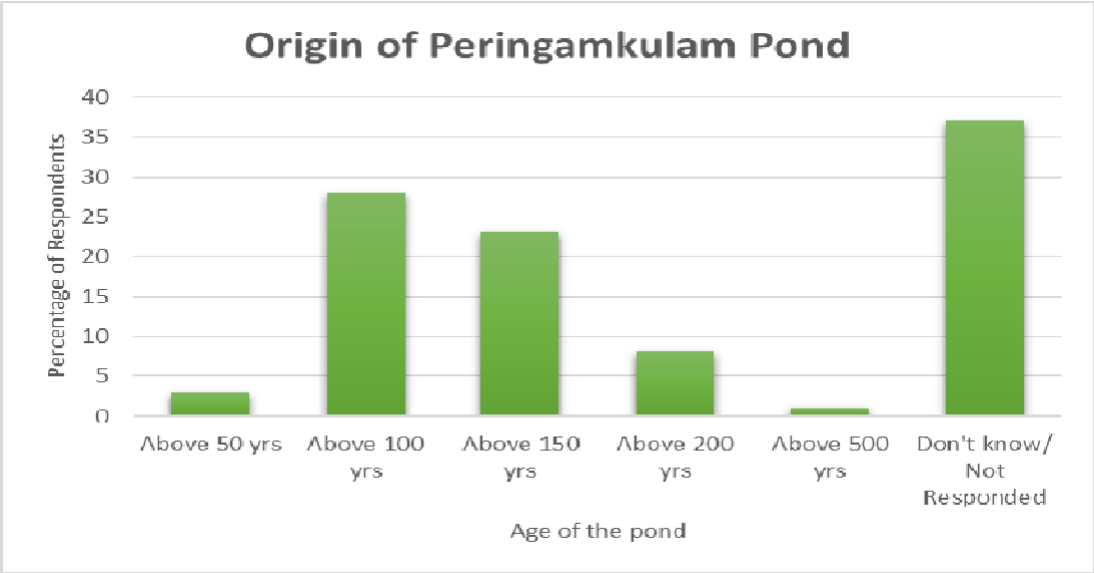


Fig.3. The age of the pond opined by stakeholder communities

As per the survey, more than half of the local community responded that the pond aged 100 or more years (Fig. 3). Eight percent suggested for more than 200 years and 1% claimed a time period of above 500 years. About 37% people did not respond to the question or do not know the answer.

Despite of its confirmed age, the pond was of a great help to the local community and passengers for halting, refreshing, and its natural divinity. Aged people of the locality has strong memories of the pond which was active everyday from 4 AM in the morning to 12 AM at night, rushed with local people, community involved in traditional laundry livelihood, children, and passengers.

Photo: Top- PRA meeting of farming community at Kodakara; Bottom – Left: PRA meeting of Washer women community at one of their residence; Interaction with aged people of the locality at a farm land (All meetings were on 5th February 2015)

3.1.2. ETIOLOGY OF THE "PERINGAMKULAM"

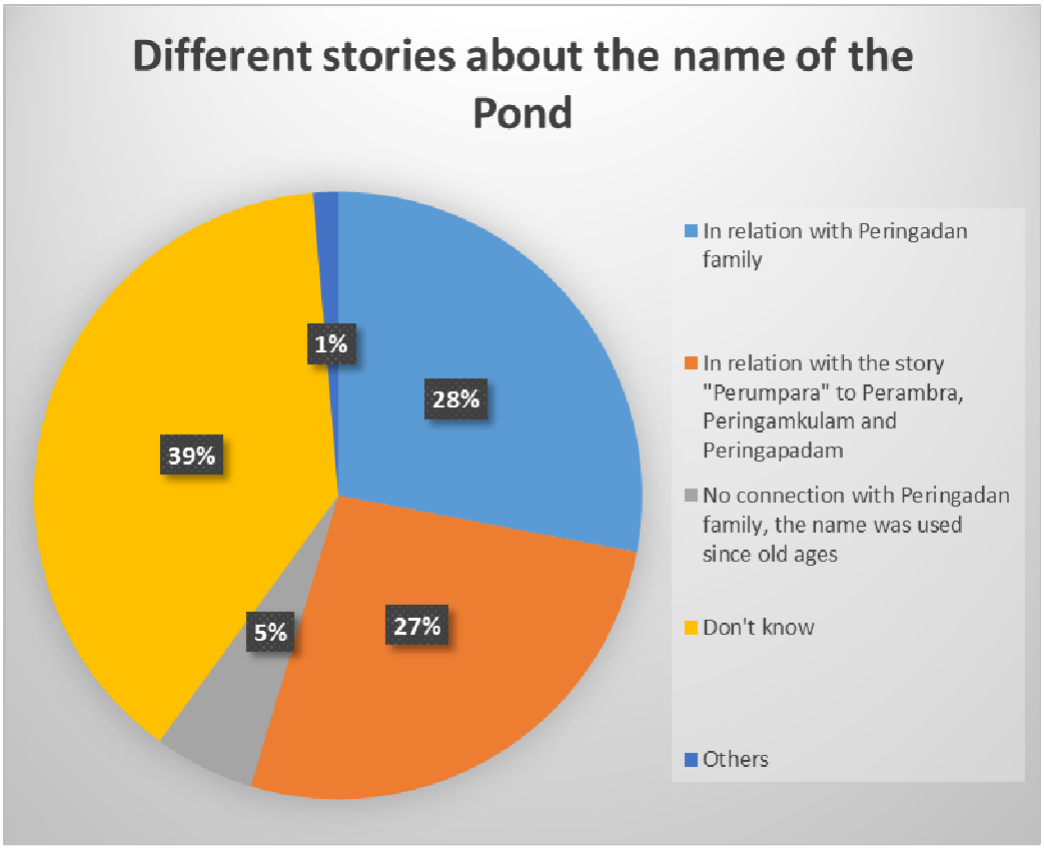


Fig. 4. Stories about the origin of the name Peringakulam

There are several stories on how the name "Peringamkulam" came into existence. Of which majority of the present generation suggested that the name might have come from a family named "Peringadan" who are residing in the region near to the pond. However, few old people in the region strongly opposed that the pond name has no relation with the family name "Peringadan," as the Peringadan family migrated to the locality in much recent past, about 60-100 years back. The pond and its name existed as such since centuries back. Some people have told that the name was simply given to the pond for documentation. Few others told that the region was full of rocks, thus the name "Perumpara" (*Perum* meaning big and *Para* meaning rock) was given, which in long run change to Perampra. The name Peringamkulam meaning big pond might have occurred in the same manner from *Perumpara*. Another person has suggested that the pond was a favorite place for Sabarimala pilgrims, mostly Tamil pilgrims, since old days during their journey. The name Peringamkulam might have been originated from their mother tongue, *Periya* meaning big and *Kulam* meaning pond in tamil, due to its big size. The pilgrims used the pond for several rituals under the guidance of *Periyaswami* or

leader of their gang. However, the most accepted story among the present stakeholder community is related to the Peringadan family. About 39% has stated that they have known the pond since their childhood, but are unaware about the history of the pond or its name.

The land surrounding the pond belongs to a family named Karimparambil, who were permanent residents of the region since past. Another story heard was that the land and the pond belonged to them during their ancestors period, which they gave to somebody for tenant and so on they lost the whole land including the one they own now during land revolution in Kerala. But somehow later they get back some portion of the land. However, since the formation of Kodakara Grama Panchayath in 1952, the Panchayat is the owner of Peringamkulam and the associated land area. During that period onwards the locality is also started to known as Peringamkulam. The another interesting fact that needs to be mentioned at this point is that the name of the pond and the region is known as *Peri"ngam"kulam* since past; however, now there is a tendency to change it to *Peri"nga"kulam* in records and documents are observed. For instance, it is written as *Peringakulam* in the name plate at the NH47, which might pass the wrong name to the passengers and visitors of the place. Whether the tendency to change the name is intentional or by mistake is not clear.

3.1.3. Physical Features Of The Pond

In the past, the road in-front of the pond was a steep hill. The road was narrow and climbing the hill was hard. Hence people have to push buses and bullock carts to cross the hill while travelling through the road. From the road, rocks were laid in a slope to the pond in the eastern side. There was another slope at the north-eastern corner of the pond to enable easy access of ponds for animals (for drinking and showering) and washing vehicles. The sprout at the western side of the pond was bigger than the present time and the steps to the pond were on the both sides of the sprout. One sprout was mainly used by females and another by males for taking shower and washing their clothes.

Fig. 5. Peringamkulam in 2006 (before National Highway Construction and alteration of landscape- File Photo of a resident)

The present retaining wall and side belts were constructed in 2000 using the funds of Puthukadd Block Panchayat. There after no major constructions have been done in Peringamkulam.

The water in the pond was transparent; but as per an old woman who did traditional laundry job at the pond, the water used to become green during summer seasons as the water level goes down.

There is a 3 m long rock at the centre of the pond. In addition, some people said that there is also one round rock at the centre while some other claimed that there are 3 round rocks at the centre. The rocks at the centre were a playing platform for the children in the past as they used to swim from the sides of the pond towards the rock. Then, returned back after taking a short break at the rock.

There were bamboo forests at the south eastern corner of the pond and pythons inhabited in those bamboo forests. The pond was surrounded by paddy fields together known as *Peringampadam,* on the western side. There were also several trees on the banks of the pond and on the sides of the roads, especially three mango trees which were popular among the local community and passerby, for its big size, shape, and sweet mangoes. One of the mango trees has big bulges on its main wood and hence the mango trees were popularly known as *Muzhayan Mavukal* (*Malayalam*. Muzha= bulges; Mavukal- Mango trees).

However, the structure and physical features of the Peringamkulam has drastically changed. Later in 2000, a side belt was constructed with rocks on the south, north and western sides of the pond. Then sprout was constructed smaller and position of stairs has been changed to enable comfortable travel through the road next to the stairs position that crosses through the paddy fields and connects the other side with the main road. The steep road in-front of the pond was flatten while NH construction (2005-2010) to straighten the road. Additionally, as per local community's opinion, the rocks might have gone beneath the loads of soil dumped into the pond during NH construction. The bamboo forests have been destroyed meanwhile to construct a house, but the house was demolished for NH construction later. Most of the paddy fields neighboring Peringamkulam have been filled for house construction and now people rarely cultivate in Peringampadam. The government has cut down the trees on the road sides for the NH Construction.

3.2 LIVELIHOODS EXISTED BASED ON PERINGAMKULAM

The major livelihood activities associated with Peringamkulam were agriculture, fishing, laundry and cattle raising. To irrigate the paddy fields near to the pond, it was the major source of water. Earlier there were three agricultural seasons (Poovu in Malayalam means three flowerings a year namely *Puncha*, *Virippu* and *Mundakan*) to cultivate paddy but now it has reduced to only one season (*Puncha* alone). Also, most of the paddy fields are filled now so drastic reduction in cropping area occurred during recent years. Therefore, water usage for agriculture is also declined compared to the past. Fishing was also a livelihood activity based on the pond. Angling fishes in the pond was the main activity happened in pond almost every day, but now it has decreased very much. Currently only few people are doing angling as a time-pass or hobby but not as livelihood. In addition, individuals used to undertake the ownership of pond for fishing during a period of one year through auction to carry out fishing by paying the Panchayat. However, it has stopped after 2008. Laundry and cattle raising were the other activities related to the pond. In past, some families were washing clothes in the pond and that was their livelihood activity (Fig.4). They claimed that they used to wash clothes at the pond from 6 am to 5 pm and dried the clothes there itself. Even people from Shanthi Hospital (about 3 km. away) in Kodakara used to come to Peringamkulam to wash clothes. Moreover, many people used the pond to shower the cattle and that was also a drinking water source for those animals.

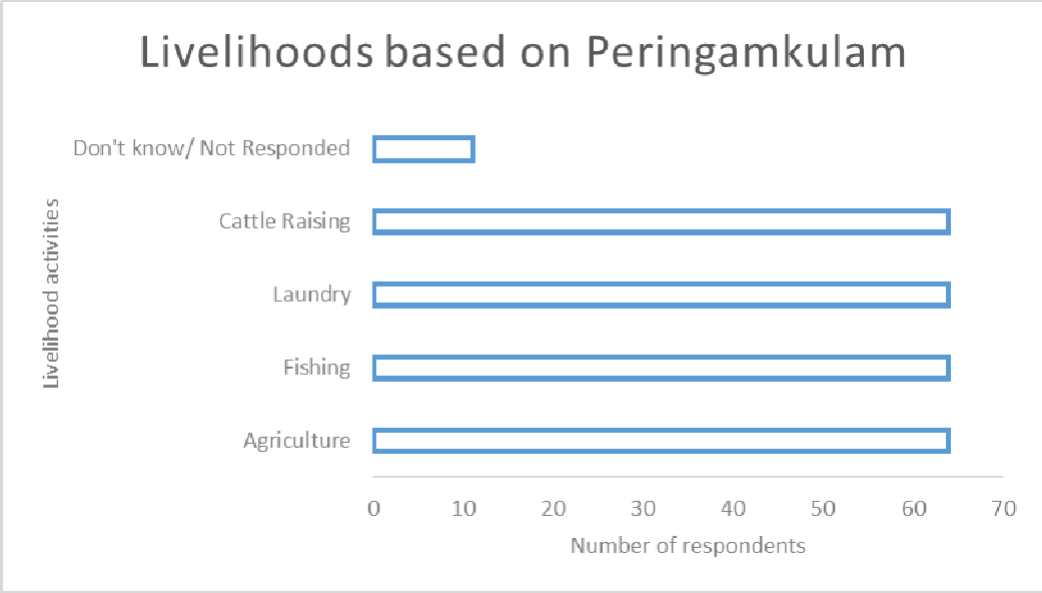


Fig. 6. Major Livelihoods related to Peringamkulam in the past

3.2. Main Uses Of The Pond In Past And Present

Similarly, the main uses of the pond in the past were agriculture, bathing, laundry, showering animals, fishing, defecating and funeral rituals and now it has limited to agriculture and fishing. The community people used the water for many domestic activities and funeral rituals. At that time the quality of the water in the pond was also good. Fig. 5 clearly shows that the use of the pond has decreased significantly compared to the past. Currently, the pond is only used for agriculture and fishing by community people as the quality of water in the pond is not same as the past.

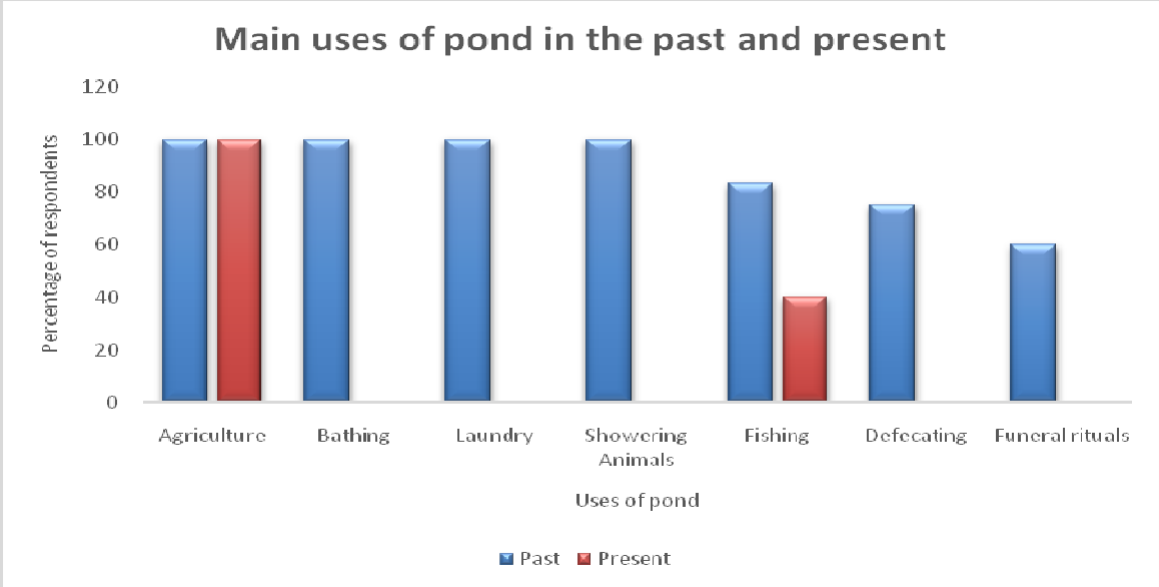


Fig. 7 Uses of pond in the past and present as opined by the community

Likewise, there is a change in the number and group of beneficiaries associated with the Peringamkulam pond. In the past, other than local community, bullock cart owners and drivers, their bullocks, later Sabarimala pilgrims, recently truck drivers and tourists were also used the water in the pond. Many travelers from all over the india used the water for bathing, defecating, washing and considered the location as a resting place in the middle of their journey. Fig. 8 indicates the beneficiaries of peringamkulam pond in the past and present. It shows that now the water is only used by local community for agriculture and fishing.

