

Preservation of Lakes in the City of Bangalore

Report of the committee constituted by the Hon'ble High Court of Karnataka
to examine the ground realities & prepare an Action Plan for preservation of lakes
in the city of Bangalore.
(26th February 2011)

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Date: **21-02-2011**

PREFACE

Hon'ble the Chief Justice and a Companion Judge, while hearing a Public Interest Litigation, were pleased to constitute a Committee consisting of Ten Members headed by the Chairman, High Court Legal Services Committee, to suggest the required steps and measures to be taken for preservation and restoration of lakes in and around Bangalore and to submit its report.

In this regard, earlier, Laxman Rau Committee (1988) had dealt with the very issue of preservation of lakes in clear terms, but the efforts of the Government, Forest Department, BBMP, BDA, Karnataka State Pollution Control Board and LDA, could not match the requirement of the day.

Bangalore is on a course of rapid expansion, transforming itself from a metro to a Mega City. During this process, the worst hit are the lakes of the region, which are put to misuse, threatening the water security, ecology and environment of the region. The estimated population of Bangalore by the

year 2020 would be around 120 lakhs and it demands a very proactive regulation, planning and execution system in place, to face the challenges of water scarcity and to keep the City habitable.

The Committee has met as frequently as required and deliberated on various facets of the problem of lake conversion and the action required to mitigate the same. The Committee further sought the views of the experts and experienced people in lake conversion while finalizing its report. It has also examined the root cause and ground realities and prepared the action plan for preservation and restoration of lakes in and around Bangalore.

After umpteen meetings and discussions with its members and experts from various walks of life, the Committee is of the view that:

- Much accelerated efforts are required for surveying the lake areas as per records and removal of encroachments, protecting the lake areas through fencing and watch & ward, stopping sewage entry into the storm water drain and its treatment, opening up of encroached/ blocked raja kaluves and branch kaluves, etc;
- Since new areas are getting added to the City, under the guise of expansion, thoughtful advance planning is required in these peripheral areas of the City, which are fortunately not much spoiled.

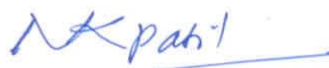
- Concrete steps will have to be taken to secure all the raja kaluves and drains, to keep adequate buffer as envisaged under the Zonal Regulations surrounding the lakes and raja kaluves, to keep in place Under Ground Drainage (UGD) and sewage treatment in time, to keep strict vigil over the lake lands and to prevent encroachments.
- As it is aptly said “a stitch in time, saves nine”, these timely measures will help in non-recurrence of problems that we face in core Bangalore to-day.

I must express my deep appreciation for all the assistance and suggestions rendered by each one of the members and all others and profusely thank them for spending their valuable time and sharing their expertise and knowledge in finalizing the report.

Hope and trust this report will be a mirror for preservation and restoration of lakes, not only in Bangalore but also wherever it is required.

Bangalore,
Now camped at Dharwad.

Date: 21/02/2011.



(N.K.PATIL)

JUDGE, HIGH COURT OF KARNATAKA,
& CHAIRMAN, HIGH COURT LEGAL
SERVICES COMMITTEE, BANGALORE.

Preservation of Lakes in the City of Bangalore

Report of the Committee constituted by the Hon'ble High Court of Karnataka to examine the ground realities and prepare an action plan for preservation of lakes in the City of Bangalore.

(Hon'ble High Court of Karnataka's Order dated 26/11/2010 in WP NO.817/2008 & others)

Report submitted on 26/02/2011 by the Committee, appointed by the Hon'ble High Court of Karnataka vide its order dated 26/11/2010 in WP.No 817/2008 & others.

<p style="text-align: center;">Sd/- Chairman Hon'ble Sri Justice N.K.Patil Judge, High Court of Karnataka Chairman, Karnataka High Court Legal Services Committee</p>	
Members	
<p style="text-align: center;">Sd/- Sri K.S.Prabhakara, IAS Secretary, Revenue Department, GoK</p>	<p style="text-align: center;">Sd/- Sri A.S.Sadasivaiah, IFS (retd) Chairman Karnataka State Pollution Control Board</p>
<p style="text-align: center;">Sd/- Sri P.B.Ramamurthy, IAS Chairman Bangalore Water Supply & Sewerage Board</p>	<p style="text-align: center;">Sd/- Sri I.B.Srivastava, IFS Principal Chief Conservator of Forests, Karnataka State</p>
<p style="text-align: center;">Sd/- Sri Bharat Lal Meena, IAS Commissioner Bangalore Development Authority</p>	<p style="text-align: center;">Sd/- Sri Siddaiah, IAS Commissioner Bruhat Bangalore Mahanagara Palike</p>
<p style="text-align: center;">Sd/- Sri P.N.Srinivasachari, IAS Secretary, Minor Irrigation Department, GoK</p>	<p style="text-align: center;">Sd/- Sri K.S. Sai Baba, IFS Chief Executive Officer Lake Development Authority</p>
<p style="text-align: center;">Sd/- Sri H.B.Mukunda Director, Town Planning, GoK</p>	

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Note: A Map of Lakes of Bangalore City is appended to this report.

