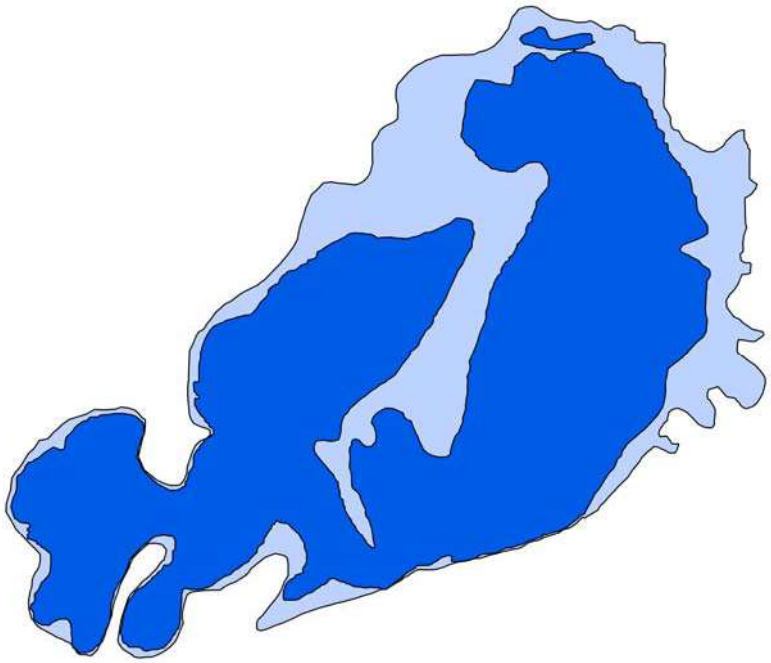
Report on the proposal for downsizing the Kolleru Wildlife Sanctuary (+5 to +3 feet contour)



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ABBREVIATIONS

+3 Contour = +3 feet above Mean Sea level Contour
+5 Contour = +5 feet above Mean Sea level Contour
ALP = Alternate Livelihood Program
APPCB = Andhra Pradesh Pollution Control Board
APSRAC = Andhra Pradesh State Remote Sensing Applications Centre, Hyderabad)
BOD = Biochemical Oxygen Demand
CEC = Centrally Empowered Committee
COD = Chemical Oxygen Demand
CWH = Critical Wildlife Habitat
CWRA = Central Wetland Regulatory Authority
DO = Dissolved Oxygen
DRDA = District Rural Development Agency
EDC = Eco-Development committees
FD = Forest Department
GoAP = Government of Andhra Pradesh
GoI = Government of India

KWS = Kolleru Wildlife Sanctuary
MoEF = Ministry of Environment & Forests, GoI
NBWL = National Board of Wildlife
PES = Payment for Ecological Services
RF = Reserve Forests
SACON = Sálim Ali Centre for Ornithology and Natural History, Coimbatore
TDS = Total Dissolved Solids
TMC = Thousand million cubic feet
TSS = Total Suspended Solids
WLPA = Wildlife Protection Act 1972
WLS = Wildlife Sanctuary

EXECUTIVE SUMMARY

Kolleru, the largest fresh water lake in India, falls in the West Godavari and Krishna districts of the state of Andhra Pradesh. The catchment of the lake extends up to 6121 km^2, of which 4763 km^2 comprise of upland, and 1358 km^2 deltaic. The high lands of the Eastern Ghats and northern plains in the Krishna basin and the southern plains of Godavari basin form its catchment. The lake is, in effect, two large conjoined elliptical sub basins, of which the larger one runs on its long axis from North to South. The two major islands in the lake, located at 1 to 2 m above Mean Sea Level (MSL), are Kolletikota and Gudivakalanka. The lake Kolleru debouches in to the Bay of Bengal through the meandering channel called Upputeru, which is about 65 km long. The channel is under strong tidal influence and turns brackish especially towards its downstream stretch.

In 1999, 308 km^2 of the Lake falling below +5 feet above MSL contour line was declared as Kolleru Wildlife Sanctuary (KWS). Even after the declaration, ecologically not-so-benign activities and encroachments continued unabated in the area. Regularizing the possession of land, aquaculture and related activities in the area became a matter of local public concern and political agenda. During the last state assembly election reduction of the sanctuary boundary to +3 feet from +5 feet contour and distributing the land thus released to public became a popular election promise. Consequently, on 4th September 2008, the Andhra Pradesh Legislature unanimously passed a resolution "*to request the National Board of Wildlife, Govt of India and the 'Central Empowered Committee' to recommend for reducing the boundary of Kolleru Wildlife Sanctuary from +5 feet contour to +3 feet contour to mitigate the problems of the farmers*".

Realizing the ecological, legal, socio-economic and livelihood related implications of the resolution, the Ministry of Environment and Forest (MoEF), Government of India (GoI) constituted this committee to look into the issue. The major terms of reference of the committee were as follows.

- Study the issue in greater detail both from the perspective of the protection of livelihood of the local fishers and farming community and the conservation and

protection of the wetland of Kolleru and recommend to the government on the merits and demerits of the proposal of the Andhra Pradesh assembly for reduction of the Wildlife Sanctuary from the contour 5 to contour 3.