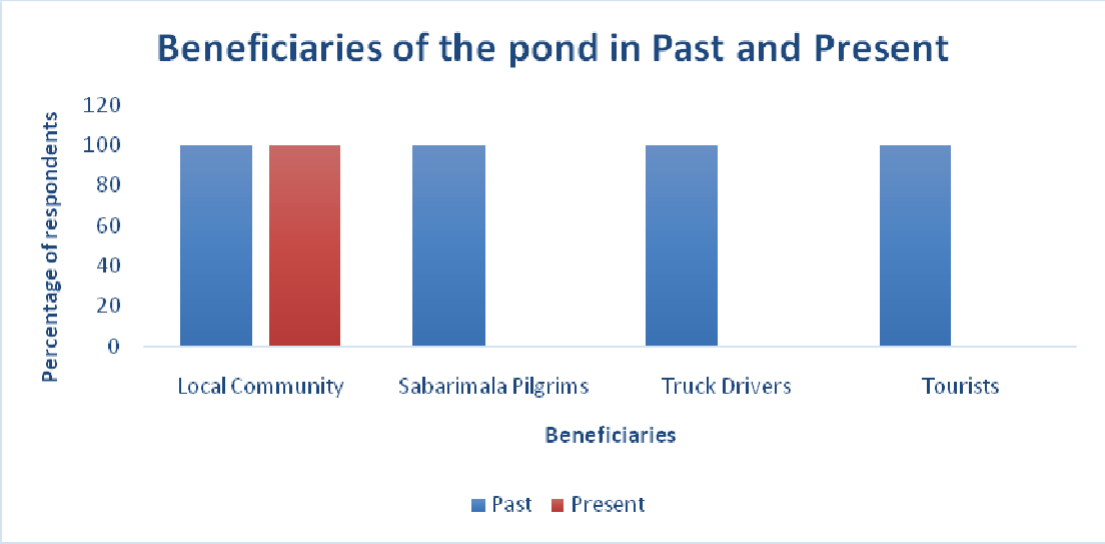


Fig.8 . User community of the pond in the past and present

3.4. Other Water Bodies In The Region

	No.	Water Quality	
		Good	Polluted & Bad
Total No. of Ponds (Kulam)	41	23	18
Total No. of Bunds (Chira)	6	2	4
Total No. of Rivulets (Thodu)	9	8	1
Note : 1. Area of all water bodies have been reducing 2. Peringakulam is reported as polluted and in an abandoned condition (2009)			

Table 2. Surface water bodies of Kodakara Grama Panchayath

Source: Report on Traffic-transportation survey, Environmental survey, and Heritage Survey, 2008-2009, Kodakara Grama Panchayath, Thrissur. Published in 2009.

Kodakara was rich in surface water bodies till recently. The environment survey conducted in Kodakara during 2009 listed 41 ponds (including Peringamkulam), six bunds (chira) and 9 rivulets (thodu) as surface water resources of the Panchayath (Table 2). Most of these ponds have been lost there size over the years and heavily polluted and now in an abandoned condition (Table 3).

The main man made canal in this region is Blachira canal, that receives water from Thumboormuzhi check dam. Water from Athirapilly water-fall situated on the west-flowing Chalakudy River near the Vazhachaal Forest Division and Sholayar ranges, is collected at Thumboormuzhi Check dam. Then it will be diverted as Right Branch Canal or *Valathukara* and Left Branch Canal or *Edathukara*. The Right Branch Canal or *Valathukara* flows towards to Mala, Potta, Chalakudy side and Left Branch Canal or *Edathukara* canals flows to Angamaly and Karukutty side. The Blachira Canal is built from *Valathukara* canal and has several distributaries. When water moves through Blachira Canal, it will be collected at Thuppanchira, another nearby pond, and which strengthen the underground springs in the region including Peringamkulam stream from Peringamkulam, stream from Blachira canal, and stream from Cheravathoorchira. Streams from Peringamkulam and Blachira canal join at the Peringampadam, and later joins with the stream from *Cheravathoorchira* at the back of the Kodakara Market, and later joins to Kurumali River. The sides of the Blachira canal are not concreted hence when water passes through the canal; it permits infiltration of water through the soil and helps in increasing water level in the region including Peringamkulam.

Meeting of TIES team with Kodakara Grama Panchayath committee and officials. 5.2.15

Table . 3. List of surface water resources of Kodakara Grama Panchayath (2009)

No.	Name of Surface Water Resource	Availability of Water	Type of Current Usage	Water Quality	Remarks (Area Reduced Or Not
KULAM (POND)					
1	Poonilarkavu Temple Pond	All Seasons	Usable	Clean	Reduced
2	PoothikulangaraTemple Pond	All Seasons	Irrigation	Clean	Reduced
3	Kundankulam (Pond)	Seasonal	Irrigation	Clean	Reduced
4	Thuppan Chirakulam Pond	Seasonal	Irrigation	Clean	Reduced
5	Mothakulam (Pond)	Seasonal	Irrigation	Clean	Reduced
6	Kaithakulam (Pond)	All Seasons	Irrigation	Clean	Reduced
7	Panthallookaran Pond	All Seasons	Irrigation	Clean	Reduced
8	Thavalakulam (Pond)	Seasonal	Irrigation	Clean	Reduced
9	Allukulam (Pond)	Seasonal	Irrigation	Clean	Reduced
10	Valathi Parambente Pond	All Seasons	Drinking water	Clean	Reduced
11	Sankaran kulam (Pond)	Seasonal	No usable	Polluted	Reduced
12	Iynikulam (Pond)	All Seasons	No usable	Polluted	Reduced
13	Panikar Thzhathu Pond	All Seasons	Irrigation	Clean	Reduced
14	Blachu Pond	Seasonal	Irrigation	Clean	Reduced
15	Adaykkamara Pond	Seasonal	No usable	Polluted	Reduced
16	Nedungattu Pond	Seasonal	Irrigation	Clean	Reduced
17	Kattilayan Pond	Seasonal	Irrigation	Clean	Reduced
18	Chandi Pond	Seasonal	Irrigation	Clean	Reduced
19	Kadumkutti Pond	Seasonal	Irrigation	Clean	Reduced
20	Karayam Pond	Seasonal	Irrigation	Clean	Reduced
21	Njara Pond	All Seasons	No usable	Polluted	Reduced
22	Kurishu Pond	All Seasons	No usable	Polluted	Reduced
23	Kallan Pond	All Seasons	No usable	Polluted	Reduced
24	Puthukkavu Temple Pond	All Seasons	No usable	Clean	Reduced
25	Peringakulam (Pond)	All Seasons	No usable	Polluted	Reduced
26	Ulinjery Pond	Seasonal	No usable	Polluted	Reduced
27	Oran Pond	Seasonal	All Seasons	Polluted	Reduced
28	Marathompilli Manakulam (Pond)	All Seasons	All Seasons	Clean	Reduced
29	Karapilli Pond	Seasonal	No usable	Polluted	Reduced
30	Aasheri Pond	Seasonal	No usable	Polluted	Reduced
31	Kattu Pond	Seasonal	No usable	Polluted	Reduced

32	Padannakulam (Pond)	All Seasons	Drinking water	Clean	Reduced
33	Kunathu Pond	Seasonal	No usable	Polluted	Reduced
34	Para Pond	Seasonal	Usable	Clean	Reduced
35	Kaarathodu (Pond)	Seasonal	Irrigation	Clean	Reduced
36	Kotha Pond	Seasonal	Usable	Polluted	Reduced
37	Murian Pond	Seasonal	Usable	Polluted	Reduced
38	Kurichi Pond	Seasonal	Usable	Polluted	Reduced
39	Mutheri Pond	Seasonal	Drinking water	Clean	Reduced
40	Karur SriSankara Temple Pond	All Seasons	Drinking water	Clean	Reduced
41	Pothu Pond	All Seasons	Drinking water	Clean	Reduced
CHIRA (BUND)					
1	Blachira Bund	Seasonal	No usable	Polluted	Reduced
2	Kavanattu Bund	All Seasons	Irrigation	Clean	Reduced
3	Tesseri Bund	Seasonal	No usable	Polluted	Reduced
4	Annan Bund	All Seasons	No usable	Polluted	Reduced
5	Cheruvathoor Bund	All Seasons	Irrigation	Clean	Reduced
6	Thotta Bund	All Seasons	Usable	Polluted	Reduced
THODU (RIVULET)					
1	Kuzhikaani thodu (Rivulet)	All Seasons	Irrigation	Clean	Reduced
2	Chatlampadam Naduthodu (Rivulet)	All Seasons	Irrigation	Clean	Reduced
3	Valiyathodu (Rivulet)	All Seasons	Irrigation	Clean	Reduced
4	Valayaamkulam Thodu (Rivulet)	Seasonal	Irrigation	Clean	Reduced
5	Pallippadam Thodu (Rivulet)	Seasonal	Irrigation	Clean	Reduced
6	Moundappadam Kolani Thodu (Rivulet)	Seasonal	Irrigation	Clean	Reduced
7	Cherothi Thodu (Rivulet)	Seasonal	No usable	Polluted	Reduced
8	Puthukkavupadam Thodu (Rivulet)	Seasonal	Usable	Clean	Reduced
9	Puthukavuthodu (Rivulet)	Seasonal	Usable	Clean	Reduced

Source: Report on Traffic-transportation survey, Environmental survey, and Heritage Survey, 2008-2009, Kodakara Grama Panchayath, Thrissur. Published in 2009.

3.5. GEOGRAPHY

3.5.1. GEOGRAPHICAL DETAILS

All available information on past and present maps, data, photos, contour levels, photos *etc*. were collected from village office, Panchayath office, Kodakara Agricultural Office, Puthukadd Block Panchayath Office National Highway Authority Office at Chempukavu and Guruvayoor Infrastructure Private Limited Toll Office at Amballoore. The Peringakulam situates in the 13th ward of Kodakara Grama Panchayath (Fig. 7).

The terrain is a confluent of plain land on west and sloppy hill on the east. As per the records of the village the pond and adjoining property owned by Kodakara Panchayath had an area of 59.97 cents (24 Ar 28 Sq.links- Thrissur district; Mukundapuram Taluk, Survey No. 179/05; area recorded as Purampokku land) (Fig.8). National Highway Authority acquired a total of 17.27 cents on the eastern side for the construction of the NH 47 road (4.77 cents in first acquisition and 12.50 in second acquisition) (See

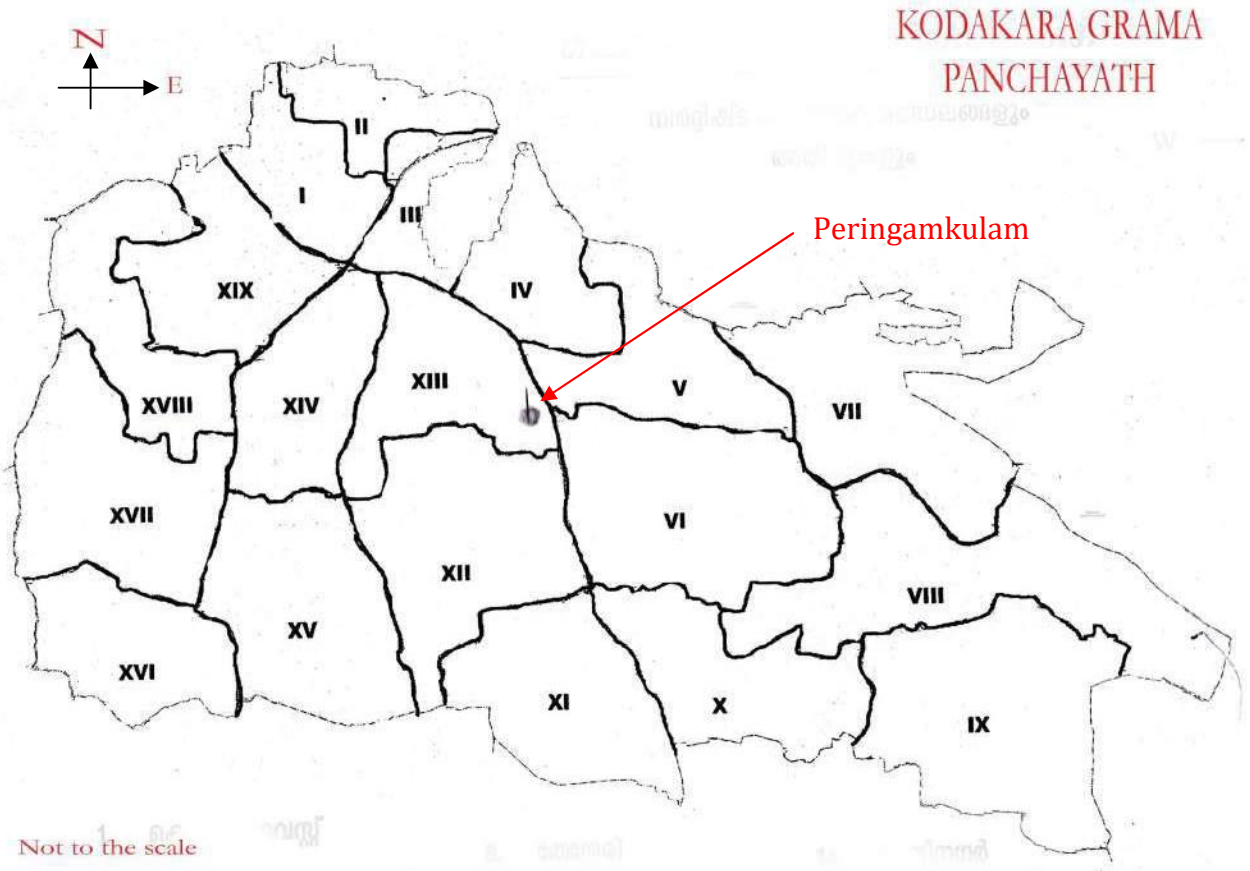
Field survey by authorized staff of TIES

Appendix 2). According to this data, currently pond and adjoining area has a total area of 42.71 cents (17 Ar 29 Sq. Links) only. As part of this study the area is surveyed on in 24th January 2015 using Total Station equipment and the map is given in Fig. 9. As per this survey, pond and adjoining area has 46.89 cents (18 Ar 89 sq.links). This is excluding the 1 metre service line area of the NH, which is not marked in the location. The water filled area of the pond is 28.99 cents.

The boundary of the pond is not clearly marked and the stones are not found. On the southern side a retaining wall is built by the owner of the adjoining land but it is reported as encroachment to the pond area. The boundaries should be clearly marked and boundary wall shall be constructed with the help of Village and Panchayath offices.

Furthermore, the local community underlines that the size of the pond has decreased over time, but most of them have no clear cut idea about the exact rate of reduction in the size. Nearly about half of the surveyed people mentioned that one fourth of the pond has decreased, 14.66 percent claimed that one third of the pond size has decreased, while another 22.67 percent sadly addressed that half of the pond size has decreased (Table 4). However, a small portion comprising 4 percent of the surveyed community claimed that the pond remains same as in the past. The pond size is mainly reduced due to National highway construction in 2005 to 2011.