Annexures:

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List of Abbreviations used in the Report:

BBMP: Bruhat Bangalore Mahanagara Palike
BDA: Bangalore Development Authority
BWSSB: Bangalore Water Supply & Sewerage Board
KFD: Karnataka Forest Department
KSPCB: Karnataka State Pollution Control Board
LDA: Lake Development Authority
BIAPA: Bangalore International Airport Area Planning Authority
MICPA: Mysore Infrastructure Corridor Planning Authority
MI : Minor Irrigation
MLD: Million Litres per Day
STP: Sewage Treatment Plant
UGD: Under Ground Drainage

1. **Introduction:**

Several Public Interest Litigations concerning conservation of lakes have been filed in the last 15 years before the Hon'ble High Court of Karnataka. There are standing directions of the Hon'ble Court regarding survey of lake areas and removal of encroachments, stoppage of sewerage entry into lakes, non-diversion of lake area for any other purposes etc. In continuation of its concern for preservation of lakes the Hon'ble High Court vide order dated 26/11/2010 passed in WP No.817/2008 and others has constituted a committee to examine the ground realities and prepare an action plan for the preservation of lakes in the City of Bangalore. The Composition of the committee is as hereunder.

Chairman Hon'ble Sri Justice N.K.Patil Judge, High Court of Karnataka Chairman, Karnataka High Court Legal Services Committee	
Sri K.S.Prabhakara, IAS Secretary, Revenue Department, GoK	Sri A.S.Sadasivaiah, IFS (retd) Chairman Karnataka State Pollution Control Board
Sri P.B.Ramamurthy, IAS Chairman Bangalore Water Supply & Sewerage Board	Sri I.B.Srivastava, IFS Principal Chief Conservator of Forests, Karnataka State
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Sri H.B.Mukunda Director, Town Planning, GoK	

The committee chaired by Hon'ble Sri Justice N.K.Patil met six times on 4/12/2010, 16/12/2010, 30/12/2010, 16/01/2011, 30/01/2011, 12/02/2011 and finally on 26/2/2011 to finalise and submit the report. In addition, the members of the committee met as frequently as necessary to deliberate on various issues concerning lakes. An interactive session was also held on 11/01/2011 to solicit the views/suggestions from various organizations and individuals associated with lakes conservation and wetland conservation.

The report is the culmination of many inputs from the records of various offices and suggestions of many experts.

In this Report, Bangalore City is considered as co-terminus with BDA area of 1300 Sq Km, which includes 800 Sq Km area of BBMP and 91 Sq Km of BMICPA. Lakes numbering 386 situated in this area of 1300 Sq Km are considered for restoration, where as ground position is to be verified in case of another 121 Kuntas/Lakes.

2. **Historical Background to the Lakes of Bangalore:**

Bangalore City is located at an average elevation of 900 metre above MSL. The undulating terrain of Bangalore, with its hills and valleys provided a very natural drainage pattern with small streams originating from ridges cascading down to form major streams in the three major valleys i.e., Hebbal, Vrushabhavathi and Koramangala & Challaghatta. The City falls into the category of semi-arid tropics with an annual average rainfall of 900 mm, distributed well among the South-West and North-East monsoon. The natural streams were intercepted at appropriate places to create man made lakes/tanks to capture the rainfall to meet the irrigation and drinking water needs of the city. Hence each lake harvests rainfall from the catchment and surplus water flows into the downstream lakes. Bangalore city has no perennial river nearby and this could be one of the reasons for construction of series of tanks, most of them during the 16th century. The earliest history of creation of lakes in and around Bangalore City is traced to the founders of Bengaluru, the Kempe Gowdas and later to the Wodeyars of the Mysore Kingdom. The citizens had abundance water to drink and irrigate their lands and use for secondary purposes also.

In her seminal critique of the urbanisation processes of Bangalore over time, Janaki Nair in her book "The Promise of the Metropolis: Bangalore's Twentieth Century"¹ credits the evolution of this metropolis to the building and conservation of tanks/lakes. She reports that "for a settlement that has been in existence for over four and half centuries, the city of Bengaluru boasts a few physical marker or monumental sites as visible signs of its antiquity. The topography of the region to which Bengaluru belongs is remarkable and there are few signs of an archaic temple town, a commercial centre, or a tract energized by a river or other water source." So in such a landscape that does not bear the physical details of historicity of centuries as Delhi or Hampi does, Nair suggests that "the earliest

1 Nair, Janaki, *Bangalore's Twentieth Century: The Promise of a Metropolis*, (Oxford University Press, 2005)

settlement was probably a hamlet of no particular commercial or demographic importance to warrant the name of an urban setting, functioning instead as a node that drew the surpluses of the agricultural countryside, and was dominated by rural notables..... Located at the ridge top of the main water parting of the Arkavathi and the S. Pinakini rivers, the region relied on tanks which were constructed right across this territory as the principal source of water for agricultural and domestic needs. This network of tanks supported mixed farming and market gardening activities."

On the antiquity of the city, Naik highlights that "some historians believe that the name 'Bengaluru' is derived from an old settlement near present day Yelahanka, long before the time of Kempegowda, the 'Yelahanka Nada Prabhu' or Chieftain whose name is usually associated with the founding of the town in 1537". Importantly she notes that it "is likely that Kempegowda's rule coincided with the development of a new urban form: a fortified settlement linked to a network of temples and tanks, later attracting many merchants and artisans who took up residence there." Were it not for tanks providing water security in an otherwise semi-arid area, it is more than likely that the journey towards a successful metropolis would have been truncated centuries ago. The critical importance of tanks to the success of this emerging urban area has been recognised by every ruler from Kempegowda, Hyder Ali, Tipu Sultan and the British as well. According to Nair "for a site that was not close to a water source and was situated on an elevated ridge, a reliable supply of water for agricultural or domestic purposes was imperative from the earliest days of the settlement. The limited availability of water may have imposed its own limits on the growth of the City population. No wonder then that the provision of water through a system of tanks became a crucial element of city building throughout the twentieth century. Some claim that Bengaluru was referred to as '*Kalyananagara*', a city of *kalyanis* or tanks. Kempegowda himself is credited with the construction of the famed Dharmambudi and Kempambudi tanks, as well as Sampangi tank. The founder's namesake and successor Immadi Kempegowda constructed the Gidda Gowda and Karanji tanks, the latter supplying the fortified city; both these tanks appear to have been filled up in the 1920s to make way for a labour colony and a *jutka* stand respectively."