- Tour extensively in the area and interact with the stakeholders including public representatives of the area and study the issue from a holistic view keeping the interest of both the local people and environment.
- Look into the matter of paying compensation to the private landowners who are losing their lands in the Wildlife Sanctuary.
- Get a quick scientific survey of the entire area done through satellite mapping to get an actual picture of the status of the lake and the alignment of the contour lines.

The committee started working on the above lines in June 2010. It realized the need for looking at the matter from a broader perspective taking into account the ecological services of the lake. In its first meeting at Hyderabad on 2nd June 2010 at Aranya Bhavan the committee decided to i) consolidate information available on Kolleru, ii) interact with the line departments of Andhra Pradesh such as forest, fisheries, revenue and irrigation departments, iii) examine relevant satellite images, contour maps and boundary maps from different agencies, iv) interact with other stakeholders; fishers, local residents, aquaculture groups, farmers, conservationists and peoples' representatives, v) conduct mandal level meetings with the stake holders and undertake field visits, and vi) consolidate all the information and prepare the report for submission to the MoEF, GoI. Since a large quantum of data and related information is to be examined on Kolleru to develop a realistic perspective of the issues, the committee required more time than that was initially given by the MoEF.

The necessary data or information were collected from district administration, forest, revenue and fisheries departments, DRDA, APPCB as well as published and grey literature. Field visits were undertaken from 20 to 25 September 2010, in and around the lake Kolleru interacting with various field officials from government departments, the public and the leaders to understand their views and perceptions. Later the committee met a couple of times at SACON (Coimbatore) and APSRAC (Hyderabad), going through the drafts and finalized the report.

Kolleru lake system represents one of the largest and oldest natural lacustrine systems in the country. The lake receives water from several sources, of which the streams Budameru, Tammileru (East and West branches), Ramileru, Gunderu and Bulusuvagu are natural and foremost in terms of water input.

Like all wetlands, the lake lacks definite boundary and has an irregular shoreline. In fact, the lake's boundary varies depending upon the seasonal inflows and outflows, as is the case of all inland wetlands. The Lake could extend to an area falling below +10 feet contour with a water-spread over 901 km^2 during monsoon. It could recede down in summer to at +3 feet contours with water spread of about 135 km^2 or lower at times.

The lake Kolleru and its surroundings have 148 rural settlements (50 in the lake-bed and 98 in the belt area). Primary occupation of people in the bed villages is fishing; agriculture being the second option. People in the belt villages have agriculture as primary occupation, followed by fishery related activities. Major crop raised here is rice, cultivated twice in a year. Kolleru also supports duckary, earlier an important means of livelihood for the locals. Capture fishery was also an important means of livelihood for large proportion of the people residing in the area. Fishery in the area, during the last couple of decades had shifted to a more capital intensive corporate venture.

The comparatively shallow Kolleru lake ecosystem offers excellent habitats for a variety of resident and migratory avian species. Several endangered or threatened species are also seen here. The Kolleru Lake is also an Important Bird Area. Avifauna of the area include a variety of waterfowl including ducks, teals, storks, egrets, herons, ibises, bitterns, cormorants, and a number of waders. More than 200 species of birds have been reported from the lake and its environs. Around 100 species of birds reported form the lake are migratory birds coming from different parts of Eurasia (Palaearctic region). These species depend largely on the wetland to meet their resource requirements.

Other fauna in and around the lake include various species of invertebrates, fishes, amphibians, reptiles, and mammals. About 63 species of fishes belonging to 29

families have been recorded from the lake. Of these, 44 are freshwater species. The natural species composition of fishes seems to have considerably changed for various reasons. Recently air breathing fish such as *Anabas testudineus, Anabas oligolepis, Heteropneustes fossilis* and *Clarias batrachus* are reported more frequently from the lake, perhaps for the low dissolved oxygen due to high organic pollution load in the water.

Besides offering critical habitats to several globally important faunal and floral groups, the lake offers many important ecological services some of which are discussed elsewhere in this report. Considering that the lake functions as a flood-moderating reservoir between the Krishna and Godavari deltas and that it supports several vulnerable species and a variety of resident and migratory birds, the Kolleru wetland was declared as a Wildlife Sanctuary, a RAMSAR site and also as an Important Bird Area (IBA). **However, of late, indiscriminate exploitation of the Kolleru area has evidently resulted in depletion of many of the ecological goods and services conventionally derived from it leading to unwanted flooding and other negative consequences.** Anthropogenic pressures such as cultivation in the lake bed, lavish use of fertilizers and pesticides, large-scale encroachment of lake bed for aqua farms, fishpond discharges, domestic wastes and sewage from three municipalities, and discharge of industrial effluents and agricultural run-off carrying inorganic nutrients have vitally affected and altered the ecological character of the wetland.