Fig. 7. Map of Kodakara Grama Panchayath showing wards and Peringamkulam



Names of Wards: I. Kodakara West II. Haavumthara III. Kodakara East IV. Azhakam V. Vallappaady VI. Perambra North VII. Kanakamala VIII. Thesserry IX. Pazhambilly X. Permabra South XI. Naadukunnu XII. Permbra West XIII. Marathampillikkara XIV. Sakthinagar XV. Aanathadam XVI. Pulippaara XVII. Kaaroor XVIII. Manakkulangara XIX. Vazhiyambalam

Pond Size	No. of Participants	Percentage
Pond size remains same	3	4
Half of the pond size has reduced	17	22.67
One third of pond size has reduced	11	14.66
One fourth of the pond size has reduced	26	46.67
Don't know/ Not Responded	18	24
Total	75	100

Table 4. Stakeholders view on the reduction of size of the pond

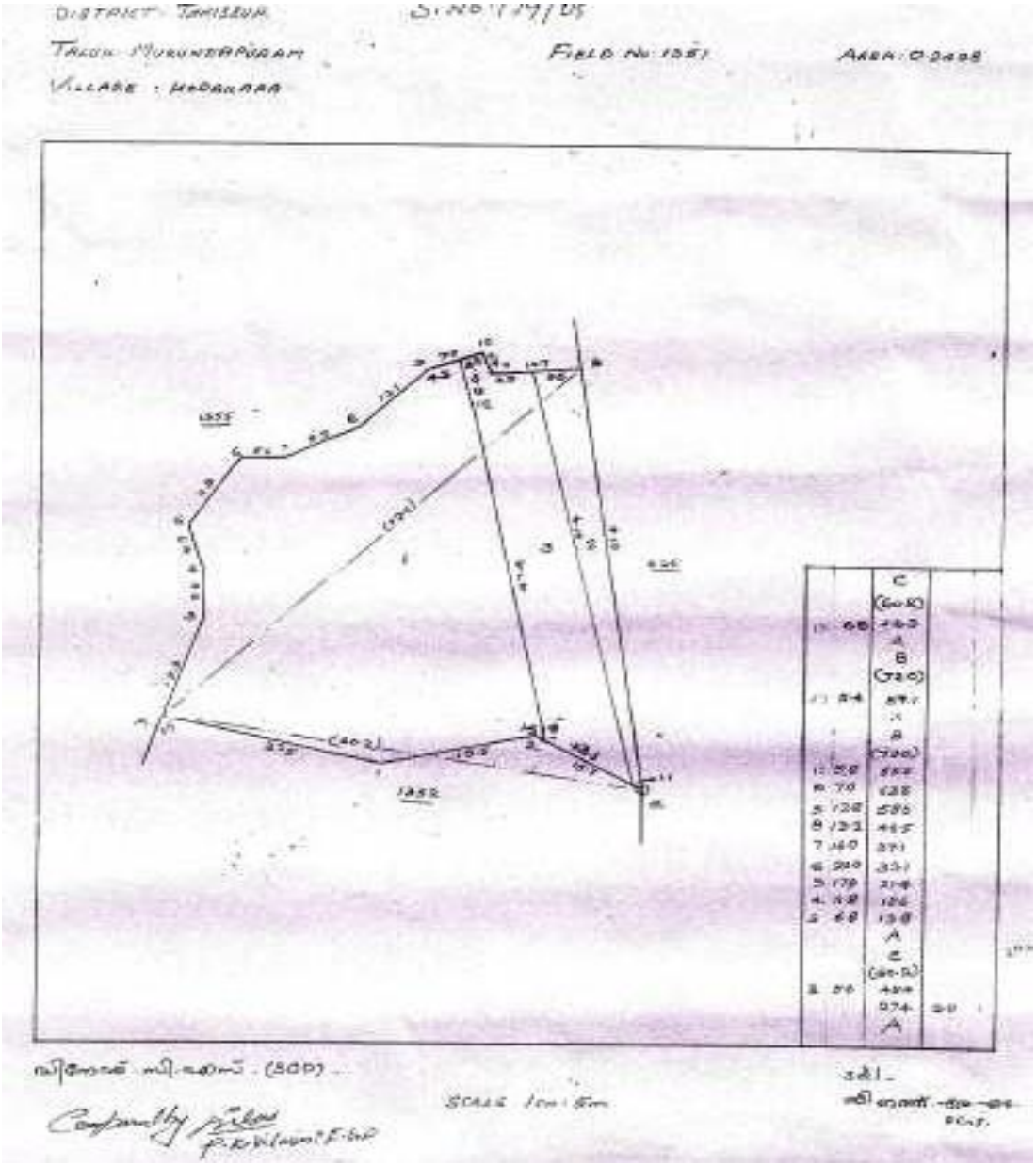


Fig. 8. Map showing the area of Peringamkulam (Before the acquisition by the NH authority) (*Source*: Village office, Kodakara)

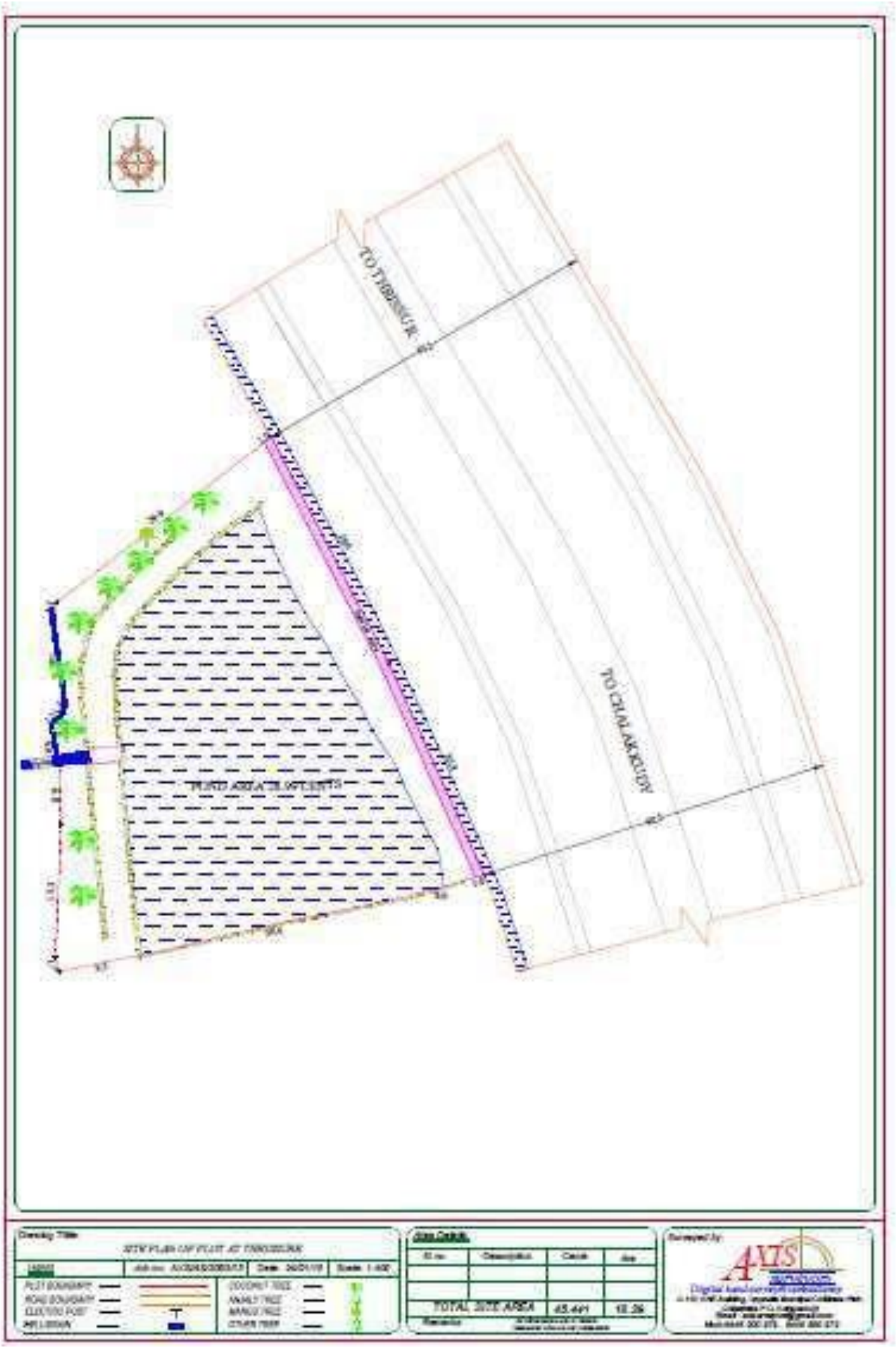


Fig. 9. Site plan of the Peringamkulam Pond

3.5.2. CLAY AND SAND QUANTITY ANALYSIS

The depth of the pond as well as the quantity of clay and sand in the pond was estimated using manual depth measurements coupled with Total station readings. Three cross sections were taken and the profiles and field books are given below:

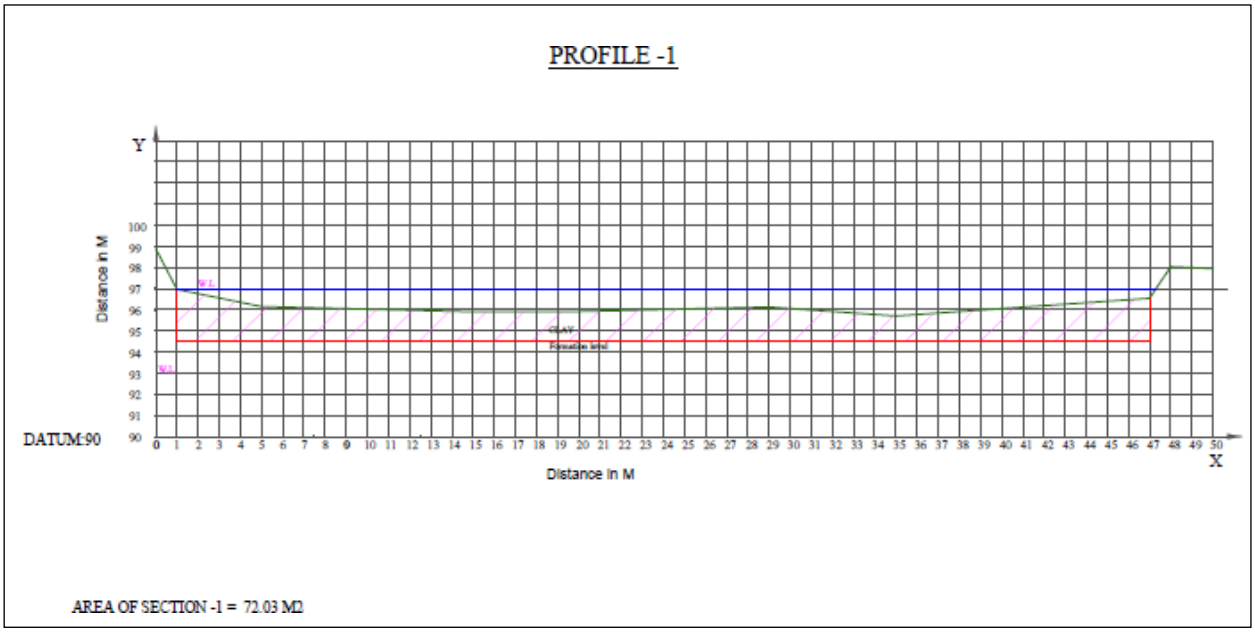


Fig. 10. Cross section 1 showing the depth and quantity of clay/sand

PROFILE 1					
BS	**IS**	**FS**	**HI**	**RL**	**REMARKS**
0.125			**100.125**	**100**	TBM
	3.125			**97.00**	WATER LEVEL
	1.245			**98.880**	RETAING WALL TOP
	3.160			**96.965**	RETAING WALL BOTTOM
	3.975			96.150	
	4.215			95.910	
	4.275			95.850	
	3.995			96.130	
	4.415			95.710	
	3.575			96.550	RETAING WALL BOTTOM
	2.095			98.030	RETAING WALL TOP
	2.175			97.950	

Table 5. Field Book of Profile 1

The maximum depth of the pond is 3 meters from the water level and average depth is 1.2 m. The average depth of the water column is one metre. The total amount of clay and sand available in the pond is 1683.84 m^3.

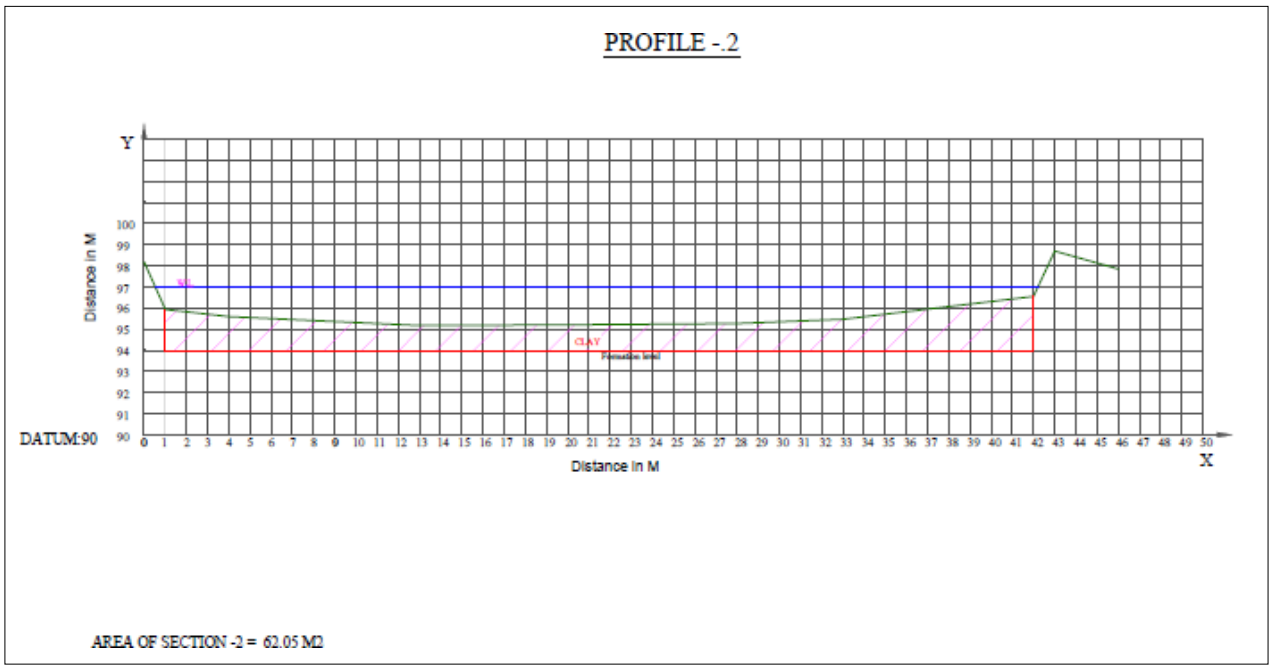


Fig. 10. Cross section 2 showing the depth and quantity of clay/sand

PROFILE 2					
-	-	-	-	-	-
BS	**IS**	**FS**	**HI**	**RL**	**REMARKS**
	1.925			**98.200**	RETAING WALL TOP
	4.190			**95.935**	RETAING WALL BOTTOM
	4.525			95.600	
	4.955			95.170	
	4.925			95.200	
	4.860			95.265	
	4.655			95.470	
	3.580			96.545	RETAING WALL BOTTOM
	1.430			98.695	RETAING WALL TOP
	2.275			97.850	

Table 6. Field book of Profile 2

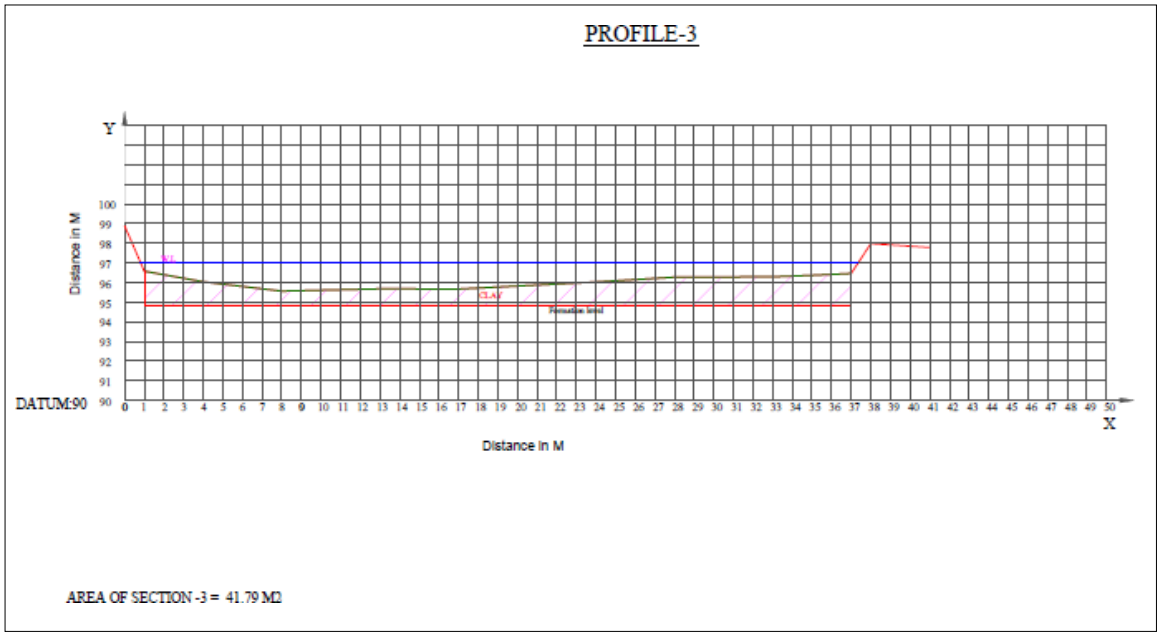


Fig. 11. Cross section 3 showing the depth and quantity of clay/sand

	PROFILE 3				
BS	**IS**	**FS**	**HI**	**RL**	**REMARKS**
	2.110			**98.015**	RETAING WALL TOP
	3.545			96.580	RETAING WALL BOTTOM
	3.670			96.455	
	4.125			96.000	
	4.525			95.600	
	4.425			95.700	
	4.375			95.750	
	3.855			96.270	
	3.830			96.295	
	3.760			96.365	
	3.665			96.460	RETAING WALL BOTTOM
	2.140			97.985	RETAING WALL TOP
		2.340		97.785	

Table 7. Field book of Profile 3

CS NO	AREA OF CS	MEAN AREA	DISTANCE	QUANTITY
1	72.03	36.015	0.0	0
2	62.05	67.04	13.5	905.04
3	41.79	51.92	15.0	778.8
	Total Quantity clay + sand			**1683.84 m^3**

Table 8. Total Quantity of clay and sand

3.6. WATER QUALITY AND QUANTITY

3.6.1. WATER QUANTITY

Peringamkulam is mainly a rain water harvesting source in the region. Mostly the water in the pond is stagnant though there is a small sprout in the western side as outlet that flows towards the paddy field and then leads to another stream. There is no direct surface water connection to the pond. It has multiple springs that direct to the pond, in which two or three are visible in the eastern side of the pond. People said that when water passes through the Blachira Branch Canal, which is the biggest water source in that area, the spring becomes stronger.