Highlighting how the importance of tanks in sustaining Bangalore's growth and prosperity was recognised and promoted by the British, Nair indicates that "the dependence of tanks did not diminish even when the economic structure of the city had

vastly changed. The British did not draw legitimacy for their rule from the patronage of Brahmins and temples, but the supply of water to the old and new cities was as important as in earlier times. The Ulsoor tank, Miller's tank and Hesarghatta lake served as reservoirs for the city in the nineteenth century. Tanks required periodic human effort on a massive scale to keep them functional. The Ulsoor tank around 1900 was regarded so dangerous to public health, that it required drainage and de-weeding on a massive scale. By the late nineteenth century, when tanks were becoming clearly inadequate to meet the city's needs, Sankey's Reservoir was designed to collect and store rain water, with connections through contour channels to the Miller's tank and Dharmambudhi tank. Indeed, said Lewis Rice, so keenly felt was the need for augmented water supplies to the city, that contests were frequently held to design such systems, and 'there is scarcely a site or tank for miles around Bangalore that has not formed part of one or another project'. The evidence of such creative crafting of landscape into a water terrain is evident in any toposheet prepared by the Survey of India, with its last most authoritative account of 1972 revealing not one valley or depression being left uncared for; instead they are all sites to harvest rain and runoff, thus significantly enhancing water security and productivity of agriculture and horticulture.

This complex history of tank building has to be taken into consideration when we approach the contentious problems of its conservation and rehabilitation. Evaluating the extensive nature of its emergence over centuries, the Bangalore District Gazeteer reports in 1990 that tanks in the Bangalore region that roughly corresponds with the BMRDA region of today, contributed 12,541 ha. of water spread². This is a critical determinant to the future of this metropolis as much of this water-spread and the canals that interlinked them have been destroyed. This has eroded the capacity of these water systems to capture and store the rain that falls only on 57 days of the year, yet demonstrating amazing resilience in supporting recharge of groundwater, thus water security for the millions depending on it.

In 1791 when Lord Cornwallis sent a contingent of British East India Company soldiers from Fort St. George, Madras, to the Mysore State to find an alternate route to Srirangapatna for fighting Tippu Sultan, the Captain who headed the team came to Bangalore town. He was amazed by the climate and environment of Bangalore and

2 Bangalore District, Gazeteer of India, 1990, ed. Suryanath U. Kamath.

described it as *LAND OF A THOUSAND LAKES*.

Dharmabudhi, Millers, Sankey, Ulsoor and Hessarughatta tanks were supplying water to the needs of the city. In the 1970s the scheme to pump water to the city, that too against gravity from Cauvery river 100 km away, began to provide piped water supply to the city.

Earlier to urbanization, these lakes were maintained on the traditional community pattern of ownership as a common resource, which needed regular maintenance in order to meet water needs.

3. **Lakshman Rau Committee for Preservation and Restoration of Bangalore Lakes and Subsequent Developments:**

During 1985, the Government of Karnataka constituted an expert committee headed by Sri N.Lakshman Rau to examine all the aspects of the preservation, restoration or otherwise of the existing tanks in the metropolitan area of Bangalore.

The Committee made the following important recommendations.

- a) The existing water bodies act as recharging resources to ground water on the downstream which will help to draft water through dug wells/bore wells meant for domestic or industrial purposes. These existing tanks should not be breached but retained as water bodies.
- b) Efforts should be made to ensure that these tanks are not polluted by discharge of effluent and industrial waste.
- c) Further, to prevent silting up of these lakes, off-shore development is to be taken up by large scale tree planting and also removal of encroachments
- d) The tanks which have already been breached should not be utilized for formation of sites but taken up to create tree parks.
- e) Existing tanks should be de-weeded and aquatic life must be developed
- f) The tank areas where there is no *atchcut* (command area) are to be handed over to Forest department for tree planting and formation of regional parks.
- g) The BDA/BMP/Minor Irrigation department must immediately remove encroachments on the tank areas.
- h) Government should set up an implementation agency and review the implementation of the recommendations periodically. For this purpose the Forest Department, BDA, BMP, Minor Irrigation Department, BWSSB and Town Planning

Department may be involved.

- i) Mosquito control measures are to be entrusted to Bangalore City Corporation or any other suitable agency.
- j) The responsibility for the maintenance of water bodies in clean and safe condition should be by Bangalore Water Supply & Sewerage Board. By proper maintenance of water bodies, it is possible to improve the ground water table, so that there will be scope for tapping ground water through bore-wells.
- k) The possibility of construction of more tanks along the natural valleys which now have a run-off water should be examined and implementation taken up.