During the last couple of decades, the changing socio-economic and political milieu of the state in general and the region in particular brought enormous alteration to the lake area and consequent strains on this wetland ecosystem. Land use changes associated with aquaculture, industrial development, contemporary agriculture practices, and roads and bunds in the wetland area fragments the entire wetland and restrain its natural hydrologic regime and ecological cycles. Studies using remote sensing and GIS show striking increase in the land under aquaculture. The lucrative business of aquaculture made far reaching consequence on the habitual land use in the lake area. Encroachments in to the wildlife sanctuary and conversion of rice paddies to aquaculture farms has become commonplace in the wetland. Encroachments in

Kolleru Wildlife Sanctuary between 1999 and 2005 for aquaculture farms are also reported.

It was reported that increased aquaculture activity helped the proxy cultivators than the genuine owner farmers. However, there are no (documentary evidences) records to this effect as the lease agreements are mostly verbal understandings, without written agreements, made in the presence of village elders and at times in village temples before the deity.

Eutrophication and changes in flora and fauna has happened in Kolleru. Almost 60% decline of apple snail is reported, certain species of fish have either become rare or disappeared from the lake due to the inland aquaculture, and some of the birds have disappeared from the area. Submersion of paddy fields in the belt villages of Kolleru have become frequent and wider, and farmers in belt villages, beyond +5 contour levels, are being badly affected due to the submersion of crops because of the floods aggravated with the proliferation of fish tanks with high rise bunds below and above +5 contour by infringing on to the natural drainage regime.

As a result of judicial interventions, in 2006 “Operation Kolleru” was undertaken, to demolish illegal fish farms in the sanctuary area. Nevertheless, there are several reports that the fish tanks were formed afresh and are in operation. Floods have continued for various reasons acting in concert. The “Operation Kolleru” an act undertaken upon judicial interventions, lasted 55 days, in three phases starting from 16 February 2006 and completing on 13 June 2006. As reported, 1776 large tanks were destroyed and 89.08 lakh cubic meters of earth forming the tank bunds were removed. The operation had notable socio-economic and ecological impacts.

Kolleru Wildlife Sanctuary was declared vide GO Ms No 120 dated 4-10-1999, covering a part of the lake falling below +5 feet contour. However, appropriate compensation for loss of land was not made and Resettlement and Rehabilitation (R & R) issues were not satisfactorily addressed. Neither alternative sources of livelihood were developed nor was any socioeconomic development through community participation attempted. No attempt to disseminate correct message about the sanctuary and its socio-economic and environmental implications is known to have

been made. No attempt is also known to have been made to conduct a proper survey of the whole area focusing on its wetland / ecological characteristics, depth profile and re-confirmation of the so-called contours. Thirty-eight villages falling in five mandals were listed in the preliminary notification, but in all, 74 villages in 9 mandals were notified in the final notification. The reasons for these variations were left ambiguous and not justified in the final notification. Several issues related to the sanctuary notification remains to be addressed and settled.

The committee made extensive tour of the area and interacted with the stakeholders. The public meetings were very interactive; however, the committee while sitting through the whole proceedings developed a gut feeling that almost all of them appeared as stage managed by the leaders advocating a particular view point; reduce the boundary of the sanctuary. **It was felt that alternative view points were censored and not allowed to be brought up to the committee**.

During the public meetings and the journey through the villages 2269 representations were received. Overwhelming majority supported reduction of the area of the wildlife sanctuary, to bring down its boundary from +5 feet contour line to +3 feet contour line. The committee examined various arguments for and against reduction put forth before it. Some of the arguments essentially focused on the livelihood issues and economic development of the area, while some rare voices raised wider issues such as ecological services, habitats for a large number of endangered and threatened wild species, water storage, ground water recharge and so on. The representations largely points to the hype created for reducing the sanctuary area and to a large extent the lack of correct information reaching to the stakeholders.

Although human beings are highly dependent on ecosystem services, sufficient ecological understanding of the same is still wanting. In the case of Kolleru, information on these aspects is practically absent. As of now, the ecosystem services are generally taken for granted as free of cost and hence remain invisible to market forces. A change is urgently required in this outlook. A change is required to adequately value these veiled but vital services and to make provisions for payment for these ecological services (PES).

Managing ecosystems addressing human needs involves several trade-offs that require detailed understanding of the biophysical magnitude of the changes in ecological services resulting from human actions and the impacts of these changes on human welfare. It is felt that before considering any further changes in the KWS or the Ramsar area, it is prudent to understand the characteristic ecological underpinnings of the area, and to integrate the knowledge in the socio-economic context to develop better policies and management strategies that will help balancing the aspirations of the local inhabitants and the larger conservation needs.

An ecosystem like Kolleru has to be considered as a natural, renewable resource generating infrastructural asset. It is wise to invest in preservation of this common wealth bestowed on us by nature. The nation and people from the mainstream has to support the locals for helping in maintaining the ecosystem with all its conservation and ecosystem values; payment for ecological services (PES). **The local public needs to be rewarded or benefited from the conservation of local resources.** The nation and the people from the mainstream should be made to pay for the invisible / intangible ecosystem services / benefits, essentially invisible to the market forces and this should accrue visibly to the benefit of the local inhabitants.

Looking at the issues confronting the KWS, the local inhabitants and the lake ecosystem we conclude that reduction of the wildlife sanctuary area would worsen the situation in Kolleru. In due course of time most of the lakebed is likely to be converted into fish tanks. Floods will remain incessant. The ecological setup of the area will degrade and wildlife will certainly suffer and many species will become locally extinct.