Peringamkulam pond is a perennial source of water in that area. Among the survey respondents, 37% claimed that there is no water level fluctuation in the Peringamkulam pond and about the same percentage of respondents said that there is a water level fluctuation in the pond mainly during the summer season. Almost 25 % does not respond to that question.. According to the people mentioned about the water level fluctuation, majority claimed that almost 1 foot of water decreases during the summer season. Only 21 % of respondents said that the water level decline is below one foot and 4 % said that it is above three foot (Fig. 12). However, everybody underlines the fact that due to the existence of the pond, the local community has enough drinking water in their wells throughout the year. Pond recharges neighboring open wells significantly.

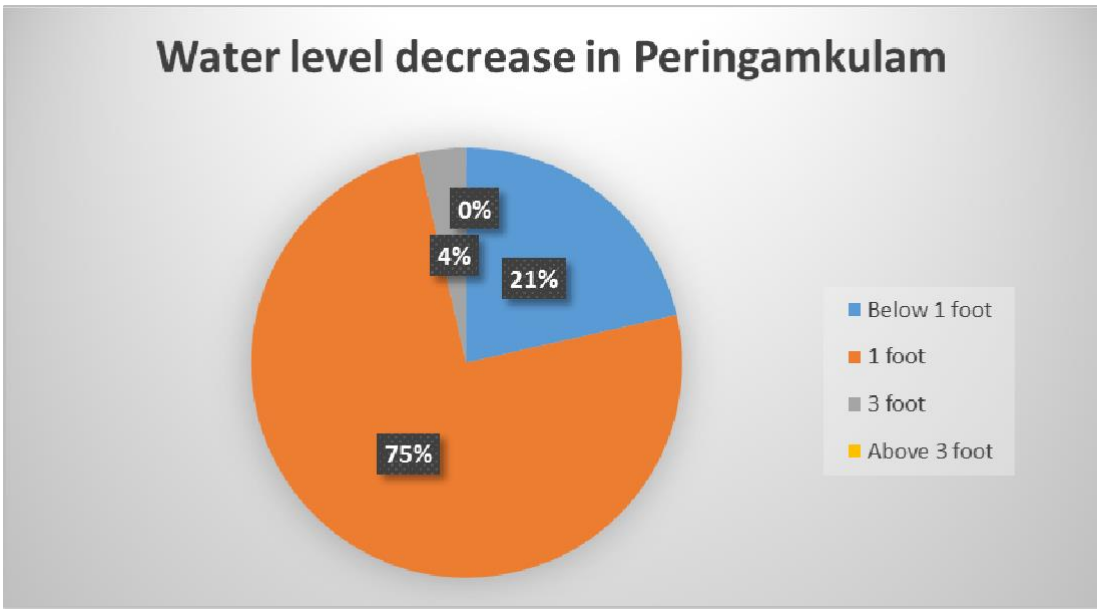


Fig.12. Opinion of stakeholders on the summer water level of Peringamkulam pond

3.6.2. WATER QUALITY

Peringamkulam is known for its pristine environment and pure water, till recent times. Local people used the pond for bathing, swimming and agricultural purposes mainly (Fig. 13). Most of the aged people have good memories of their childhood that they were used to bath, swim and even play in the pond. While they were playing it was very common to drink water from the pond itself. Washer women who daily spent about 8-10 hours in the pond also used to drink water from the pond. They said that pond water had such a purity and goodness! They remembered incidents such as bullock cart men who used to rest under the Mango tree drank water from the pond very much.

But after the acquisition of the pond area by the National High way Authority, the pond has been in an abandoned condition and water body became almost stagnant. This has resulted in the accumulated growth of rooted, emerging, submerged and floating types of aquatic plants, mainly weeds. Besides, creepers grown from the bank of the pond including invasive *alien* species such as Mile-a-minute plant (*Mikenia micrantha*) encroached into the surface of the pond, which is already covered with floating plants. This has prevented the penetration of sunlight into deeper layers of the pond, hence the aeration and photosynthetic activities of the bottom layers of the pond has been heavily blocked. Thus currently the water quality has been deteriorated.

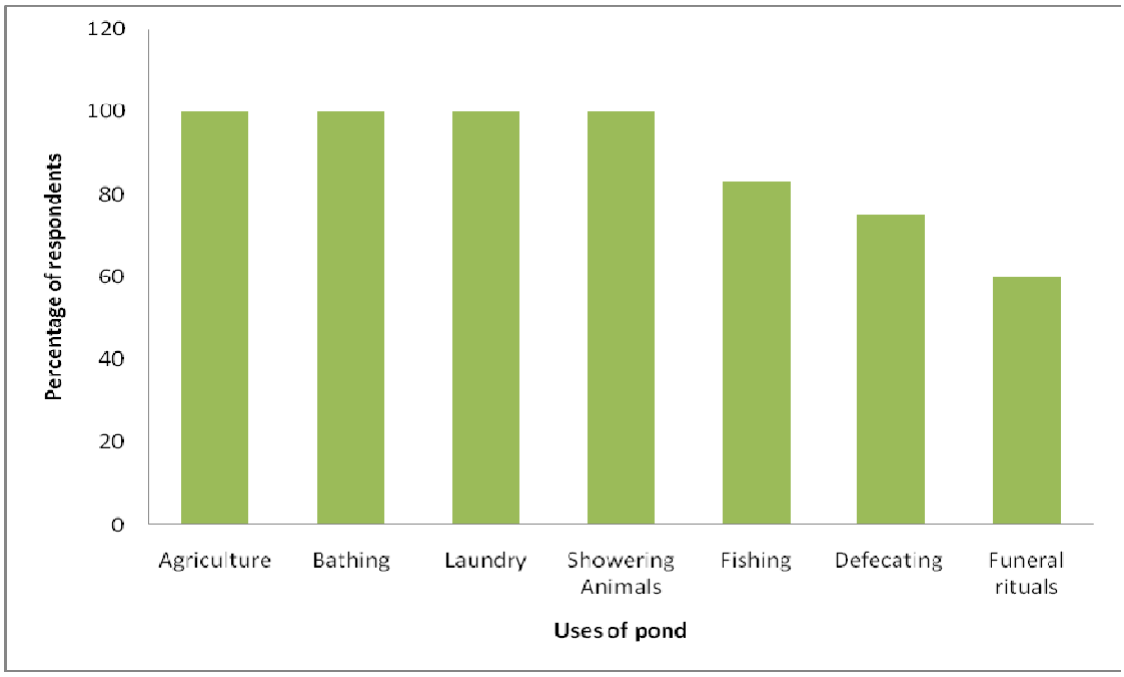


Fig. 13. Pattern of water usage of pond in the past (before 2005)

Sl. No.	Parameter	Sample value I	Sample value II	Permissible limit (WHO standard)
1	pH	8.73	4.4	6.5 – 8.5
2	Turbidity	0.02	0.01	10 NTU
3	Total Hardness	12.0	10.0	300 mg/l as $CaCO_3$
4	Ca^+ ions	6.0	6.0	75 mg/l as Ca^+
5	Mg^+ ions	6.0	4.0	80 mg/l as Mg^+
6	Alkalinity	28.0	8.0	200 mg/l as $CaCO_3$
7	Total iron	0	0	0.3 mg/l as Fe
8	Chloride	40	0	250 mg/l as Cl
9	Fluoride	0	0	1.0 mg/l as F
10	Nitrate	0	0	45 mg/l as NO_3
11	Total Dissolved Solids	80.8	5.89	500 mg/L
12	Sulfate	0	0	200 mg/l as SO_4
13	Total bacterial count/1ml	18	32	0
14	Total coliforms MPN/100ml	2400+	2400+	0
15	Faecal coliforms MPN/100ml	75	150	0
16	*E. coli*	Present	Present	0

Table 9. Water quality test results of Peringamkulam

Collecting water samples for testing

As part of this study water samples were collected from the pond twice, covering a period of two months (January-February 2015) and the results are given in Table 9. The results shows that organic pollution is there mainly due to the decaying materials, but physical and chemical properties are within the standards (Indian and APHA) for open water bodies such as ponds (bathing and swimming purpose). It is well evident that Peringamkulam is potentially enough to have a self cleaning mechanism maintained by the uninterrupted inflow and outflow system, provided the stagnation should be avoided and few aquatic plants should be retained. Absence of serious pollution or dumping of wastes is also noteworthy.

Sharing memories-interviewing an aged resident of Perambra

Mating of a damselfly at the pond premises

3.7 Biodiversity Estimation

Biodiversity indicates the soundness of ecosystem and ecosystem services. The biodiversity in and around the pond is estimated through direct observation and participatory research method. In order to make it more clear, the total biodiversity are categorized separately as biodiversity in the aquatic system and around the pond. For the biodiversity estimation around the pond, the area within 500 m radius from Peringamkulam as centre has taken as study area. Eight transects have been considered for the estimation and, among which three transects are taken towards the western side of the pond, three towards the eastern side of the pond and two along the NH. This estimation gives an overall idea of biodiversity around the Peringamkulam pond. By a general observation and interviews, biodiversity in the aquatic system is identified. It is noticed that overall biodiversity within the study area is moderately rich including in and around the pond.

3.7.1 Biodiversity Status Of The Pond (Water Area & Banks)

Ponds are amongst the most diverse freshwater habitats and support different types of species such as plants, fishes, birds, reptiles, frogs, insects, mammals etc. In the study, we have mainly studied on aquatic plants and fishes in the pond. In ponds plants either grow entirely underwater or partially on the surface. In Peringamkulam, there is an over growth of aquatic algae, and creeper type plants from the pond's edge floated on the water. Though the floated plants are removed from the pond, the plant debris and its seeds remain deposited underneath the water. Therefore, new aquatic plants are started growing in the water and the debris floated in the water. The floras found in the pond are enlisted in Table 10. There was an excessive growth of *Najas graminea*, *Salvinia molesta* and Hairy bean in the pond and some ferns were grown on the wall of the pond. People stated that after changing the position of steps to the pond, flow of water to the outlet has decreased resulting in the contamination of water and growth of algae in the water. Furthermore, the pond has moderately rich varieties of freshwater fish species. The fishes identified are listed in Table 11.

Sl No.	Malayalam Name	Common Name	Scientific Name
1	Mullan payal	Paddy field water nymph	*Najas graminea*
2	African Payal	Salvinia	*Salvinia molesta*
3	Mullan Payal	--	*Najas minor*
4	Sanchipayal	Bladderwort	*Utricularia aurea*
5	Tharavu Payal	Duckweed	*Lemna perpusilla*
6	Kuppa cheera	Alligator weed	*Alternanthera philoxeroides*
7	Cheriya pannal	--	*Cyclosorus interruptus*
8	Yakshipayal, Vellathipannal	Water Fern	*Ceratopteris thalictroides*
9	Azolla	Azolla	*Azolla pinnata*
10	Nalilakodakan	Water clover	*Marsilea minuta*
11	Mullenpayal	Fanwort	*Cabombo caroliniana*
12	Muppadan	Variable flatsedge	*Cyperus difformis*
13	Karimkoovalam	Oval-leafed pondweed	*Monochoria vaginalis*

Table 10. List of flora in the pond

Sl No.	Malayalam Name	Common Name	Scientific Name
1	Poonjan	Malabar Killie	*Aplocheilus lineatus*
2	Varal	Striped Snake head	*Channa striata*
3	Mushi	Valencienne'c clariid	*Clarias dussumieri*
4	Kadu		
5	Paral	Common Rasbora	*Rasbora dandia*
6	Mananjil	Indian Mottled Eel	*Anguilla bengalensis*
7	Andikalli	Climbing Perch	*Anabas testudineus*
8	Karimeen	Pearl Spot	*Etroplus suratensis*
9	Kaari	Stinging catfish	*Clarias batrachus*
10	Karipidi		
11	Aaral	Malabar Loach	*Lepidocephalichthys thermalis*
12	Vaala	Fresh water eel	*Wallago attu*
13	Kaipa	Green Stripe Barb	*Puntius vittatus*
14	Poovalipparal	Black spot Barb	*Puntius filamentosus*
15	Kolan		*Heteropneustes fossilis*
16	Thilopia		*Thilapia mosambica*
17	Pallathi	Orange Chromid	*Etroplus maculatus*

Table 11. List of fishes in the pond

However, majority of survey respondents claimed that the fish diversity in the Peringamkulam decreased significantly compared to the past (Fig. 14). Some people mentioned that a disease affected the fishes in the pond some years back, that is the reason for decline of fishes in the pond.

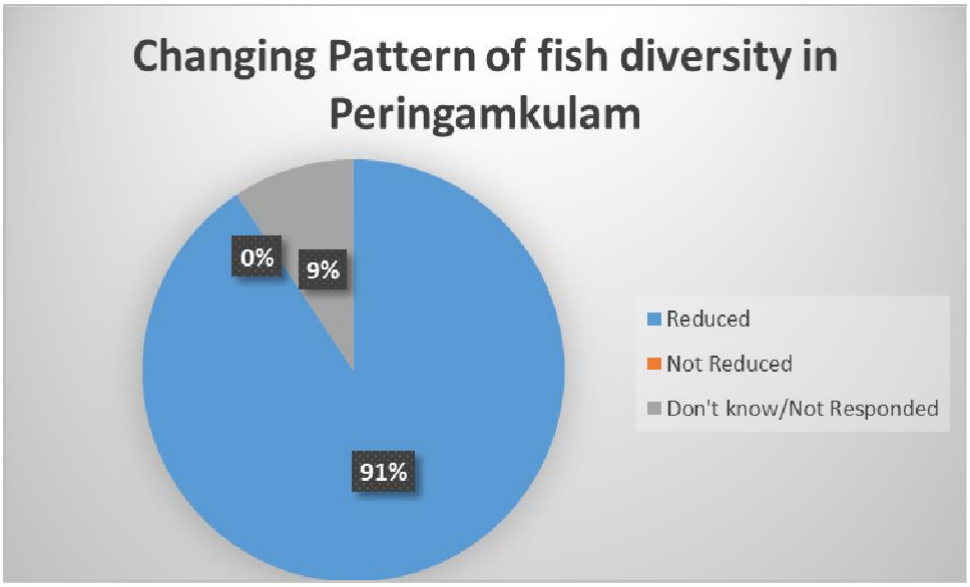


Fig.14. Changing pattern of fish diversity in Peringamkulam

3.7.2 Biodiversity Status Around The Pond

The land use pattern especially cropping pattern around the Peringamkulam was recorded through transect survey and the data is given in Table 12. The area has a moderate human inhabitation and each house has its own home yard agriculture which obeys the typical features of Small Holder Ecosystems (SHE). They are almost self-sufficient with mixed crops, fruit trees, spices *etc*. The conglomeration of such type of ecosystems gives a typical Kerala village appearance to the area. This is of high importance because the NH on one side is representing typical urban characteristics while on the other side a traditional Kerala village still exists. This has both academic and tourism significances.

Through the direct observation, it was recorded that 500 m radius of the pond area is moderately rich in floral diversity, with a predominance of crops (Table 12). A good biodiversity strength and abundance also were noticed in the study area.