The committee has dealt with 46 disused tanks and 81 live tanks in the Bangalore conurbation area and gave recommendations lake-wise. Regarding 262 tanks between the conurbation boundary and metropolitan area boundary, the committee opined that the lakes have command area and cannot be breached and hence no development was proposed, except foreshore area planting to prevent silting up of lakes.

The Government has accepted the Lakshman Rau committee report in 1988 and issued, the GO No.PWD 82 IMB 85 Bangalore dated 11th February,1988. But, implementation agency as envisaged was not constituted to review the implementation of the recommendations of the committee periodically.

As per the recommendations of Lakshman Rau committee, 115 Lakes were transferred to Forest Department in the year 1988. KFD developed 14 Lakes in an integrated manner and fenced another 13 lakes. Foreshore planting was carried out in 32 lakes. Encroachments of around 120 acres was evicted in 32 lakes. KFD could have done better if adequate staff and funds were provided for the task entrusted to it.

BBMP and BDA have developed lakes in a big way during the past one decade. BBMP has restored 13 lakes and BDA has restored 7 lakes. Details of restored Lakes is provided vide **Annexure-I(BBMP) and Annexure-IV(BDA)**. Further restoration work is in progress in another 18 lakes (BBMP) and 6 lakes (BDA). Details are furnished vide **Annexure-II(BBMP) and Annexure-V(BDA)**. Since the BBMP came forward to develop the lakes on priority basis, Government ordered transfer of 94 lakes from the custody of Forest Department to BBMP vide its order dated 19/04/2010. Subsequent to this Forest Department has only 5 lakes in its custody i.e Hennur, Jarakbandekaval , Madivala, Mylasandra and Puttenahalli (yelahanka) lakes.

4. **Rapid urbanization of Bangalore, its impact on lakes and the ground realities.**

In 1941 the population of Bangalore was 0.41 million and the City's area was 29 Sq km. When the elections to the Bruhat Bangalore Mahanagara Palike (BBMP) was held in 2010 its population was about 87 lakhs, with its area 800 sq Km. It is estimated that the population of the City will be around 12.5 million by 2020.

When the city started getting water from Cauvery river and the agricultural lands were converted into built up areas due to urbanization, many lakes were converted into residential layouts, bus-stands and play grounds.

By 1985, there were about 43 disused tanks in Bangalore City and these lake lands were utilized for various public purposes/converted into house sites or encroached. The ground realities concerning the preservation of Bangalore City lakes can be summed up as under.

- a) The sewerage net work in core area of Bangalore City (old BMP area) is outdated and not properly networked. Consequently the storm water drains feeding the series of lakes of Bangalore city carry untreated sewage in to the lakes, causing enormous pollution of lake water and resultant unhygienic conditions in surrounding areas. Bangalore city **has around 1.5 lakh bore-wells to meet the water requirement of the city** and there are incidents of ground water contamination reported. A ground water study carried out in 2008 in the three valley regions of the city indicated that the water is not fit for human consumption. Details are furnished vide **Annexure-XVI**. The non-interception and diversion of sewage entry into the storm water drains is a major problem and a serious concern to be addressed by BWSSB.
- b) The series of lakes in Bangalore city are meant to capture rainwater efficiently from catchment area. But the Raja kaluves and other drains that carry rainwater in to the lakes are encroached, blocked or narrowed in many places. Consequently many lakes are getting dried up without entry of water during rains. Dried up lake beds are exposed to encroachments. On the other hand some of the areas are getting flooded even after a rainfall of 40 mm, as the rajakaluves and drains are blocked/encroached/narrowed down, causing avoidable miseries and hardship to the people.

- c) Lake areas have become dumping grounds for solid waste debris, construction waste etc. Most of the lakes are open areas without fencing and watch & ward.
- d) Lake areas are diverted for road making, road widening in a big-way. For example the outer-ring road constructed during early 1990s has used lake bed area in many lakes like Agara, Ibbalur, Mahadevapura and Nagavara.
- e) Encroachments are rampant in lake areas due to high value of land consequent to the unprecedented rapid urbanization of the city, especially during the past two decades. The Joint Legislature Committee (Ramaswamy committee) Report (2007) on encroachments of Government lands, included 1848 acres (2488 cases) of encroachment in case of lake/tank areas in Bangalore Urban district. A task force was constituted for protection of Government lands. Land grabbers in the guise of developers and builders pose serious threat to the protection of all public lands; lakes are no exception. Fabrication of records and documents is resorted to, leading to grabbing of lake lands. Despite of the fact that survey number wise details of encroachments and encroachers is a part of the report, action is yet to be initiated in many cases.
- f) Bangalore Development Authority acquired lake area on various occasions of its layout developments and converted it into sites subsequently. Agara, Saneguruvanahalli, Chikkamarenahalli, Kacharkanahalli, Geddalahalli, Chelkere, lakes are some of the examples.
- g) Revenue department has granted lake area for various public/private purposes in many cases violating the provisions of law and it continues unabated.
- h) The areas, which were earlier salubrious for their surrounds with lakes, have now become unhygienic due to pollution and bad odour.
- i) Due to depleted Dissolved Oxygen(DO) levels fish deaths occur occasionally in many lakes like Ibbalur, Devarabisanahalli. Lakes are loaded with nitrates and phosphates leading to eutrophication. LDA carried out water analysis of 86 lakes in Bangalore City during 2009-10. Out of the 86 lakes, 39 are highly polluted and 47 are moderately polluted. KSPCB has a regular monitoring of Lake Water Quality and the details are furnished vide **Annexure-XVII**.
- j) Layouts and apartments have come close to lake boundaries and there are instances of direct connections of sewerage line in to the lakes.