It is apparent that contours would have lost its expected sanctity because of anthropogenic interferences, excavations and siltation. **The floods happening in the area are largely due to unscientific human interventions interfering with the hydrological regimes and flow pattern.**

The boundary has to be fixed and standardized after scientific consideration of the ecological characteristics, and environmental flows to ensure the ecosystem sustainability of the area. Issues to be considered seriously while re-fixing the

boundary are i) critical water level from hydrological point of view, ii) ecological requirement including habitat and breeding requirement for migratory and resident species both during monsoon and non monsoon seasons, iii) ensuring the minimum level of water required especially during the lean and winter months, iv) functioning of the water body as a flood barrier and v) traditional agricultural / fishery practices.

The area need to be mapped in full based on ecological and conservational aspects and the area that is relatively undisturbed and frequented by the birds need to be demarcated. That area will remain impermissible to all activities, called core area, and shall be declared as a "**Critical Wildlife Habitat**". Till such a survey is conducted the area within +3 feet contour must be untouchable and inviolable. Beyond this area a stretch skirting this core area will be demarcated as buffer area or conservation area, where environmentally benign activities will be permitted and will be managed by a co-management group, as cited in the Wildlife Protection Act. Till the survey mentioned above is done, the area falling between +3 and +5 feet contour will be considered as buffer area, under the full control of the forest department. It may be noted that as per the Wetlands (Conservations and Management) Rules 2010 all Ramsar sites are fully protected.

Execute appropriate R& R policy for all affected people within the contour +3 feet to +5 feet. People below 3 feet contour, holding zirayithi pattas, may be relocated paying appropriate compensation, as is legally mandatory, for the land holding coupled with a package for livelihood losses. The D-form patta holders also need to be offered a package for livelihood and involve them in the management of the lake to obviate the possible conflicts. Compensation may be considered as in certain precedent situations done by the Irrigation Department in Andhra Pradesh.

Under the Wildlife (Protection) Act, 1972, the state government can declare an area as Wildlife Sanctuary. However, upon issuing the final notification, all authority vests with the central government who has to seek approval of NBWL and its standing committee to make any changes in the notification. In the instant case where Supreme Court has already passed final orders, orders from the Supreme Court also have to be obtained. Hence the state governments should be careful, in future, to follow the provisions of the Act meticulously while declaring sanctuaries, especially those

clauses dealing with determining and settling the rights of people. If the genuine rights are denied, that nullifies the purpose of declaring an area as protected, because of several socio-economic, cultural, and legal complications and repercussions that would rise from antagonizing the local public who otherwise could have been patronized to be at least apathetic towards the protected area if not the custodians of its ecological resources and values. **The conflicts in Kolleru has turned out to be this grave largely due to the failure on the part of the concerned authorities in addressing relevant socio-economic and legal issues arising from the declaration of the sanctuary in time.**

Reduction of the present sanctuary area is not a viable solution for the socio-economic and ecological issues confronting the Lake Kolleru. A detailed survey of the lake Kolleru is to be conducted to delineate boundary based on ecological characteristics at the earliest. **However, pending the detailed survey by a technically competent agency, no change in the status of the area under the KWS should be permitted, including operation of the fish farms within the existing boundary of the sanctuary.**

The lake Kolleru serves several ecological services and that needs to be preserved for posterity. As noted above, it is a valuable infrastructure asset bestowed on us. The state needs to take active measures to conserve the same; it is always wise to invest public money on conserving a public resource and in providing for appropriate means to ensure confidence of the public and their participation in the endeavor. Striking a balance between environmental concerns and livelihood issues is a challenge, which the managers and policy makers essentially are required to address.

1 PREFACE

In 1999, part of the Lake Kolleru was declared as Kolleru Wildlife Sanctuary (KWS). Even after the declaration, ecologically not-so-benign activities have continued in the area unabated. Spread of aquaculture farms and encroachments in the lake area has remained unrelenting. Regularizing the possession of land, aquaculture and related activities in the area becoming a matter of local public concern, during the last state assembly election campaign reduction of the sanctuary boundary to +3 feet above MSL contour level and allotting the released land to public turned up to be a popular election promise. The government which came to power, although of a different political alliance to that which brought up the subject as an election issue, declared the reduction of the contour line bordering the wildlife sanctuary and passed a unanimous resolution. On 4th September 2008, the Andhra Pradesh legislature passed a resolution "*to request the National Board of Wildlife, Govt of India and the 'Central Empowered Committee' to recommend for reducing the boundary of Kolleru Wildlife Sanctuary from +5 feet contour to +3 feet contour to mitigate the problems of the farmers*".

Realizing the ecological, socio-economic, livelihood and legal implications of the resolution, the Ministry of Environment and Forest (MoEF), Government of India (GoI) constituted a committee to look into the issue (Appendix 1). The major terms of reference of the committee were as follows.