Crop lands Area (Approximate)	Location and Ownership	Type
26 cent	Velayudan's land on the northern side of Peringamkulam	Mixed Cropping (Coconut tree, Tapioca, Pepper)
23 cent	Govindan's land on the back of the Peringakulam	Mixed Cropping (Coconut tree, Tapioca, Pepper, Banana)
26 cent	Narayan's Land on the back of the Peringamkulam	Banana Cultivation
55 cent	Kannai Kurian's land near Chiravathoor chira road	Mixed Cultivation (Rice, Banana, and coconut)
10-15 hectare /10-15 acre/ 50 acre Peringapadam	Behind the Peringamkulam, but now 30% of which has reduced.	Rice Cultivation

Table 12. Cropping pattern of the surrounding area of Peringakulam

Malayalam Name	Common Name	*Scientific Name*
1. Vattachoriyannam	Indian Stinging Nettle	*Tragia involucrate*
2. Aanachunda	Turkey Berry	*Solanum torvum*
3. Acacia	Earpod Wattle	*Acacia auriculiformis*
4. African Payal	Salvinia	*Salvinia molesta*
5. Ambazham	Hog plum	*Spondias pinnata*
6. Anathakara	Candile Cassia	*Cassia allata*
7. Arali (pink)	Oleander	*Oleander nerium*
8. Arali (white)	WhiteOleander	*Oleander nerium var. alba*
9. Arayal	Peepal Tree	*Ficus religiosa*
10. Atha Maram	Custard apple	*Anona squamosal*
11. Athi	Cluster Fig	*Ficus racemosa*
12. Avanaku	Castor oil Plant	*Ricinus communis*
13. Badam	Badam	*Terminalia catappa*
14. Illi	Bamboo	*Bambusa sp.*
15. Bougainvilla	Bougainvillae	*Bougainvillea glabra*
16. Chathura payar	Winged bean	*Psophocarpus tetragonolobus*
17. Chembu	Colocasia	*Colocasia esculenta*
18. Chemparathi	Hibiscus	*Hibiscus roosasinensis*
19. Changalam Paranda	Devil's Backbone	*Vitis quadrangularis*
20. Chikku Pazham	Sapodilla	*Manilkara zapota*
21. Chuvana cheera	Velvet curtain	*Amaranthus sp.*
22. Communist Pacha	Eupatorium	*Chromolaena odorata*
23. Croton	Croton	*Codiaeum variegatum*
24. Chemparathi	Hibiscus	*Hibiscus roosasinensis var.*
25. Elumbli puli	Bilimbi	*Averrhoa bilimbi*
26. Erikku	Madar Plant	*Calotropis gigantia*
27. Ethilkanni	Loranthus	*Loranthus falcatus*
28. Euphorbia	Euphorbia	*Euphorbia milii*
29. Ezhillampala	Devil Tree	*Alstonia scholaris*
30. Garuda kodi	Indian Birthwort	*Aristolochia indica*
31. Gramboo	Clove	*Syzygium aromaticum.*
32. Jathi	Nutmeg	*Myristica fragrans*
33. Kadachakka	Bread Fruit	*Artocarpus altilis*
34. Kaithachakka	Pineapple	*Ananas comosus*
35. Kanikonna	Golden shower tree	*Cassia fistula*
36. Kanjiram	Snake wood	*Strychnos psilosperma*
37. Kantharimulaku	Bird’s eye Chilli	*Capsicum annum*
38. Kappa	Tapioca	*Manihot esculenta*
39. Kappalam	Papaya	*Carica papaya*
40. Kara Pazham	Ceylon Olive	*Elaeocarpus serratus*
41. Otiyan maram	Indian Ash Tree	*Lannea coromandelica*
42. Kariveppu	Curry leaves	*Murraya koenigii*
43. Karuva Patta	Cinnamon	*Cinnamomum verum*

44.	Kashumavu	Cashewnut	*Anacardium occidentale*
45.	Kavungu	Arecanut	*Areca catechu*
46.	Kolambi	Yellow bell flower	*Tecoma stans*
47.	Kongini	Lantana	*Lantana camera*
48.	Koonan Pala	Nag kuda	*Tabernaemontana dichotona*
49.	Krishna tulsi	Holly Basil	*Ocimum sanctum*
50.	Kudampuli	Malabar Tamarind	*Garcinia cambogia*
51.	Kumbalam	Winter melon	*Benincasa hispida*
52.	Lakshmi Tharu	Paradise tree	*Simarouba glauca*
53.	Loobika	Red gooseberry	*Flacourtia inermis*
54.	Maavu	Mango tree	*Mangifera indica*
55.	Mahagani	Mahogany	*Swietenia macrophylla*
56.	Mani Maruthu	Giant Crape-myrtle	*Lagerstroemia speciosa*
57.	Manjadi Maram	Red sandalwood	*Adenanthera pavonina*
58.	Mantharam	White orchid tree	*Bauhinia tomentosa*
59.	Mantharam (pink)	Purple Bauhinia	*Bauhinia purpurea*
60.	Marotti	Leathery leaved tree	*Hydnocarpus wightiana*
61.	Maylanchi	Henna	*Lawsonia inermis*
62.	Money Plant	Devils eye	*Epipremnum aureum*
63.	Mulberry	Mulberry	*Morus alba*
64.	Mullan Payal	--	*Cabomba aquatic*
65.	Mullan Payal		*Cabomba caroliniana*
66.	Munja	Arni	*Premna latifolia*
67.	Muringa	Drum stick plant	*Moringa oleifera*
68.	Mussanda	Mussanda	*Mussaenda erythrophylla*
69.	Muyal cheviyan	Cupid's Shaving Brush	*Emilia sonchifolia*
70.	Nagagandhi	Baliospermum	*Baliospermum montanum*
71.	Nalumani chedi	Four o'clock flower	*Mirabilis Jalapa*
72.	Nanthyarvattam	East Indian Rosebay	*Ervatamia coronaria*
73.	Nelli	Goose Berry Tree	*Phyllanthus emblica*
74.	Nilapana	Black musli	*Curculigo orchioides*
75.	Nithyakalyani	Periwinkle	*Vinca rosea*
76.	Njaval	Black Plum	*Syzygium cumini*
77.	Oorpan chedi	Country Rose Mallow	*Urena lobata*
78.	Orchid	--	*Orchidaceae*
79.	Pachacheera	Green Spinach	*Amaranthus hybridus*
80.	Pachamulaku	Green chilly	*Capsicum annuum*
81.	Pada thali	Water spinach	*Ipomea aquatic*
82.	Pana	Palm	*Arecaceae*
83.	Panal	Ban Nimbu	*Glycosmis mauritiana*
84.	Pani koorka	Coleus	*Coleus aromaticus*
85.	Panineer Chamba	Wild Jambua	*Syzygium occidentale*
86.	Panji maram	Cotton tree	*Gossypium hirsutum*

87.	Pannal chedi	Fern	*Adiantum Capillus – Veneris*
88.	Parpadakapullu	--	*Mollugo pentaphylla*
89.	KattuPeechilinga	Bitter luffa	*Luffa acutangula*
90.	Pera	Guava	*Psidium gavjava*
91.	Pine trees (exotic)	--	-
92.	Plavu	Jackfruit tree	*Artocarpus heterophyllus*
93.	Pongalyam	Putranjiva	*Putranjiva roxburghii*
94.	Poovan kuruthal	Little	*Cyanthillium cinereum*
95.	Poovarashu	Portia Tree	*Thespesia populnea*
96.	Pothapullu	Potha grass	*Themeda cymbaria Hack*
97.	Peringalam	Clerodendrum	*Clerodendrum viscosum Vent*
98.	Rosa	Rose	*Rosa sp.*
99.	Shathavari	Wild asparagus	*Asparagus recemosus*
100.	Sarvasuganthi	Allspice	*Pimenta dioica*
101.	Seemakonna	Mata Ratón;	*Gliricidia sepium*
102.	Seetha Pazham	Custard apple	*Annona squamosal*
103.	Shangupushpam	Butterfly pea	*Clitoria ternalea*
104.	Shavamnari	Madagaskar periwinkle	*Vinca rosea*
105.	Sooryakanthi	Sunflower	*Helianthus annuus*
106.	Thazhutham	Punarnava	*Boerhaavia diffusa*
107.	Theerakam	Brahma's Banyan	Ficus exasperate
108.	Thekku	Teak	*Tectona grandis*
109.	Thengu	Coconut tree	*Cocos nucifera*
110.	Thondi	Indian gum tragacanth	Sterculia urens
111.	Thotta Payar	Hairy bean	Mucuna bracteata
112.	Thottavadi	Touch me not	*Mymosa pudica*
113.	Thumba	Lucas	Leucas aspera
114.	Vadamulla	Gobe Amaranth	Gomphrena globosa
115.	Vaka	Gulmohar	*Quercus*
116.	Valanpuli	Tamarind	Tamarindus indicus
117.	Valari Payar	Cow Pea	Vigna sinensis
118.	Valli mulla	Jasmine	Jasminum officinale
119.	Varakan pullu	-	-
120.	Vatha Kodi	Fox grape	Cayratia trifolia
121.	Vatta	Gum plant	*Macaranga peltata*
122.	Vayal chulli	Indian hygrophila	Hygrophila auriculata
123.	Vazha	Banana	*Musa sp.*
124.	Vazhachedi	Heliconia	Heliconis sp
125.	Vazhuthana	Brinjal	*Solanum melongena*
126.	Vella Chethi	Ixora	Ixora coxiana var.
127.	Veluthulli chedi	--	Bignonia violacea
128.	Grape Glory	--	Merremia vitifolia

Table 13. List of flora in the surrounding area of pond

Similarly, wide varieties of fauna are also observed in study area. Being a short-term study main focus was on birds, butterflies, dragonfly and damselflies, reptiles, amphibians and mammals. The diversity and abundance of fauna around the Peringakulam pond is moderately rich and rare species are also observed in the study area (Table 14).

BIRDS			
Sl.No.	**Malayalam Name**	**Common Name**	***Scientific Name***
1	Chenkanni Thithiri	Red-Wattled Lapwing	*Vanellus indicus*
2	Kalimundi	Cattle Egret	*Bubulcus ibis*
3	Chayamundi	Purple Heron	*Ardea purpurea*
4	Cheriya Neerkakka	Little Cormorant	*Phalacrocorax niger*
5	Kula Kokku	Indian Pond Heron	*Ardeola grayii*
6	Uppan/Chembothu	Lesser Coucal	*Centropus sinenis*
7	Perumundi	Great Egret	*Ardea alba*
8	Cherumundi	Median Egret	*Mesophoyx intermedia*
9	Penakakka	House crow	*Corvus splendens*
10	Chinnamundi	Little Egret	*Egretta garzetta*
11	Kuyil	Koel	*Eudynamys scolopacea*
12	Cheriya meenkothi	Common King Fisher	*Alcedo atthis*
13	Valiyavelithatha	Blue -tailed Bee-eater	*Merops philippinus*
14	Neerkkada	Common Sandpiper	*Actitis hypoleucos*
15	Valiya Erattavalan	Greater Racket- Tailed Drongo	*Dicrurus paradiseus*
16	Ponman	White Breasted Kingfisher	*Halcyon smyrnensis*
17	Madatha	Common Myna	*Acridotheres tristis*
18	Mannathikili	Magpie Robbin	*Copsychus saularis*
19	Kuruvi	House sparrow	*Passer domesticus*
20	Puthangiri	Large Grey Babbler	*Turdoides malcolmi*
21	Thoppi kili	Red whiskered Bulbul	*Pycnonotus jocosus*
BUTTERFLIES			
Sl.No.	**Malayalam Name**	**Common Name**	***Scientific Name***
1	Pottuvellatti	Psyche	*Leptosia nina*
2	Manjathakaramuthi	Common Emigrant	*Catopsilia pomona*
3	Thakaramuthi	Mottled Emigrant	*Catopsilia pyranthe*
4	Manjapappathi	Common Grass Yellow	*Eurema hecabe*
5	Chocolate albatross	Chocolate albatross	*Appias tyncida*
6	Panchanethri	Common five ring	*Ypthima baldus*
7	Theechirakan	Tawny Caster	*Acreaea violae*
8	Thavidan	Common Brush Brown	*Mycalesis perseus*
9	Chakkarashalabham	Crimson Rose	*Pachilopta hector*
10	Natturose	Common rose	*Pachilopta aristolochiae*

11	Viravaalan	Tailed Jay	*Graphium agamemnon*
12	Marotti Shalabham	Tamil Yeoman	*Cirrochroa thais*
13	Ponthachuttan	Common Sailor	*Neptis hylas*
14	Aavanachoppan	Common castor	*Ricinus communis*
15	Vanachottashalabham	Great Egg fly	*Hypolimnas bolina*
16	Erikkuthappi	Plain Tiger	*Danaus chrysippus*
17	Varayankaduva	Striped Tiger	*Danaus genutia*
18	Aralishalabham	Common Indian crow	*Euploea core*
19	Neelakaduva	Blue Tiger	*Tirumala limniace*
Dragonflies and Damselflies			
Sl.No.	**Malayalam Name**	**Common Name**	***Scientific Name***
1	Changathi Thumbi	Asian Groundling	*Brachythemis contaminate*
2	Swami thumbi	Blackspot Widow	*Neurothemis tullia*
3	Chendhavidan vyali	Red- faced Skimmer	*Orthetrum Chrysis*
4	Cheru venneran	Sombre Lieutenant	*Brachydiplax sobrina*
5	Onathumbi	Global Wanderers	*Pantala flavescens*
6	Mathil Thumbi	Indian Rockdweller	*Bradinopyga geminata*
7	Thavittu Venneeran	Blue Dasher	*Brachydiplax chalybea*
8	Vayal thumbi	Oriental Scarlet	*Crocothemis servilia*
9	Chuttinilathan	Black-tipped Percher	*Diplacodes nebulosa*
10	Pacha vyali	Green Skimmer	*Orthetrum*
11	Shalabhathumbi	Common Picture Wing	*Rhyothemis*
12	Karimban thumbi	Black – Marsh Trotter	*Tramea limbata*
13	Pavizhavalan	White Burned Buskhawk	*Tholymis tillarga*
14	Pulthurumban	Paddy field parasol	*Neurothemis intermedia*
15	Nattu Nilathan	Ground Skimmer	*Diplacodes*
16	Cheriya thanal thumbi	Clear-winged Flash Wing	*Vestalis gracilis*
17	Theekarimuthan	Elusive Adjutant	*Aethriamanta brevipennis*
18	Nattu Chathuppan	Yellow wax-tail	*Ceriagrion coromandelianum*
MAMMALS			
1	Kadavaval	Indian Fying Fox	*Pteropus giganteus*
2	Valiya kurumookkan Narichir	Greater Short-nosed Fruit Bat	*Cynopterus sphinx*
3	Narichil	Lesser False Vampire Bat	*Megaderma spasma*
4	Narichil	Indian Pipistrelle	*Pipistrellus coromanda*
5	Narichil	Indian Pigmy Bat	*Pipistrellus tenius*
6	Annaan	Three-striped Pam Squirrel	*Funambulus palmarum*
7	Peruchazi	Lesser Bandicoot Rat	*Bandicota bengalensis*
8	Panniyeli	Large Bandicoot Rat	*Bandicota indica*

AMBHIBIANS			
1	Pachathavala	Green Pond Frog	*Euphlyctis hexadactylus*
2	Kuttathi thavala	Skittering Frog	*Euplyctis cyanophlyctis*
3	Chorithavala	Common Indian Toad	*Duttaphrynus melanostictus*
4	Varayan Thavala	Indian Bull Frog	*Hoplobatrachus tigerinus*
5	--	Golden Frog	*Hylarana aurantica*
6	Marathavala	Common Tree Frog	*Polypedates maculatus*
7	--	Kanibush Frog	*Pseudophilatus kani*
REPTILES			
1	Chera	Rat Snake	*Ptyas mucosa*
2	Neerkkoli	Checkered Keelback	*Xenochrophis piscator*
3	Moorkhan	Spectacled Cobra	*Naja naja*
4	Karaama	Indian Black Turtle	*Melanochelys trijuga*
5	Onthu	Oriental Garden Lizard	*Calotes versicolor*
6	Pacha onthu	Southern Green Calotes	*Calotes calotes*
7	Arana	Common or Brahminy Skink	*Mabuya carinata*

Table 14. List of fauna in and around the Peringakulam pond

3.8 Environmental Threats And Reasons For The Destruction Of The Pond

In Kerala, unfortunately water bodies are nowadays considered as the best place to release sewage and dump solid wastes. The abandonment of water bodies and development as a waste dumping site happens simultaneously. If the water body is on the sides of a road, people will make it as a habit to throw their household wastes into it. There are lot of reports available on such types of waste dumping including that of slaughter house wastes. However, Peringamkulam is saved from such a habit of the passerby community, till this time. The pond area has minor pollution only and as evidence during the cleaning drive little quantity of plastic bags and bottles have removed. The local community plays a vital role in protecting the pond from waste dumping. However the water quality of the pond is found deteriorated mainly due to the stagnation of water and clogging of weeds.

According to the surveyed people, the major environmental threats associated with Peringamkulam pond are pollution due to stagnation, algal growth, water quality degradation and biodiversity loss (Fig. 15).