- k) The newly added Town Municipal Councils and villages to the BBMP jurisdiction, have no UGD network and the open sewage enters the nearby lakes along with drains meant to carry rainwater.
- l) Heavy extraction of earth and sand is also seen in some of the lakes, leaving huge craters on lake beds.

5. **The imperatives for Preservation of Bangalore lakes:**

The necessity of lake preservation is more pronounced in the context of urbanization, when city takes more and more villages into its fold as in case of ever-growing Bangalore City. Urbanization leads to conversion of agricultural lands to non-agricultural purpose. But it does not mean that the lakes that irrigated these lands have lost their utility to the community.

- a) Lakes have a greater role to play in urbanized areas to capture rainwater efficiently to facilitate ground water recharge, which is absolutely required in Bangalore with around 1.5 lakh bore-wells to meet the water requirements. Further, well maintained lakes can augment the water supply to the Bangalore City, as there is already acute shortage of water supply. No more water can be drawn from Cauvery, after Stage IV, Phase II is completed by 2011. Presently the City is not in a position to supply the required 150 litres/capita water requirement to the existing population of 89 lakh people in BBMP area. Hence it needs emergent proactive planning and implementation to cater to the needs of estimated 12 million population by 2020. The most feasible and viable option is to keep the lake water clean by not allowing sewerage entry into lakes on one side and to recycle about 1000 MLD of waste water by going for tertiary treatment. Otherwise the basic water security need will be at stake and the poorer sections of the society get affected badly.
- b) Lakes are the lung spaces of a city and climate moderators adding to thermal ambience. The City with its built-up area and asphalted roads and less tree cover, will have further deteriorated environs if lakes are disused/destroyed. Lakes have a direct bearing on the quality of life in urban areas.
- c) Lakes support aquatic and semi-aquatic eco-systems and conservation of lakes is important to conserve biodiversity of flora and fauna unique to the

aquatic/wetland ecosystems. Local and migratory birds depend on these lakes for food and perching.

d) Proper maintenance of lake series and connected *raja kaluves*/drainages will prevent flooding of areas as is happening in the city in an increased manner in recent years.

e) Lakes have a great recreational value in urban setting. If parks are developed surrounding the lake at the time of layout development, they add to the quality of urban life.

6. **Lake Development Authority and its role in preservation of lakes:**

Lake Development Authority was constituted in 2002, as a registered society. The jurisdiction of the society extends over the lakes in metropolitan area of Bangalore inclusive of BMRDA area. Besides the LDA has jurisdiction of lakes over other City Municipal Corporations and Town Municipal Councils in the State. LDA is the regulatory, planning and policy making body with nodal functions for protection, conservation, reclamation, restoration, regeneration and integrated development of lakes in the jurisdiction of the authority. LDA has a Governing council headed by the Chief Secretary, Govt., of Karnataka. Notwithstanding its lofty objectives, LDA has no statutory powers and has no teeth to deal with the complex issues involving the Lake conservation in urban areas of the state. It is the nodal agency for the National Lake Conservation Programme (NLCP) in the State and took up restoration of 16 lakes in Karnataka, with 5 of them in Bangalore City. It is also the Nodal agency for National Wetland Projects in the State. The LDA has in its custody 11 lakes in Bangalore City. Details are furnished vide **Annexure-VII**

Looking into the need for a focal agency to conserve lakes in the urban areas of the State and to have a proper law to deal with various offences related to lakes, the State Government is contemplating on Lake Development Authority Bill. The Draft bill is under the active consideration of the Government. If it comes in the form of legislation, LDA can play a very meaningful role in the conservation of lakes in Bangalore City and other urban areas in the state.

7. **Ecological Perspective of lake restoration:**

The purpose of any lake restoration programme is to keep the area of the lake intact by removing encroachments, provide for impounding only clean water and safeguard the ecology of the lake. Some of the ecologically sound techniques for lake restoration are listed hereunder and Detailed Project Reports have to be prepared keeping these principles in view.

- a) **On Island Design:** Islands in lakes are used by birds and other biota for resting, roosting and nesting. For this, islands need to be well away from human activity and should be located at sufficient distance from the main-bund and water-edge in such a manner that the surrounding water provides sufficient insulation from ground predators and human activity. Unless the area of the lake is more than 20 Ha, it may not be wise to plan for island formation in the lake under restoration. Reed planting on the islands must be based on careful selection and based on a clear understanding of bird use of islands. The design of islands and choice of trees for plantation is given in **Annexure-XIII**.
- b) **Walkways above High Water Mark instead of Jogging Tracks:** Instead of ringed elevated jogging tracks, a packed-mud/ cobble-stone ground-level walkway can be developed with a width not exceeding 3 mt (three meters). This can be established all around the lake perimeter beyond the high-water mark or close to the perimeter fence. Such ground-level walkways will not obstruct the inflow of run-off water from the surrounding catchment area, wherever it is still exists.
- c) **Planting of tank area with trees and bushes above high water mark:** In the open lake area that spreads above the high-water mark and the perimeter fence, select trees and bushes that are beneficial to birds, butterflies and other biota can be planted. List of such trees is listed in **Annexure-XIII**.
- d) **Designation of lakes as bird sanctuaries (with no boating and commercial fishing):** Historically, the lakes in Karnataka have supported immense aquatic biodiversity including birds and other biota. Lakes that have a past history of supporting high bird diversity in terms of species richness and their numbers should be identified in consultation with competent personnel/birdwatchers and declared

as bird sanctuaries. An *in situ* development and management plan should be drawn-up by treating each lake as a unique case. Such lakes should be identified as unique bird habitats/bird refuges, should be kept free of all disturbances like boating and other water-sports, commercial fishing, poaching, etc, and notified for protection as per the Wetland Rules, 2010.