- Study the issue in greater detail both from the perspective of the protection of livelihood of the local Fishers and farming community and the conservation and protection of the wetland of Kolleru and recommend to the government on the merits and demerits of the proposal of the Andhra Pradesh assembly for reduction of the Wildlife Sanctuary from the contour 5 to contour 3.
- Tour extensively in the area and interact with all the stakeholders including public representatives of the area and study the issue from a holistic view keeping the interest of both the local people and environment.
- Look into the matter of paying compensation to the private landowners who are losing their lands for the Wildlife Sanctuary.

- Get a quick scientific survey of the entire area done through satellite mapping to get a realistic picture of the status of the lake and the alignment of the contour lines.

The committee started working on these lines in June 2010. However, upon deliberation the committee realized the need for looking at the matter from a broader perspective taking the ecological services from the Lake Kolleru.

2 OPERATIONAL STRATEGY OF THE COMMITTEE

The committee first met at Hyderabad on 2nd June 2010 in the Aranya Bhavan, Hyderabad and deliberated upon the strategy to go ahead with the work. It was decided to i) consolidate information available on Kolleru, ii) interact with line departments of the Andhra Pradesh government such as forest, fisheries, revenue and irrigation departments, iii) examine relevant satellite images, contour maps and boundary maps from different agencies, iv) interact with other stakeholders; fishers, local residents, aquaculture groups, farmers, conservationists and peoples' representatives, v) conduct mandal level meetings with the stake holders and undertake field visits, and vi) consolidate all information and prepare the report for submission to the MoEF, GoI.

A large quantum of data and related information is required on Kolleru to develop a realistic perspective of the issues. Accordingly requests were made to the central and state governments for directions to the concerned government departments. Orders that came in due course from the union government as well as the state government could facilitate collection of relevant data from the concerned line departments. Secondary data / information were also gathered from various published and unpublished reports / articles in scientific journals and other sources. News items were also followed to appreciate general local situations and perceptions. Thus, data or reports were collected from district officials such as district administration, forest department, District Rural Development Agency (DRDA), Andhra Pradesh Pollution Control Board (APPCB) and Fisheries department.

The Andhra Pradesh State Remote Sensing Applications Centre (APSRAC, Hyderabad) kindly came forward to extend their expertise and was entrusted with the task of acquiring satellite imageries, digitizing concerned cadastral and revenue maps, analyzing them and preparing required output maps and to provide the required analysis results. The major primary information the committee obtained was from the APSRAC.

In addition the committee undertook intensive field visits, during 20 to 25 September 2010, in and around the lake Kolleru and interacted with various field officials from government departments, the public and the leaders to understand their views and apprehensions. The field visits also helped the committee to have firsthand experience of the ground situation and to verify a range of multidimensional and multi-sectoral issues brought up from various corners during the visit. Incidentally, during this period the Kolleru was widely flooded, giving the committee a chance to take account of the flood miseries. The committee also collected written representations from various stakeholders, local public, civic and non-governmental organizations, community leaders and elected representatives of the area and conducted public hearings at pre-determined and widely publicized locations (Appendix 2, Figure 1) looking for diverse viewpoints. Figure 2: shows the route map of the field visits.