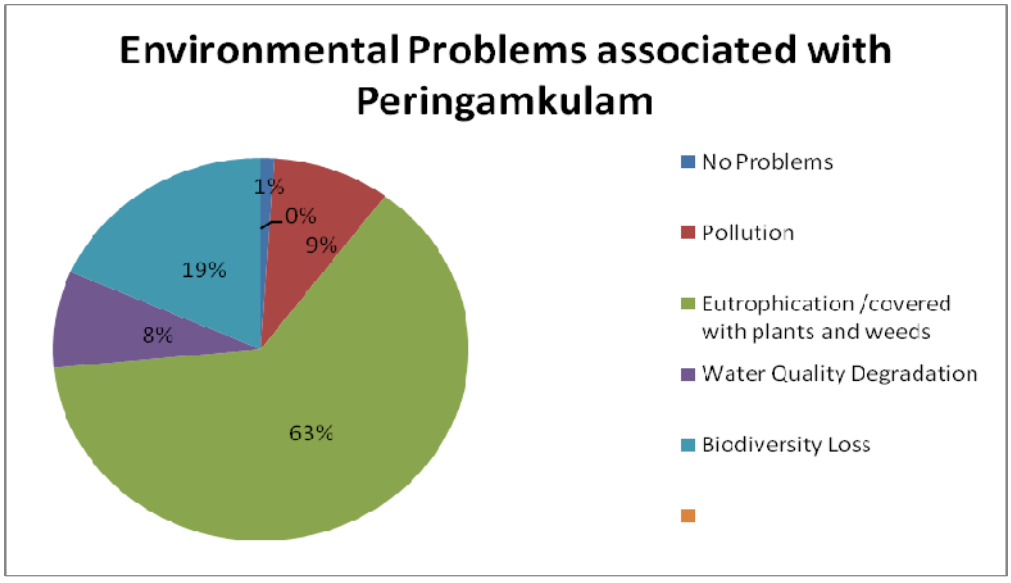


Fig.15. Environmental threats of Peringamkulam

In case of pollution, the major pollutants found in and around the Peringamkulam pond are plastics, slaughtering wastes and other wastes such as rubber sandals, food wastes, construction wastes *etc* (Fig. 16). People claimed that there is no sewage discharge in the pond but vehicular passengers throw wastes into the pond as the pond is already covered by algal and weed growth. However, pollution is not a noticeable problem in Peringamkulam pond like the weed and aquatic plant growth.

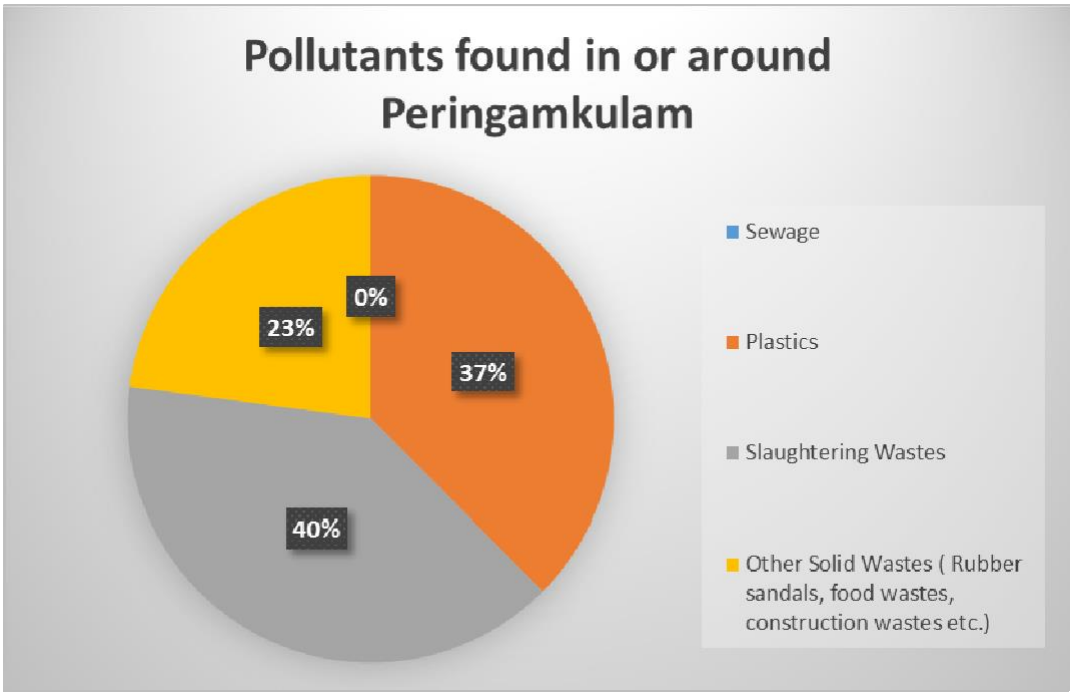


Fig. 16 Major Pollutants of Peringamkulam

According to the community people the reasons for the destruction of Peringamkulam pond are side belt construction, change in the position of steps towards the pond, and construction national highway. During the NH construction (2005 – 2011), loads of soil and wastes were dumped into the pond that has contributed to the destruction of the pond severely. Construction of national highway also reduced people's access to the pond as crossing the road became difficult for them. Local community stopped using the pond since 2005, so the water movement in the pond reduced significantly that leads to the growth of algae in the water. Moreover, change in the position of steps to the pond and reducing the size of the sprout has decreased the flow of contaminated water to the outside of the pond, resulting in pollution and growth of weeds.

Some people also mention that destruction of water resources is a consequence of agricultural loss. When farmers and community are benefitted from ponds in cultivation for irrigation and water storage for long term, people take initiative to protect them. It was a natural give and take process; however, the process is destructed with the lack of agricultural activities. On the other hand, the facilities at the home have increased as a result people stopped using the pond, which has resulted in increased weed growth in the pond. Apart from this, a disease affected to the fishes in the pond in 2005, so most of the people stopped using the pond water.

3.8.1. NH 47 AND PERINGAMKULAM POND

The passage of National Highway 47 on the eastern side of the pond is highly influencing the ecology of the pond. The acquisition of the pond by the NH authority is recorded as the principal reason for the abandonment of pond from public use. Still a one metre wide service area remains inside the pond area where now the debris deposited. The expansion and activities happening with NH will have definite influence on the pond and its surroundings.

NH has a very heavy traffic now itself, and it is increasing day by day. The data available with Guruvayoor Infrastructure Private Limited who are responsible for the toll collection at the Paliakkara toll gate, Ollur, Thrissur (about 15 km. from Peringamkulam) showed that on an average more than 35000 - 40000 vehicles ply through the road a day (24 hour period), excluding two wheelers. Out of this 25,000 vehicles are towards Thrissur and 15,000 vehicles are towards Chalakudy. Of the 40,000 vehicles, 60% comprises of cars and the other 40 % comprises of trucks, Light Commercial Vehicles (LCV) and Buses. Two wheelers are not included. The night traffic is also tight but with less cars (only 12 % of total 60% cars) and buses, LCV and more trucks. Day time is dominated with 48% of total 60% cars, but trucks are very less.

The heavy traffic of the NH is a hindrance for the access to the Peringamkulam, especially those who reside on the eastern side of the road. A lot of accidents are also reported in this region (Suraj, A. V. 2015). More sign boards and Zebra crossings with humps should be implemented here to avoid further accidents.

The heavy traffic through the road reiterates the scope of the Peringamkulam Way-side tourism project. Significant percent of vehicles plying through NH are cars during day time, hence the spot will be attractive for families as an interim halting spot. However, lack of parking area will be a problem for such a development.

Public meeting of Peringamkulam residents

3.8.2. ENVIRONMENTAL AWARENESS SURVEY

An additional survey was conducted among various stakeholder groups in order to understand their level of environmental knowledge and the scope of proposed Peringamkulam way side ecotourism project. A total of 50 respondents (25 males and 25 females) from different walk of life and representing various stakeholder communities were interviewed with a structured survey sheet. The aim of the survey is to develop a baseline data on the environmental awareness of the local community before the implementation of the Peringamkulam Ecotourism Project.

Categories		Percentage (%)
Survey Respondents	Male	50
	Female	50
Age	20 – 40	30
	41 – 60	44
	61 – 80	14
	81 – 100	12
Education	Below SSLC	38
	SSLC	24
	Plus Two	18
	Diploma	6
	Graduate	14
	Post Graduate	0
Employment	Apollo Employee	4
	Farmer / Cattle Raising	22
	Government Job/ Private Job	10
	Business	4
	Skilled Labour	18
	House wife	20
	Senior citizen	10
	Others	12

Table16. Demography of the surveyed community for Environmental Awareness

A set of questions asked to the community in order to measure their level of understanding and it is represented as percent of community surveyed. The meaning of the word 'Environment' is clearly known to 46% of the community now (Table 17).

"Environment" means :	Percentage (%)
Pollution in villages & cities	4
Green landscapes	14
The quality of surrounding which we are living	46
Nature Conservation	18
None of these	14
Don't know	4

Table 17

Environmental Problem	Percentage (%)
Loss of Agricultural crops	32
Mobile Tower Radiation	2
Water Shortage	24
Air Pollution	6
Increasing Wastes	8
Water Clogging in yards (due to filling of natural canals and streams)	6
Water Pollution	4
Filling of paddy fields for Construction	6
Destruction of Water Sources	4
Damage of Coconut trees	8
Don't know	20

Table 18

Are all natural resources are replenish able?	Percentage (%)
Yes	86
No	8
Don't Know	6

Table 19

Do ponds play a crucial role in maintaining ground water?	Percentage (%)
Yes	96
No	0
Don't know	4

Table **20**

In which of these you belong to?	Percentage (%)
I protect environment and I get its advantages	62
I protect environment, but the advantages are lessen as others are not doing the same.	16
I like to protect environment, but it is often time consuming and expensive.	6
I would like to protect environment, but do not know what to do.	16

Table 21

Shortage of water?	Percentage (%)
Yes	50
No	48
Don't Know	2

Table 22

The topics familiar to you?	Percentage (%)
Climate Change	30
Natural hazards (Earth Quake, Flood etc)	30
Human made disasters (Oil Spill, Industrial Accidents etc.)	22
Biodiversity Loss	30
Water Pollution	86
Air pollution	36
Agricultural Pollution	44
Genetically modified food	18
Increased use of chemical products in daily life and ill effects	18
Increasing amount of wastes including plastics and ill effects	64
Destruction of natural resources	32
Fast food and health problems	20
I know all of these	12
I do not know any of these	6

Table 23

About 24% of respondents seems water shortage as the major environmental issue they are facing (Table 18). However, 86% believe that all natural resources are capable of replenishing automatically whatever we do (Table 19). Interestingly 96% of surveyed community strongly believe that ponds and other surface water resources are necessary for recharging open wells and ground water resources (Table 20). 62% of respondents

claimed that they are leading a life style that protects environment and getting benefits out of that also (Table 21). The 50% of respondents have acute shortage of water during summer seasons (Table 22). Among the various topics related to environment 86% are familiar with water pollution, 64% of waste management issues especially of plastics and 44% of agricultural pollution especially of pesticides and other poisons (Table 23).

Among these responses it can estimated that the environmental awareness level of the community is on an average at 50%. This is almost at par with state average (State of the Environment, KSCSTE, 2013), but comparing the general literacy rate this has to be improved a lot. The proposed Peringamkulam conservation and Responsible Tourism project will surely change this status, not only among the local community but also with the visiting community as the environmental awareness programmes and practices are part and parcel of the project.

3.8.3. Stakeholder And Community Response To The Proposed Project: Peringamkulam Responsible Tourism Project

The concept and framework of the proposed project on the Conservation and Responsible Tourism at Peringamkulam was briefly presented before various stakeholder group meetings held as part of PRA programme. The PRA Meetings were conducted in five groups. The PRA meeting for the Panchayat officials were conducted at the Panchayat conference hall and about 15 members including Panchayat Secretary, Ward Members and CDS Members attended the meeting. The PRA Meeting for Kudumbasree were conducted near Marathampilly pond at a paddy field during their lunch break, and more than 20 people participated in the meeting. The PRA Meeting for the general public was arranged at SNDP Hall at Peringakulam and above 30 people attended the meeting. Farmer's and Traditional Washer Community meetings were arranged at the houses of one stakeholder member. About 15 farmers and more than 5 traditional washer community members attended the meeting. An overwhelming positive response was observed in all meetings and everybody offered full support to the implementation of the project.

The following suggestions were raised by various groups:

1. The traditional usage pattern of the local community with ponds should be conserved. The tractor passage to the paddy fields on the western sides through the sides of the pond shall be remained.
2. The sides of the pond should be reconstructed and the current bathing ghat should be removed from there and shifted to both sides of the outlet canal.
3. The pond premises should be made beautiful.
4. The water should be kept clean. Bathing and swimming for children should be allowed.
5. Toilet, dress changing rooms should be made.
6. Apollo should implement the project, and then only it will be maintained properly.
7. Secretary, Kodakara Grama Panchayath and few other community members raised apprehensions over the maintenance of the project, but the Governance plan and self-sustainable mechanisms suggested, clarified their doubts.

Public meeting of Peringamkulam residents

4. CONCLUSIONS

- Peringamkulam has a history of more than 200 years. Exact origin is not known. It is believed that the pond was constructed during the reign of Sakthan Thampuran (1751 – 1805)
- There are lot of stories regarding the origin of the pond and etiology of its name 'Peringamkulam'. But anything is not conclusive.
- During 30-50 years back, the pond was a beautiful spot with lot of Mango trees on eastern side and pristine water. But with the acquisition of pond by NH authority, part of the pond was dumped with debris and mango trees were cut.
- Peringamkulam supported livelihood of local community in many ways such as cattle rearing, laundry, fishing and agriculture.
- There were seven major types of uses for the pond in the past such as agriculture, bathing, laundry, showering animals, fishing, defecation and washing, and performing funeral rituals. But after the NH acquisition only two livelihoods sustained (that too in very limited manner)- agriculture and fishing (angling alone)
- The main beneficiaries of the pond in the past were local community, Sabarimala pilgrims, truck drivers, and tourists whereas currently a few of local community alone.
- There are a total of 42 ponds (including Peringamkulam), 6 bunds and 9 rivulets recorded in Kodakara Grama Panchayath (2009). However 40% of such water bodies are only in good condition and now very few are protected. Peringamkulam was recorded as polluted and abandoned.
- Originally pond has an area of 59.97 cents as per the records of Kodakara Village office. NH authority acquired a total of 17.27 cents and now 42.70 cents only remaining. However the survey done by the study team on 24.1.2015 showed that 46.89 cents of land is there now (excluding one meter wide service line area of NH, which is not yet demarked). The water filled area of the pond occupies 28.99 cents.
- The average depth of the pond is 1.2 m. and maximum depth is 3m. The height of the summer water column is 1 m.
- The total amount of clay and sand available in the pond is 1683.84 m^3. The community members insisted that the pond has almost same water level during both summer and rainy seasons. 73% of surveyed community members argued that even in extreme summer, at least one foot depth of water will be there.

- Community survey showed that the water quality of the pond was excellent, even potable, till recently. After the acquisition of the pond by NH authority, due to the stagnation, weed infestation and pollution, water quality has been significantly reduced. However, the current testing of water quality showed biological pollution alone (high coliform content)
- Biodiversity status of the pond and its bank showed that the area has 13 species of aquatic plants and 17 species of fishes.
- Biodiversity status of the surrounding area (500 m radius) of the pond showed that small holder ecosystems with typical crop diversity of Kerala is the predominant land use pattern existing. This has created a typical village atmosphere all around the region except eastern side, where the NH-47 plies.
- A total of 128 plants, 21 birds, 19 butterflies, 18 dragonflies and damselflies, 8 species of mammals, 7 amphibians, and 6 reptiles are recorded from this area through taxonomic survey.
- The analysis of environmental threats of Peringamkulam showed that relatively less pollution exists due to direct anthropogenic causes. Survey respondents commented problems such as eutrophication and weed infestation, and related stagnation as the major issues. The pollution due to stagnation is evident from the water quality studies too.
- NH-47 has significant influence on the ecology and sociology of Peringamkulam. On an average 30000 – 40000 vehicles are plying through NH-47 during 24-hour period. Hence the accessibility to the pond for local residents of the eastern side of the road is limited and risky. The high toll of accidents is an evidence for this fact.
- More sign boards, Zebra crossings and signalled humps are needed on the location in order to reduce accidents.
- The high rate of traffic especially cars (families) reiterate the tourism potential of the proposed project. But a separate space should be find and allocated for vehicle parking.
- Environmental awareness survey revealed that the community has an average awareness level of 50% (i.e., 50% of the community has the knowledge on basic environmental principles and problems). The proposed project definitely will improve the status.
- The local community and all stakeholder groups welcomed the proposal to make the venue as a responsible tourism destination. They suggested that the implementation should be under the aegis of Apollo Tyres.

5. Proposal For Peringamkulam Conservation And Sustainable Development: Peringamkulam Way-Side Ecotourism Project

5.1. Background

Peringamkulam is an ancient pond in Kodakara Grama Panchyath, Thrissur, Kerala. Till recent years, local people used it regularly for bathing, swimming, playing in water by children, washing clothes, and the water used for agricultural activities in the neighboring crop lands. Besides, travelers especially pedestrians and those who drove bullock carts enjoyed the pond premises as a resting place and refreshed with a bathing in the pond. With the adoption of a key portion of the pond by the National Highway authority for the construction of NH-47 in 2006, the pond was heavily deposited with debris and other wastes on the roadside area. This has been the beginning of destruction of the pond and eventually people abandoned the pond from their daily use. This has led to the total neglect of the pond and weeds infested the area. But even in such a dilapidated condition the water level of the pond remained almost same throughout the year, without flood in rainy season and not drying in summer season, keeping its perennial nature.