- e) **Management of Raja Kaluves:** No encroachment, sewage inflow or garbage dumping must be allowed into Raja Kaluves. In addition, appropriate silt and waste trapping structures may be set up at regular distances of the Raja Kaluve. Protection of these canals are critical as they lifelines for the survival of lakes and harbour immense potential for biodiversity conservation, recreation, and grazing and farming, including urban community gardens. With imagination and innovation, Raja Kaluves can easily become the space for building ecologically committed communities in urban areas. The Raja Kaluves that are not encroached, or partially destroyed, must be protected from further encroachment and destruction by live fencing as though they were tree wedges interlinking lakes. A list of species that may be planted along Raja Kaluves is furnished in **Annexure-XIII**.

- f) **Prevention of sewage inflow into the lake:** Sewage treated to secondary treatment standards must only be allowed into the lake bodies. No raw sewage or trade effluents must be allowed into lakes bodies. Wherever possible, treated sewage must be made to flow through dense reed beds and/or constructed wetlands, designed in a manner that is both aesthetic, ecologically viable and with low maintenance. These reed beds/constructed wetlands aid in cleaning up/filtering the waters, improve local micro-climatic conditions, increase ground water recharge between the lake bodies.

8. **Strategy for preservation of Bangalore lakes:**

- 1) Lake area should not be diverted for any other purpose as lakes have an increased and important role to play vis-a-vis lakes in rural areas, like ground water recharge,

climate moderation, act as lung spaces, water for various purposes, urban recreation etc. The City has lost many important lakes due various diversions already.

- 2) Lake area is to be surveyed with total station as per the village map and records. Encroachments, if any, are to be removed. As part of survey, boundary stones in concrete are to be fixed in 3 to 4 corners of the survey, to facilitate easy future re-survey work of the lake as and when required. It is suggested to record Latitude & Longitude values of the corner stones so fixed by using Differential Global Positioning System (GPS) of sub-meter accuracy. It is relevant in the background of ever escalating land value in Bangalore city and consequent vested interests to grab public lands adjoining private lands. Geographical Information System (GIS) is to be established for the lakes of Bangalore City for planning and monitoring purpose.
- 3) Lake preservation is not limited to lake area itself, but very much dependant on catchment area and the drains that bring rainwater in to the lake. Raja kaluves, branch kaluves are to be surveyed and encroachment therein evicted. The buffer prescribed for primary, secondary & tertiary drains in valleys as per Zonal Regulations has to be religiously implemented, more so in areas which are not developed yet, to facilitate appropriate storm water drains, sewerage lines, inspection paths etc., as when the area comes up for development/urbanization. Advance action in this manner is imperative, if the unplanned development of Core area Bangalore City is not to recur in future.
- 4) The present norm of 30 mt buffer surrounding leagal boundary lakes is a must to preserve the lakes and if the buildings are allowed too close to lakes, it will affect the lake environment adversely. The buffer limits, needs to be reviewed and it is suggested to increase the 30 mt buffer progressively by 2mt per every 5 ha of increase in lake area beyond 40 hac. This will facilitate development of buffer surrounding the lake in the form of tree parks, walking path without reducing/compromising lake area for creation of such facilities.

- 5) Lake preservation has to be integral to Layout Development by BDA and Layout approvals by development and planning authorities like BIAPA, MICAPA, Nelamangala Planning Authority, Hosakote Planning Authority etc., as eventually these areas will be part of Bangalore city. BDA should not acquire lake area at the time of notifying the area for development and allot sites in the lake area as was done in many a layout development previously. Instead they have to properly get all the lakes, raja kaluves, drains surveyed and marked on the ground as per village records with boundary stones and make provisions for buffers as laid out in their norms. The area that has to be kept for parks as amenity in the BDA Layouts, can be earmarked surrounding the lake area, so that it serves the conservation of lakes and public recreation as well. Storm water drains and UGDs are to be laid out, before the sites are allotted, lest the problems of core Bangalore are bound to occur even in new areas.
- 6) Core operations like survey, removal of encroachments, fencing, watch and ward, clearing of blocked and encroached raja kaluves & drains, waste-weir repairs, de-silting to the extent absolutely required are to be taken up on priority.
- 7) Effective Lake area should not be reduced by converting lake area into parks, children play grounds, widened bunds etc. The de-silting has to be minimized to remove only sludge portion with minimum depth near foreshore reaching maximum depth at the bund. The present saucer shaped de-silting should be given up as it is cost prohibitive and leads to huge bund making and creating storage capacity beyond the need. Saucer shaped deepening of lake bed will affect the wetland formation in the foreshore region of the lake, which is essential to filter the water that enters the lake and important from ecological point of view. Exception to this can be restoration of lakes, with adequate anticipated inflow during rainy season, where deepening is suggested keeping in view impounding more water to recharge the depleting ground water and to mitigate the flash floods.
- 8) Unless sewage entry is restricted, based on the experience of lakes developed so far, no lake improvement is to be taken up except survey, removal of

encroachments, fencing and watch & ward. There is no point in de-silting and other developments, if lake continues to receive polluted water. Diverting sewage is not an option in the absence of other inlets into the lake to bring rainwater. Diverting sewage is leading to drying of lakes as in case of Doddabommasandra lake, Agara lake etc. BWSSBs action plan to separate the sewerage entry in to storm water drains directly and consequently in to the lakes will be in place only by 2014/2015. This being the case the agencies developing the lakes may have to invariably go far a Sewage Treatment Plant for an individual lake/for a group of interconnected lakes in consultation with BWSSB to ensure that they fit into their larger plan of sewage treatment. **Lake restoration is to be taken up based on lake series/sub-series and not in isolation, to have better results and impact.**