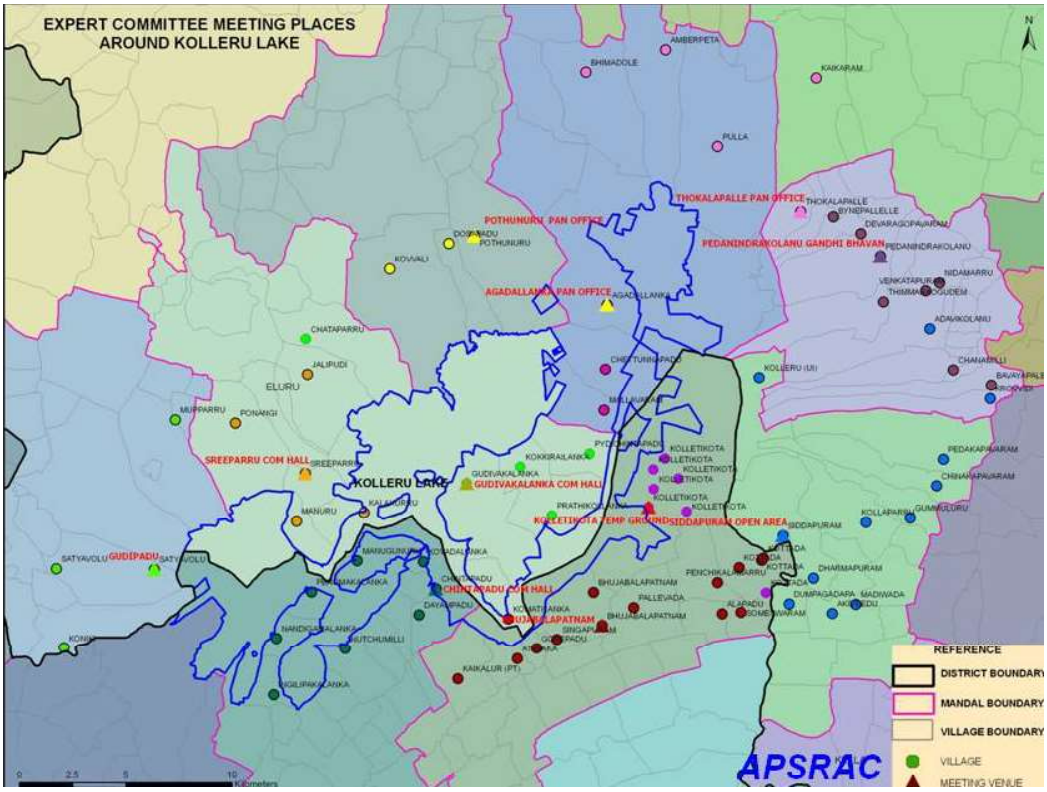

Figure 1: The locations (purple triangles) of the public meeting
See Appendix 2 for details. Courtesy: APSRAC

The second meeting of the committee was held at SACON, Coimbatore, on 14 and 15 November 2010 to develop the framework of the report. It was decided that after making a tentative draft of the report, incorporating the respective contributions from the members, the committee could discuss the same at APSRAC, Hyderabad, on 14

and 15 January 2011. Same day, upon consolidating the available information and its scrutiny, SACON was entrusted to improve upon the write up and develop the draft report to be circulated among the members for further improvement. Incorporating the corrections and comments from individual members of the committee, and after further discussions amongst us the report was finalized. For the extensive work involved the committee required more time than that was initially given by the MoEF.

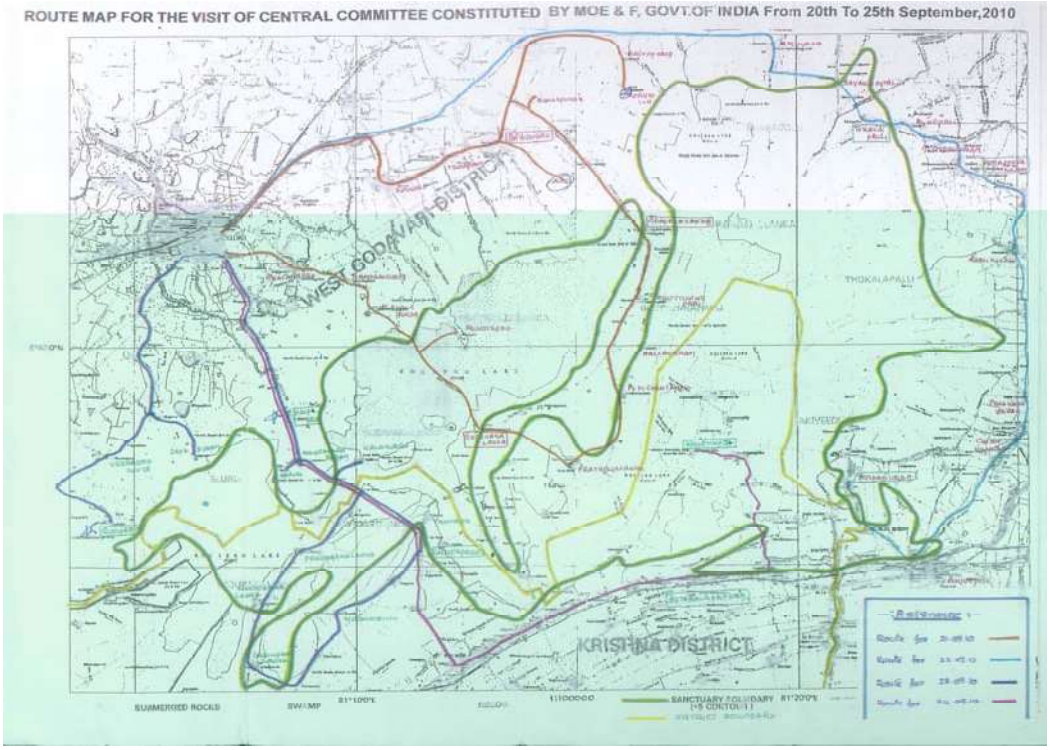

Figure 2: Route map of the field visits

3 THE KOLLERU LAKE SETTING

The Kolleru Lake (N 16º 32'& 16º 51'; E 81º 05' & 81º 20') is the largest fresh water lake in India, situated in the alluvial plains formed between two major rivers, the Godavari and the Krishna, in Andhra Pradesh (Figure 3:). The lake is spread across mostly in West Godavari district and partly in Krishna district. The lake area is covered in the Survey of India (SoI) topo-sheets 65 H/1, 2,5,6,9 and 10 (Ramana Murty and Reddy 2010). The lake serves several functions which are discussed below. In recent years several changes have taken place in the basin. Some of such important changes are discussed towards the later sections of this report.