As part of biodiversity enhancement and ecological restoration programmes of Apollo Tyre Foundation, a revival programme has been started in November 2014 with a simple but grand inauguration and a week-long cleaning drive involving *NREGS* workers of the area. Local people supported the venture wholeheartedly catalyzed by their nostalgic feelings. After the initial cleaning drive ATF proposed a detailed study to analyze various ecological and cultural roles played by the Pond and to propose a full-fledged plan to make the pond as a model for conservation of traditional water resources in a participatory manner and develop the location as an environmental education centre. ATF assigned the task to Tropical Institute of Ecological Sciences (TIES) and TIES conducted extensive studies covering various ecological, cultural and social aspects. The study revealed that local community is very much attached to the pond and their lone wish is to re-establish the pond to its original legacy and beauty. A way side eco-tourism plan was discussed widely and gets shaped through PRA exercise.

Scientific studies were conducted to keep the ecological significance of the pond and developed detailed plan including civil constructions and biodiversity conservation programmes. Thus the present proposal is developed.

5.2. AIM

To conserve Peringamkulam as a sustainable model for conservation of natural resources and develop as a Way-side Responsible tourism spot participating local community

5.3. OBJECTIVES

- To conserve the pond as a sustainable model for conserving natural resources especially surface water resources and local biodiversity, ensuring all its traditional uses
- To develop the location as a way-side responsible eco-tourism spot with community participation
- To promote the pond as an environmental education hub for natural resource management and sustainable life style practices

5.4. PROPOSALS

The proposals are developed imbibing the principles of sustainable development, minimizing the resource utilization, ensuring sustainability with least energy inputs and low maintenance cost (natures' way!!) and benefitting local community at large and catering a larger community with natural rustic experiences.

Pond Conservation: Cleaning and maintaining water quality; conserving aquatic and neighbouring terrestrial biodiversity; waste management provisions; renewable energy resources (solar lamps, biogas *etc*.); bathing, swimming provisions; retaining provisions of water usage for agricultural purposes; and ensuring self-maintenance of water quantity and quality.

Way-side Responsible Tourism Spot: Participatory and without harming pond environment in any manner, but conserving local biodiversity, culture, and social needs. Empowering local women (social and economic upliftment), conserving traditional foods and folk knowledge through value additions; model for waste management at public places.

Environmental education centre: The location will function as a centre for environmental education holding formal and informal programmes. Information boards, pamphlets available at the stalls and recorded announcements will serve as informal education tools. Occasionally seminars or workshops will be conducted, especially in connection with day celebrations (World water day; World Environment day *etc*.).

Schedule of activities Proposed

- Availing required permissions and sanctions
- Cleaning pond –removing clay and silt
- Landscaping pond and its surroundings- pavement areas; gardens; lawns etc.
- Civil works- construction of proposed structures (including electrical and plumbing works)
- Starting of food stalls, care taker taking charge; starting of book lending library
- Inauguration and opening for the public

A. Conservation of Pond and the local biodiversity

i. Pond conservation and improvement of water quality

The pond should be conserved as a model for conservation of traditional natural resource, especially rain water harvesting system of rural Kerala. The full available area of water surface should be retained. The clay and silt shall be removed and sand will be retained. The outlet from the pond shall be widened little more ensuring the continuous flow throughout the year. The shifting of bathing ghat to both sides of the outlet canal will improve the flow of water which will keep the circulation uninterruptedly. The fountain- heads (springs) on the eastern side of the pond should be activated through clearing the debris and paving with granite logs interspersed in a buffalo-grass lawn. Thus the inlet and outlets become alive and water flow is ensured. Additionally, the activities such as bathing and swimming will enable water movements greatly. This will prevent the growth algae, weeds and other aquatic plants, in abundance. Plants such as Fanwort (*Cabombo caroliniana* – Mullan Payal [Mal.]) shall be retained to an extent because they are good for not only cleaning the water but maintaining it thus too (they

will grow only in areas where not much water movements area there; so they will be confined to corners alone, as most of the other areas will be of swimming and bathing activities). Further, 2-3 Vetiver floats will be launched to clean the water biologically (Phytoremediation- cleaning water using plants; vetiver root system is potential to absorb pollutants including heavy metals and antimicrobial in action). These measures will keep the water clean and rejuvenate the original condition of the Peringamkulam pond (even potable!).

Regular checking of water quality will be done and remedial measures will be under taken, if necessary.

In order to conserve the local biodiversity, representative flora of the locality will be planted around the pond as gardens. This will also function as a butterfly garden. More fruit and nectarine trees will be planted as a belt on eastern and northern side of the pond which will gradually attract birds to the locality. In order to improve the public care and attention to biodiversity, sign boards showing the taxonomical names, peculiarities and importance of plants and animals will be placed.

ii. Physical Protection and infrastructure improvement

The pond and its adjoining area will be developed as a local tourism destination and as a model for responsible tourism. Hence, civil works should be carried out in order to improve protection of the pond, safety of the interactive community and make aesthetically appealing.

a. Design Strategies and Proposals

An environment-friendly approach is adopted to recreate the natural and healthy habitat that Peringamkulam had once. The proposed features are enlisted below (see the sketches also – Fig. 17 and 18).

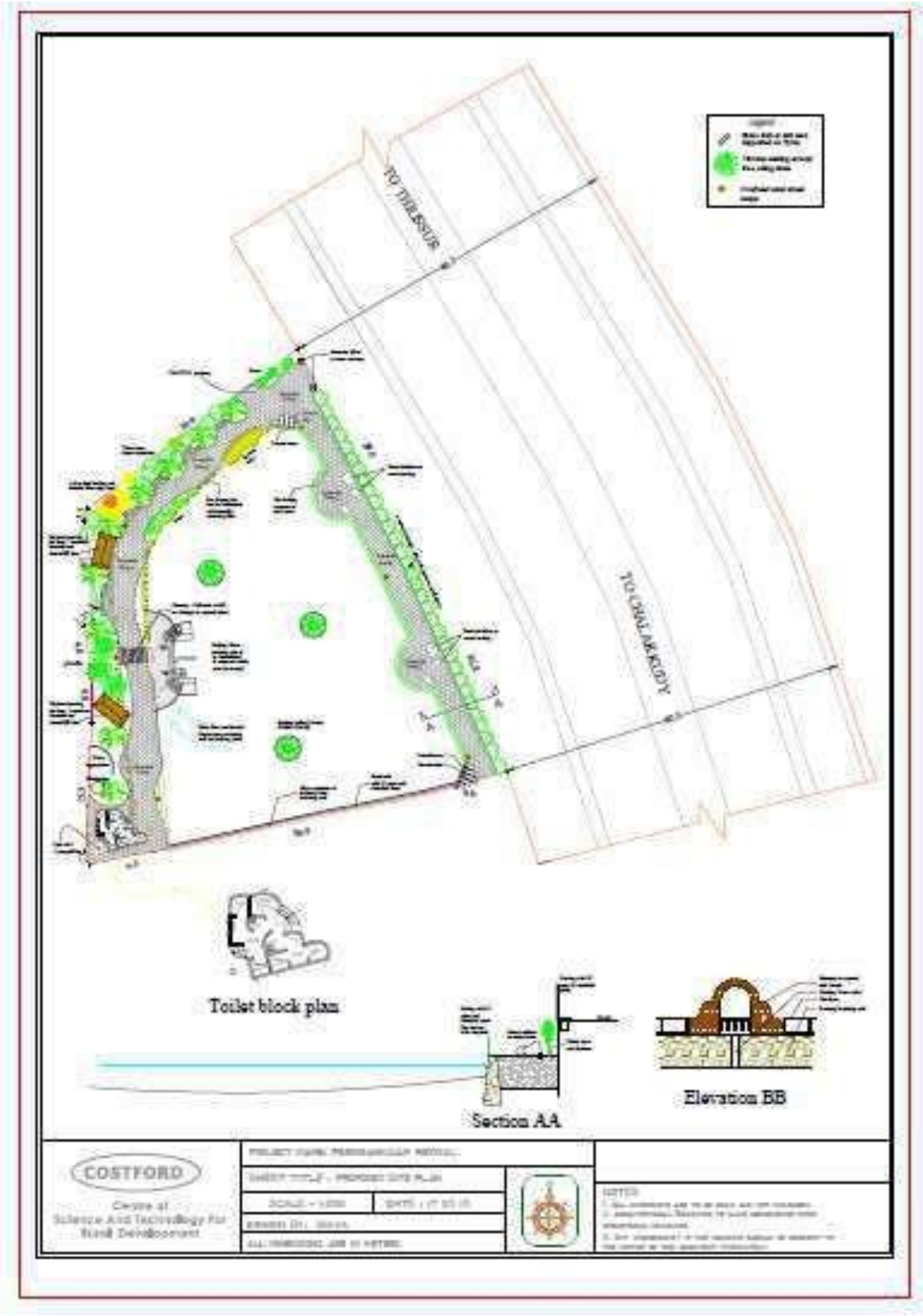
- **Entrance pillars**

Two entrance pillars are proposed at the north east edge of the site. These shall act as a gateway and a landmark for Peringamkulam.

These could be built in stone masonry to retain the earthen feel of the place.

Fig.17. Peringamkulam pond after rejuvenation (artist's imagination)

Fig. 18. Design features of Peringakulam pond



- **Pavements**

It is proposed to provide permeable interlocking pavers for the pathways. Buffalo grass would be grown within the voids. This system would allow the percolation of rain water through to the soil below and thus reduce run offs.

- **Laterite arch**

It is proposed to construct an arch in Dark laterite masonry which shall act as a landmark for the pond complex. The 'Peringamkulam' name can be inscribed on this arch. The arch would be located above the existing water outlet opening. A bridge is proposed over the existing water channel. It would be a see through bridge made by using MS bars, enabling the visitors to see the water move from the pond to the fields.

- **Built in Seats**

Two types of built in seats are proposed.

- Seats with stone slabs, supported on used tyres.
- Circular seats made from stone, surrounding a tree trunk.

- **Signage for environmental awareness**

Signages are proposed to be installed along the pathways, to inculcate a sense of responsibility in the citizens. The importance of water bodies for wildlife as well as people could be stressed upon.

These signages could be combined with the built in seats, thus serving a dual purpose as a shade.

- **Sheltered Seating**

Two sheltered seating areas are proposed, towards the Paddy field side. These could be made using Bamboo and thatch. They would provide for covered shelters during rains.

- **Boulders for seating**

It is proposed to place natural boulders on the pathway along the highway in a scattered manner to create a feel of being among nature. These would serve as casual seats for visitors' chats.

- **Bathing Ghats**

It is proposed to construct two bathing ghats, for men and women respectively. These would be at the left side of the existing Bathing ghat area, one on each side of the water outlet from the pond, enabling free flow of water outwards and owing to the inherent

sand content in the pond bed. The existing bathing ghat shall be demolished and the retrieved rubble shall be reused for the new bathing ghats.

The ghat would be placed at a 2m offset from the existing retaining wall. This gap would act to direct the water towards the outlet, thus preventing stagnation and collection of floating debris.

- **Viewing Platforms**

Two viewing platforms are proposed at the two corners of the pond along the Highway side. These would require simple construction using Pre cast Beams and slabs. Owing to their position on the pond, the view would attract visitors.

- **Pathway extension**

A pathway is proposed along the southern edge of the pond. This will create a continuous walkway around the pond.

- **Bamboo rafts with Vetiver**

Rafts made of bamboo are proposed which would be afloat on the pond. These would be filled with fertile soil on which *Ramacham* (*Vetiveria zizanioides*) grass would be grown. The strong roots of this Grass firmly bond with the bamboo. These rafts would appear as tiny green islands and also serve as breeding grounds for fishes etc. Besides, it will help to purify the water of the pond because of the phytoremediation properties of the plant.

- **Bio-fencing**

Bio-fencing on the back side of the pond would give a serene ambience and aesthetic appeal to the environment. Creepers grown on chain link mesh can also attract butterflies. This would enhance the focus of Environmental awareness, and help in inducing concern for the Eco system as a whole.

- **Fences along pathway and road**

Fences made from G I Pipe and chain links are proposed along the proposed pathway and the highway.

- **Swings**

It is proposed to provide two swings in the *Thodu* vicinity of stream. These would serve as a play area for the younger lot.

- **Landscaping and Tree planting**

Landscaping and Tree planting would be carried out along the pathways. This would serve as an effective visual and noise barrier from the National Highway on one side. Along the paddy field, they serve to provide shade and fresh air for seated visitors. Flowering trees and plants with fragrance and some fruit bearing trees is also suggested.

- **Toilet block**

A toilet block is proposed at the South West corner of the site. It would comprise of a toilet, urinals section & changing room for Gents, and a toilet & changing room for Ladies. A Caretaker's room will also be provided. Toilets and dress changing rooms will be let on a "Pay and Use" basis.

- **Services**

- **Water tank , Open well & filter unit**

An open well and a water tank is proposed to provide for the water requirements of the project. A filter unit is proposed for the drinking water requirements.

- **Kiosks for ethnic food stalls**

2-4 kiosks with a table like structure (simple masonry work), appeared from front as a shop and at the back a set up for cooking. A garden umbrella will serve as roof. The proposed Kiosks would be maintained by Women Self help groups.

The selected women who run these kiosks are responsible for the everyday cleaning of pond and its surroundings. They should collect all degradable wastes and put them in biogas plants. Those organic materials which cannot be put in biogas plants should be composted. Plastics and other non-degradable wastes should be collected and will be kept for recycling.

- **Bio digester (Biogas plant)**

All organic wastes generated at the location will be collected and managed in a biogas plant. This Bio digester is proposed to serve the purpose of cooking for the proposed Kiosks. The digester would be also fuelled by toilet waste collected from the toilet block, thus reinforcing the philosophy of terming 'waste' as a 'resource'.

The generated energy would be freely available for the use within the kiosks and thus the digester would be maintained by the women Self help groups operating the Kiosks.

- **Compost pit**

It is proposed to provide a compost pit which would be filled with any bio-degradable waste disposed by visitors and the Kiosk vendors. The manure produced can serve for maintenance of the landscape.

- **Waste management**

It is proposed to provide individual dustbins along the pathway for Degradable waste and Plastics, respectively. A collection and segregation unit would also be provided.

- **Overhead and path side lamps**

Solar powered overhead lamps and lamp posts are proposed along the pathways for efficient lighting.

- **Book lending Library**

A book lending library consisting mainly of books on environment, eco-friendly lifestyle, health *etc*. also will function at the caretaker's room. Visitors can take the books by giving full price of the book and when they return the books in good condition, the price of the book will be reimbursed, deducting just Rs.1.00 as rent. This will create a good model for spending leisure time at a public place.

iii. Peringakulam Project Management – sustainable mechanisms

Peringakulam is a public property hence many stakeholders have interest in its running and a proper co-ordination and management system is essential. A self-maintained system, both economic and ecological, is visualised for the management of pond including all stakeholders identified through the survey.

I. Governance

A special committee will be formed for the operation and management of the project including representatives of all stakeholder groups – *i.e.,* Apollo, Kodakara Grama Panchayath, Kudumbasree of 13th ward of Kodakara Panchayath, Local community and TIES.

Structure

A suggested structure for this committee, which consist of 11 members, is given below:

1. Chairman (from Apollo)

2. Vice Chairman (From Kodakara Grama Panchayath committee- preferably ward member)

3. Secretary – (From Apollo- Specialist, CSR)

4. Committee members- 8 members

- Three from Apollo- one will be the treasurer
- One representing Kodakara Grama panchayath (Panchayath secretary)
- One representing Technical Consultants (TIES)
- One representing local community (who have a passion to the pond and ecofriendly traditions)
- One representing *Kudumbasree*, who maintains the stalls

Functions

The committee will be responsible for governing the whole project including decision making at the policy level to the management of day to day affairs. The appointment of the caretaker, selection of *Kudumbasree* workers for running food stalls, and managing day-today financial income and expenditures are the other major functions of the committee.

Meetings

The committee shall convene regular meeting at least once in a month. If necessary at any time on a 24-hour notice secretary can convene meetings. The quorum of the committee will be 6.

Venue of the meeting

The venue of the meetings shall be decided by the secretary, considering convenience of the majority of members.

Account maintenance

A joint account should be opened in the name of Secretary and Treasurer of the committee.

II. Operation and Maintenance (O & M)

a. Caretaker

The day to day maintenance and operations will be managed by the caretaker appointed by the committee. A local resident who is passionate to the pond and conservation efforts is a suitable candidate. Caretaker will not have any direct salary but he will get the amount collected as “Pay and Use” fee of the toilets and dress changing rooms. He should be responsible for maintaining the toilet block clean, neat and beautiful. The

income and expenditure accounts should be submitted to the committee by the caretaker every month. The appointment of caretaker is for a period of one year on contract basis. Committee has full right to remove him and appoint another person on the ground of misbehaviour or misappropriation funds or facilities at any time, by giving two week notice.