- 9) Some of the lakes of Bangalore are prominent for their ecology due to local and migratory birds, aquatic fauna and flora. Lakes of this nature are to be improved keeping this aspect in focus so that after the development lake is not subjected to increased disturbance in the area. Such lakes may be identified and notified under Wetland (Conservation and Management) Rules, 2010.
- 10) Annual field inspection by higher authorities of the custodian organizations and annual jamabandi of lake records by revenue department & lake custodian organizations are to be carried out.
- 11) Selected lakes are to be developed for augmenting water supply to city as the City can't draw water from Cauvery beyond its allocation to the City, which it will exhaust once Cauvery water supply Stage IV, Phase II is completed by 2011. Sewage entry into the selected lakes has to be stopped totally and tertiary water treatment has to be installed.
- 12) Lake management committees have to be constituted with representatives from Resident Welfare Associations/NGOs.
- 13) Traditional users of the lakes like Dhobis/fisherman interests are to be taken care

of. If lake is used traditionally for washing clothes, dhobi ghats are to be constructed when the lake is taken up for development.

9. **Action Plan**

a) **Preservation and restoration of lakes in BBMP area.**

There are 189 lakes in BBMP area, out of which 129 are with BBMP, 44 with BDA, 11 with LDA and 5 with KFD. The summary of lakes developed, being developed and to be developed is furnished hereunder. All these lakes are to be developed by the end of 2014.

Sl. No	Department	Already Restored	Restoration in Progress	Proposed for Restoration	Total lakes In custody
(a)	BBMP	13	18	98	129
(b)	BDA	7	6	31	44
(c)	LDA	9	-	2	11
(d)	KFD	2	0	3	5
	Total	31	24	134	189

BBMP can restore the 98 lakes yet to be developed, if Rs 262 crore is made available, as their internal resources are just adequate to complete the restoration works already commenced in 18 lakes. BDA is taking up the restoration work of 37 lakes (6 ongoing restoration+31 yet to be restored) through its internal funding. LDA can take up the restoration of 2 lakes and maintenance of other lakes from its internal resources and by utilizing the annual budgetary support from the Government. KFD needs a budgetary support of Rs 305 lakh for restoration of Puttaeahalli (Yalahanka), Mylasandra and Jarakbande kaval lakes and for maintenance of Madiwala and Hennur lakes. Bellandur and Varthur lakes are with BDA and they are preparing projects for restoration of these two highly polluted terminal lakes of Koramangala & Challaghatta valley. Unless the project report is ready, the cost estimates are not available.

Lake restoration on an average needs 2 to 3 years, as it involves survey, removal of

encroachments and consequent litigation, preparation of Detailed Project Reports, Technical approvals, Tendering Process, financial closure of bids and execution of restoration work. Hence the time frame of 2011-2014 is made for restoration of 189 lakes in the custody of BBMP, BDA, LDA & KFD. Details of lakes proposed for restoration are furnished in **Annexure-III (BBMP), Annexure- VI (BDA), Annexure –VII (LDA), Annexure-VIII (KFD).**

Action: BBMP, BDA, LDA, KFD

Time frame: By the end of 2014

b) **Record verification and joint inspection n of certain lakes/kuntes in BBMP area.**

There are 121 additional kuntes (ponds)/lakes as per village maps & records and a thorough verification of these cases based on records and joint field inspection is required to assess the ground position and to arrive at a time bound Action Plan. This task involves thorough verification of revenue records and village maps and physical verification of the facts on the ground. Hence time is required till December, 2011. After field verification case by case, survey of the area will be taken up and Action Plan will be drawn up for removal of encroachment necessary restoration programme. List of lakes/kuntes in BBMP area to be verified on ground is furnished in **Annexure – XI.**

Action: Revenue Department, BBMP, LDA

Time frame: By the end of 2011

c) **Preservation and restoration of lakes in the custody of Zilla Panchayat, Bangalore Urban District in Bangalore City (BBMP+BDA area)**

In BDA area (excluding BBMP area), there are 179 lakes in the custody of Zilla Panachayat, Bangalore Urban district and 18 lakes in the custody of Minor Irrigation Department. All these lake areas are to be surveyed, encroachments to be removed and fenced by the respective custodian departments in one year time. In case further restoration works are required, the custodians will complete them by

2014, with the budgetary support from the respective Departments. Minor Irrigation Department has already made a budgetary provision for survey, removal of encroachments and fencing of 18 lakes in their custody under grants from 13th Central Finance Commission. The list of the 179 lakes and 18 lakes under Zilla Panchayath, Bangalore Urban District and Minor Irrigation Department respectively is furnished vide **Annexure- IX & Annexure-X.**

Action: Zilla panchayath, Bangalore Urban District & Minor Irrigation Department.