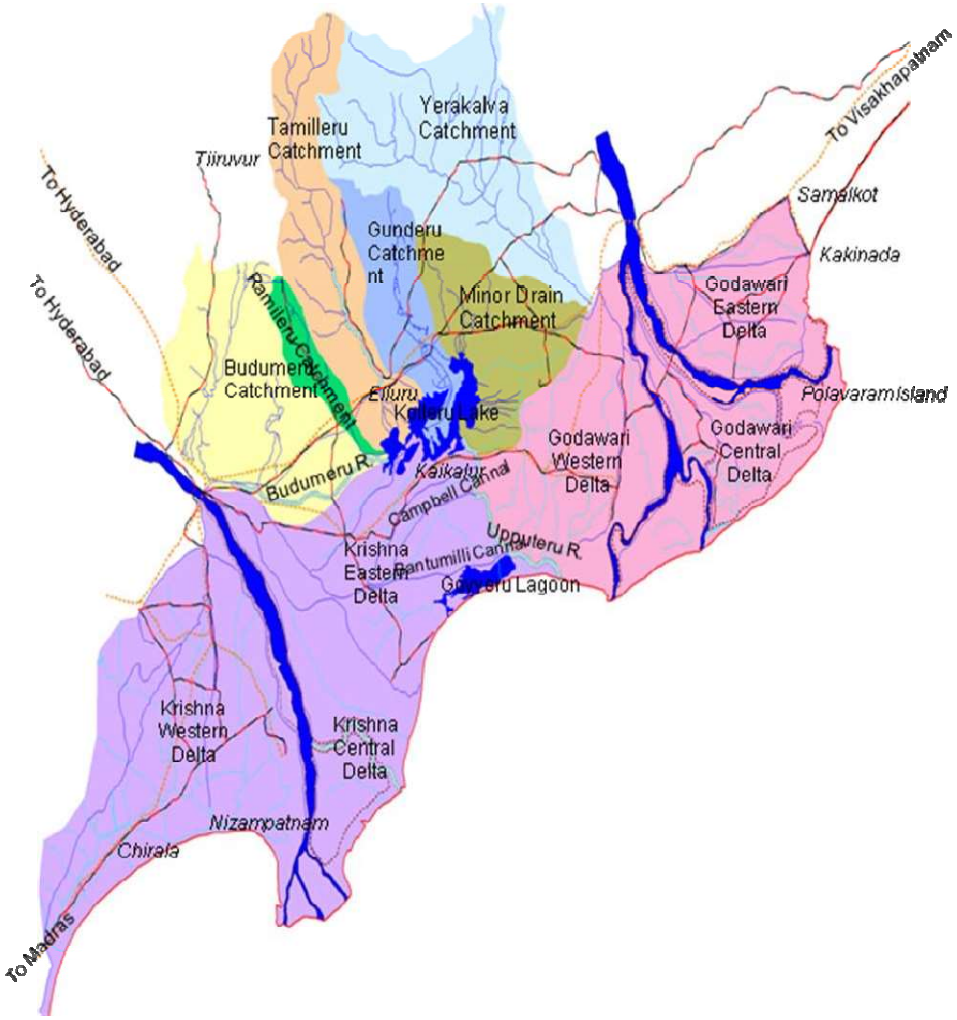

Figure 3: Geographical location of Kolleru
Source: Conservator of Forests, Eluru

3.1 Historical perspective

The Kolleru area has a hoary past having figured prominently in the history of Andhra Desha. The area was ruled by Mauryas (around 300 BC), Satavahanas (200 BC to 200 AD), Ikshvakus and Salankayanas. The Kolanu durgam (Fort at Kolletikota) became famous during the rule of Chaluka Choda and Vikramadeva Choda. Rajendra Chola and later Kulothunga Chola II wielded power over the area (Bhavaraju Venkata Krishna Rao 1942). Two copper plates found in the lake Kolleru reveals that Pallavas ruled the lake area in 4^{th} century followed by Chalukyas. The Western Chalukya king Pulikesin II marched on Vengipura, the capital of Vengidesa. According to Sir Walter Eliot, Kolleru lake area was called Kudrahara. Invasion of the Andhra country by Pulikesin II was checked by the vassals of Vishnukundin Empire. However Pulikesin's army crossed the river Godavari and attacked Vishnukundin king Mahendravarman III. Failing to resist the invader in the open field, he took refuge in the fortress of Kolanupura in the lake Kolleru. Pulikesin II laid siege of the fort and Mahendravarman III was defeated and slain. Pulikesin II installed his brother Kubja Vishnuvardhana as the ruler with Vengi as the capital. Chalukyas were succeeded by Cholas with Tanjore as their capital. Later Velanadu cholas ruled the area. Hieun Tsang, the Chinese traveler who visited Andhra Desha during the rule of Jayasimha (633-56 A.D) has recorded the presence of several ships of Jayasimha anchored in the lake, Hindu temples and Buddha vihara in the area.

3.2 The catchment and geomorphology of the basin

The catchment area of the lake extends up to 6121 km^2, of which 4763 km^2 comprise of upland, and 1358 km^2 deltaic (Ashok Kumar 2007, Figure 4:). The high lands of the Eastern Ghats situated 32 to 80 km away from the lake in the north and the flood-plains of Krishna and Godavari form its catchment. The upland area of the catchment falls in Khammam, West Godavari and Krishna districts of Andhra Pradesh.