The income from the book lending library shall be remitted to the treasurer every month. Committee should entrust one of the committee members to provide books to the library as and when it requires.

b. Kudumbasree women

3-4 food stalls/kiosks will be arranged for the sale of traditional/ethnic food items prepared at the venue or brought (selected) from their house. The committee will invite applications from Kudumbasree units of Ward 13 of Kodakara Garama Panchayath for deputing two members from one Kudumbasree for each Kiosk. If more applications received the committee will select the Kudumbasree. An MOU will be signed (See Appendix-1) between the committee and the selected Kudumbasree and based on the said clauses only, the Kudumbasree will be permitted to run the stalls. The selection is for one year and on the 11th month fresh applications will be invited every year and new appointments will be made. However there is no bar against the reappointment of already appointed Kudumbasree.

The income from the sale of food items shall be the revenue for the Kudumbasree members. The income and expenditure statements of stalls also should be maintained by the respective *Kudumbasrees*. An amount note less than Rs.50.00 should be remitted to caretaker every day and the same should be remitted to committees account at every weekends. This amount can be used for day to day maintenance expenses (*e.g.,* purchase of toilet cleaning solutions, brooms, etc.).

iv. Educational Programmes (both informal and formal)

The pond site shall be developed as a centre of environmental education especially on water conservation and traditional ways of natural resource protection. The education components can be both formal and informal (such as name boards for plants containing common name, scientific name and their significance).

Formal meetings, seminars and observations of special days will be conducted at the pond premises occasionally. Programmes of Apollo Biodiversity Club (ABC) also will be conducted here. Studies, surveys and short-term research programmes involving school and college students also will be conducted. Hence data on various environment related matters such as status of surface water bodies of the area, waste management issues of Kodakara Panchayath or lifestyle diseases of the locality will be generated and updated frequently.

Inaugural function of Pond Cleaning Drive by Apollo on 12th December 2014

5.5. BUDGET

5.6. WEB REFERENCES

Central Public Health and Environmental Engineering Organization. 2013. "Advisory on Conservation and Restoration of Water Bodies in Urban Areas". Ministry of Urban Development Government of India <http://moud.gov.in>

Gioria, Margherita and Feehan, John. 2009. "The significance of ponds in maintaining biodiversity in an intensively farmed landscape". Available from Nature Precedings <http://dx.doi.org/10.1038/npre.2009.3596.1>

Khanna D.R. ,Rana, Rajani , Matta, Gagan. 2011. "Ecology of Fish Pond ".ISBN 978-81-7035-739- 1. < http://astralint.com/images/pdf/9788170357391.pdf>

The Water Page. com. nd. "Life In A Pond - Under Water Ecosystem" <http://www.thewaterpage.com/pond-ecosystem.htm>

SECONDARY DATA SOURCES

* A. V. Suraj, Chief Operating Engineer, Guruvayoor Infrastructure Private Limited, Amount of Vehicles passing through NH-47, On 20th February 2015

* Peringamkulam Land Area Sketch from Kodakara Village Office

* Peringakulam BTR copy from Kodakara Village Office

* Data on Land Acquired for NH Construction from NHDP Office, Chempukavu, Thrissur

* Development Plan from Kodakara Panchayat

* Historical Data on Peringamkulam from Kodakara Public Library

* Agricultural Patterns in Kodakara Panchayat from Agricultural Office, Kodakara

* Details on NH Road Plan from Retired NH Officer, Mr. Gangadhar

APPENDIX I

Peringakulam Pond Historical Survey

Field Record Sheet

Date of the survey: _____

Personal Details of the Interviewee:

1. Name :
2. Age:
3. Female/Male:
4. Contact Details:

5. Employment:

Peringakulam Pond Historical Survey:

6. What do you know about the origin of the Peringakulam pond, especially regarding its age, history and management (when, why, and who made it)?
7. Have you heard of any stories regarding the origin of the name "Peringakulam?"
8. i) Please explain the physical features and surrounding of the pond?
   ii) Is it different now from the past (such as pond size, depth etc.)? If so, how and why?
9. What are the main inlets and outlets of the pond?
10. i) What were the main uses of the pond in the past?
    a) Agriculture/Irrigation
    b) Bathing
    c) Laundry
    d) Showering Animals
    e) Others (specify):

    ii) What are the present uses of the pond?
    a) Agriculture/Irrigation
    b) Bathing
    c) Laundry
    d) Showering Animals
    e) Others (specify):
11. i) Does the pond experience seasonal water level fluctuation, especially between rainy and summer season?
    a) Yes
    b) No

    ii) If yes, the drawdown height (in summer season)?

a) Below 1 foot
b) 1 foot
c) 3 foot
d) 5 foot
e) Above 5 foot

12. Have you heard of any other stories, poems, myths, beliefs, rituals, and customs associated with Peringakulam or other nearby ponds?
13. Who owns the pond and the surrounding land? In your knowledge, does the ownership have changed at any time in the past?
14. Do you think the pond experiences any of the mentioned environmental threats?
    a) Pollution
    b) Eutrophication /covered with plants and weeds
    c) Water Quality Degradation
    d) Biodiversity Loss
    e) Others (specify):
15. Have you noticed any of these pollutants in or around the Peringakulam pond?
    a) Sewage
    b) Plastics
    c) Slaughtering Wastes
    d) Other Solid Wastes (specify):
16. What are the major pollution sources?
    a) Local Community
    b) Vehicular Passengers
    c) Sewage Pollution
    d) Others (specify):
17. i) Did any livelihood exist in the region based on the pond?
    a) Yes
    b) No

    ii) If yes, specify:

    a) Agriculture
    b) Fishing
    c) Laundry
    d) Cattle Raising (a source for drinking water and showering of animals)
    e) Others (specify):

18. Fish species in the pond (past and present):
19. Does the fish diversity in the pond has reduced or changed?
    a) Yes
    b) No

20. Whether any establishments existed nearby Peringakulam, eg: agricultural market? If yes, specify:

21. History of any development projects occurred in the region, if any. Was the project successful? If not, why?

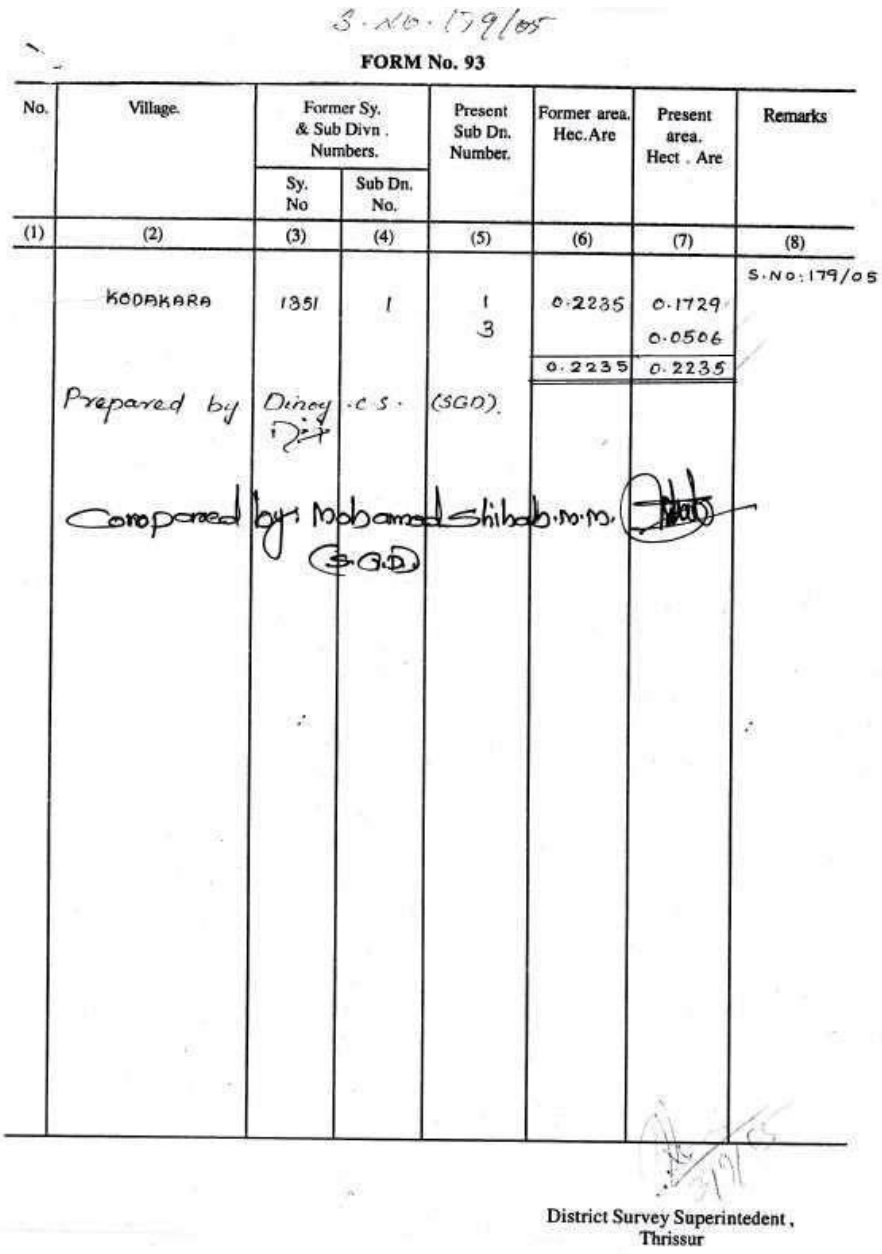
Sl. No.	Name	Pond Size (Compared to Peringakulam Pond)	Present Condition
1			
2			
3			
4			
5			

22. **Other Water Bodies:** Are there any other ponds in the region near to the Peringakulam pond? What is its size compared to the Peringakulam pond? What are their conditions?

23. What is the significance of Peringakulam pond in the region?
24. What do you think as the main reason which led to the pollution and abandonment of the pond?
25. How do you want to see Peringakulam pond in future?

APPENDIX II

DOCUMENT ON NH ACQUISITION



S.No.179/05

FORM No. 93

No.	Village.	Former Sy. & Sub Divn. Numbers.		Present Sub Dn. Number.	Former area. Hec.Are	Present area. Hect. Are	Remarks
		Sy. No	Sub Dn. No.				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	KODAKARA	1351	1	1	0.2235	0.1729	S.No:179/05
				3		0.0506	
					0.2235	0.2235	
	Prepared by	Dincy .C.S.	(SGD).				
	Compared by: Mohamed Shihab.M.M.	(S.G.D.)					

District Survey Superintedent,
Thrissur

APPENDIX III

Environmental Awareness Survey Sheet

TROPICAL INSTITUTE OF ECOLOGICAL SCIENCES

www.ties.org.in

SURVEY ON ENVIRONMENTAL AWARENESS

(Peringankulam Project- January 2015)

പേര് :.....

വിലാസം :.....

.....

ലിംഗം : സ്ത്രീ ☐ പുരുഷൻ ☐

പ്രായം : 10 - ൽ താഴെ ☐ 10 - 19 ☐ 20 - 29 ☐ 30 - 39 ☐

40 - 49 ☐ 50 - 59 ☐ 60 - 69 ☐ 70 + ☐

വിദ്യാഭ്യാസ യോഗ്യത : .....

തൊഴിൽ : .....

---

1. 'പരിസ്ഥിതി ' എന്നത് കൊണ്ട് എന്താണ് അർത്ഥമാക്കുന്നത് ?

   ഗ്രാമങ്ങളിലെയും പട്ടണങ്ങളിലെയും മലിനീകരണം ☐

   വച്ചുപ്പ് നിറഞ്ഞ പ്രകൃതി ☐

   നമ്മൾ ജീവിക്കുന്ന ചുറ്റുപാട് ☐

   പ്രകൃതി സംരക്ഷണം ☐

   ഇതൊന്നും അല്ല ☐

   അറിയില്ല ☐

2. നിങ്ങളുടെ പ്രദേശം നേരിടുന്ന ഏറ്റവും പ്രധാനപ്പെട്ട പരിസ്ഥിതി പ്രശ്നങ്ങൾ എന്തൊക്കെയാണ് ?

3. പ്രകൃതിയെ മനുഷ്യൻ തന്റെ ലാഭത്തിന് വേണ്ടി മാറ്റി മാറിക്കുന്നത് കൊണ്ട് ഒരുപാട് പ്രശ്നങ്ങൾ ഉണ്ടാകുന്നു.

   ഉണ്ട് ☐ ഇല്ല ☐ അറിയില്ല ☐

4. പ്രകൃതി വിഭവങ്ങൾ പരിമിതമാണ്

   അതെ ☐ അല്ല ☐ അറിയില്ല ☐

5. കുളങ്ങളും, നദികളും സംരക്ഷിക്കേണ്ടതുണ്ടോ ?

   വേണം ☐ വേണ്ട ☐ അറിയില്ല ☐

6. പ്രദേശത്തെ ഭൂഗർഭ ജല സംരക്ഷണത്തിന് കുളങ്ങൾ കൊണ്ട് പ്രയോജനം ഉണ്ടോ ?

   ഉണ്ട് ☐ ഇല്ല ☐ അറിയില്ല ☐

7. ഭൂമിയെയും അതിലെ മറ്റ് ജീവജാലങ്ങളെയും സംരക്ഷിക്കേണ്ടത് മനുഷ്യന്റെ കടമയാണോ ?

   അതെ ☐ അല്ല ☐ അറിയില്ല ☐

8. നിങ്ങൾ ഇവയിൽ ഏതിൽ പെടുന്നു ?

- ☐ ഞാൻ പരിസ്ഥിതിയെ സംരക്ഷിക്കുന്നു, അതിന്റെ ഗുണങ്ങൾ എനിക്കും എന്റെ സമൂഹത്തിനും ലഭിക്കുന്നുണ്ട്
- ☐ ഞാൻ പ്രകൃതിയെ സംരക്ഷിക്കാറുണ്ട്, പക്ഷേ മറ്റുള്ളവർ അതുപോലെ ചെയ്യാത്തതു കൊണ്ട് അതിന്റെ പ്രയോജനം കുറയുന്നു.
- ☐ എനിക്ക് പരിസ്ഥിതിയെ സംരക്ഷിക്കാൻ താല്പര്യം ഉണ്ട് പക്ഷേ ഒരുപാട് ബുദ്ധിമുട്ടും പ്രയാസമേറിയതും ആണ് (സമയം നഷ്ടം, സാമ്പത്തിക നഷ്ടം മുതലായവ)
- ☐ എനിക്ക് പ്രകൃതിയെ സംരക്ഷിക്കാൻ വളരെ താല്പര്യം ഉണ്ട്, പക്ഷേ എന്ത് ചെയ്യണം എന്ന് അറിയില്ല.

9. താഴെ പറയുന്നവയിൽ നിങ്ങൾക്ക് ഏത്ര എണ്ണത്തിനെ കുറിച്ചാണ് അറിയാവുന്നത് ?

- ☐ കാലാവസ്ഥാ വ്യതിയാനം
- ☐ പ്രകൃതി ദുരന്തങ്ങൾ (ഭൂമി കുലുക്കം, വെള്ളപൊക്കം മുതലായവ)
- ☐ മനുഷ്യ നിർമ്മിതമായ ദുരിതങ്ങൾ (എണ്ണ ചോർച്ച / തുള്ളുമ്പൽ, വ്യവസായിക സ്ഫോടനങ്ങളിലെ അപകടങ്ങൾ മുതലായവ)
- ☐ ലോക ജൈവവൈവിധ്യങ്ങളുടെ നശീകരണം
- ☐ ജല മലിനീകരണം
- ☐ കാർഷിക മലിനീകരണം (രാസ കീടനാശിനികളുടെയും, വളങ്ങളുടെയും അമിത ഉപയോഗം)
- ☐ കൃഷിയിൽ ജനിതക മാറ്റം വരുത്തിയ ഉൽപന്നങ്ങളുടെ ഉപയോഗവും ദുഷ്ഫലങ്ങളും
- ☐ രാസവസ്തുക്കളുടെ അമിത ഉപയോഗവും ആരോഗ്യ പ്രശ്നങ്ങളും
- ☐ മാലിന്യ വർദ്ധനവും ദുരന്ത വരങ്ങളും
- ☐ പ്രകൃതി വിഭവങ്ങളുടെ നശീകരണം
- ☐ ഫാസ്റ്റ് ഫുഡും ആരോഗ്യ പ്രശ്നങ്ങളും
- ☐ ഒന്നുമില്ല

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10. നിങ്ങളുടെ പ്രദേശത്ത് ജലക്ഷാമം അനുഭവപ്പെടാറുണ്ടോ ?

ഉണ്ട് ☐ ഇല്ല ☐ അറിയില്ല ☐

11. നിങ്ങളുടെ വീട്ടിൽ ഏറ്റവും കൂടുതൽ ജലത്തിന്റെ ഉപയോഗം എന്തിനാണ് ?

പൂന്തോട്ടം നനയ്ക്കാൻ	☐	തുണി അലക്കാൻ	☐
കുളിക്കാൻ	☐	കക്കൂസ് ഉപയോഗത്തിന്	☐
മറ്റുള്ളവ	☐	അറിയില്ല	☐

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Date of interview:.....Time:.....