Time frame: By the end 2012 (for ZP lakes) and by March, 2012 for MI lakes

d) BWSSB Action Plan to completely collect and treat sewage in BBMP area.

The existing sewerage system was provided in 1974 and 1982 in the core area of Bangalore city. The total length of smaller diameter sewers laid in core area is around 3367 Km and trunk sewers provided is about 243 Km. Due to continuous usage over the years, the existing sewerage system is not functioning properly. The main reasons attributable for this are encroachments made over the sewer lines at some places resulting in non-maintenance, spillage due to over load effect, crown corrosion of pipes at some reaches due to gas effect, silting up of sewer lines, damages caused to the sewer lines running in storm water drains etc. As a result the Board is finding it very difficult to convey the entire waste water generated to the STPs for treatment before discharging to the nearby lakes and water bodies. These main trunk lines and laterals need replacement.

The newly added eight Town Municipal Council areas and 110 villages to BBMP area have no sewerage network; hence trunk sewers and laterals are to be laid out.

BWSSB has 14 Sewage Treatment Plants with installed capacity of 721 MLD and these plants are operated at 50% capacity utilization as sewerage net work is not complete. Once if the sewerage net works are upgraded and networked

properly, capacity utilization of existing STPs can be optimally utilized. Waste water treatment facility of BWSSB is furnished vide **Annexure-XIV**. BWSSB has plans to establish STPs in 24 more locations with additional capacity of 639 MLD, making a total STP capacity of 1360 MLD.

The salient features of each valley, treatment facility available in each valley, action taken for replacement/rehabilitation of the existing sewers, sewerage network to be provided in the peripheral areas incorporated in BBMP is furnished vide **Annexure XV**.

The total estimated fund requirement is Rs 5972 crore, out of which BWSSB has tied up for Rs 1686 crore and funding of Rs 4286 crore is yet to be sourced. The detailed action plan of BWSSB is furnished in **Annexure-XV**

Action: BWSSB

Time frame: By the end of 2014

e) **Water quality monitoring by KSPCB.**

KSPCB will take up a onetime analysis of quality of water (twice a year) in case of all the lakes in the City to have a benchmark information.

Action: KSPCB

Time frame: One year

f) **Annual inspection of all the lakes in Bangalore city by higher officials.**

Apart from periodical inspections by field staff, a mandatory inspection by Executive Engineers/ AEE of the respective custodian organizations of the lakes, should be held annually to take stock of the status of lakes. After the annual inspection, a report shall be prepared and webhosted.

g) **Creation of data base for the lakes in Bangalore City and making it web hosted.**

LDA will build up a database for all the lakes in Bangalore City, based on the village maps and records giving Village wise, Survey number wise details and webhosting the same. The database also provides information about the status of

ongoing restoration works of lakes. Geographical Information System has to be established for proper planning and monitoring of lake conservation.

Action: LDA and Revenue Department

Time frame: By the end of 2012

h) **Augmenting Water Supply to Bangalore City from Lakes:**

Bangalore population will exceed 12 million by 2020 at the current growth rate. The present water shortage may lead to water crisis, if the problem is not tackled with lot of foresight and advanced planning. The lakes of Bangalore, if maintained properly, will augment the water supply to the city besides increased ground water recharge. The ground water is getting depleted and bore-wells of 700 to 1000 feet deep are quite common in the City these days. Looking at the grave water crisis looming, it is prudent to take up a comprehensive study of use of lakes to augment drinking water and to recycle waste water through tertiary treatment for reuse.

Action: BWSSB

Time frame: one year

10) Recommendations:

a) Government may examine extending the scope and jurisdiction of Bangalore Metropolitan Task Force (BMTF) to remove encroachments on lake lands.

b) Separate cell may be created in the Revenue Department for Survey of lake areas in the Bangalore City, with dedicated staff of 100 surveyors, to complete lake survey as planned.

c) Government may consider imposition of Green Cess and its modalities may be worked out. It may be levied on Vehicle users/POL consumers, Energy inefficient buildings etc. Funds so generated can be utilized for the maintenance of the restored lakes.

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The Committee has organized an interactive session on 11/01/2011. Dr Nandini, Chairperson, Dept of Environmental Sciences, Bangalore University; Sri C.N.Babu, CE (retd); Sri K.S.Ramaswamy, Chairman, TAC, LDA; Capt S. Prabhala, Chairman, Bangalore Environment Trust; Major Pramod Kapur (Retd), Koramangala Initiative; Ms Purnima Kumar, Research Associate, ATREE; Sri Jai Manjunath, Sepcon Systems; Sri M.Sekhar, IISc, Bangalore; Sri Sumesh Dudani, IISc, Bangalore; Sri R.Ramamurthi, Environmentalist, Bellandu, B'lore; Sri Boshy Khanna, DNA News Paper; Sri Sunil Dutt Yadav, Advocate have attended the session and offered their valuable suggestions; the committee is grateful to them.

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The Committee thanks one and all, who have assisted it in the task of Report preparation

12. Lake Restoration - Photos

Vengainakere Lake

Before restoration



After restoration



Nagawara lake

Before restoration



After restoration



Lalbagh lake

Before restoration



After restoration



Hebbal lake

Before restoration



After restoration



Kothanur Tank: Restored



Sankey Tank: Restored



Ullal Lake - Restored



Mallathahalli Lake: Restored



ANNEXURES

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