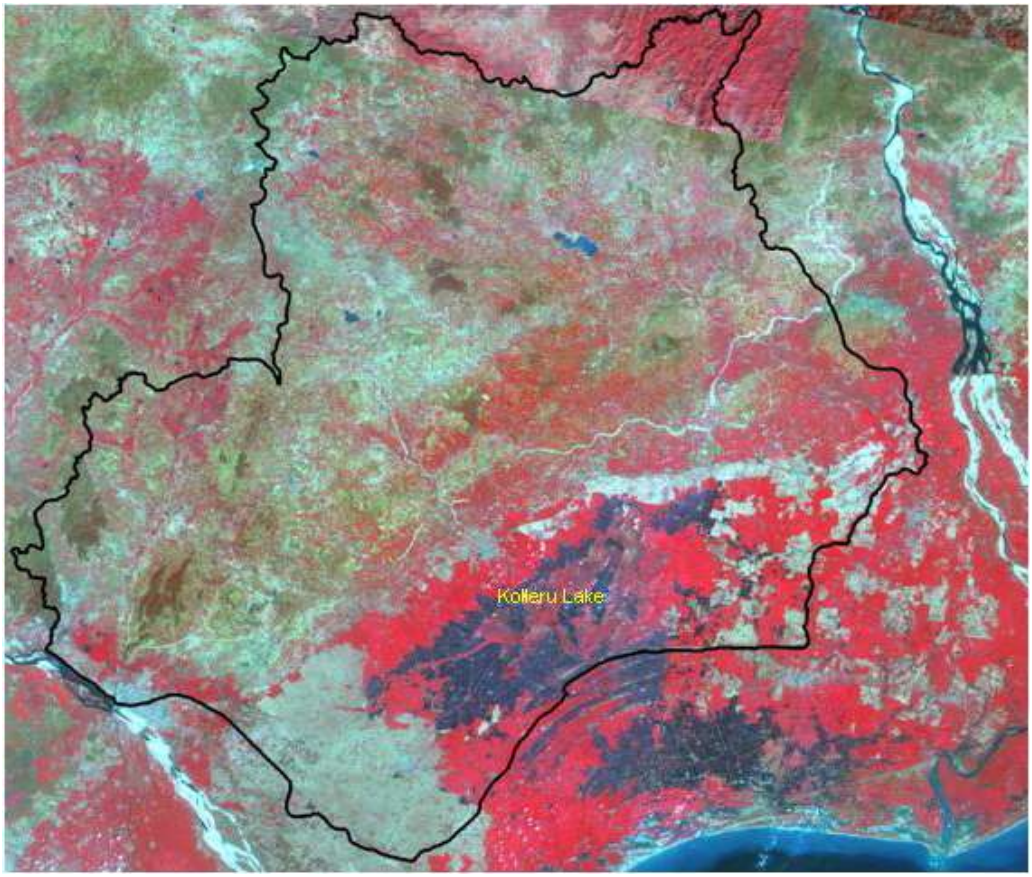

Figure 4: The catchment of the Lake Kolleru

Geological formation of the area consists of alluvial deposition with Khondalite, the Gondwana and Deccan trap rocks on all sides. Topographically the Lake is located over a deep-seated tectonic depression, which is geo-physically known as Gudivada sub-basin between the Bapatla and Tanuku subsurface ridges or highs (Raju et al., 2003). The unique topography of the area is an important reason for the lake's existence. The lake is believed to have been formed during the Holocene epoch (around 6000 years BP). The progradation of the coast line and evolution of the delta and transformation of the lake from an open marine bay to tidal lagoon delta and mangrove swamp to fresh water lake is discussed by several geologists (e.g., Babu, 1978; Mahendra Reddy and Shah, 1991; Biswas, 1993; Rao, 1998). Geologists consider the presence of a series of relict sandy beach-dune ridges right up to the southern margin of the lake near Kaikalur and Akiveedu towns as evidences for the narrowed shore line to the far inland during the geological past that eventually broadened up in the later years (Sadakata and Rao, 1997). The lake about 6000 BP

said to be a coastal lagoon as of now is more than 35 km inland from the current coast line. The only out let of the lake to Bay of Bengal, the Upputeru channel (Figure 5, Figure 6), an intricately meandering tidal channel playing crucial role in the maintenance of wetland's hydrological regime, is also distinctive evidence of it as a one-time coastal lagoon. It is assumed that as the Krishna and Godavari deltas became wider, the lagoon receded and got restricted to inlands (Rao et al., 2004).

Figure 5: The Upputeru debouching to the Bay of Bengal

The lake essentially is two large conjoined elliptical sub basins of which the larger one runs on its long axis from North to South. The lake as a whole slopes gently towards South-East. At its maximum, the lake is 39 km long and 22 km broad. Its mean depth reportedly varies from 0.5 to 2.0 m, while the maximum depth is about 10 m. For most part of the year the water depth varies between 1 and 1.5 m. During flood season it reaches 3 to 4 meters. The water body is known to occur between the bathymetric ranges of 0.3 m below sea level to 3.2 m above the sea level (Nandakishwar Rao, 1988). The belt area is 2 to 3 m above the sea level while the islands in the lake are 1 to 2 m above the water level (Radhakrishna, 1989). The two major islands in the lake are Kolletikota and Gudivakalanka.

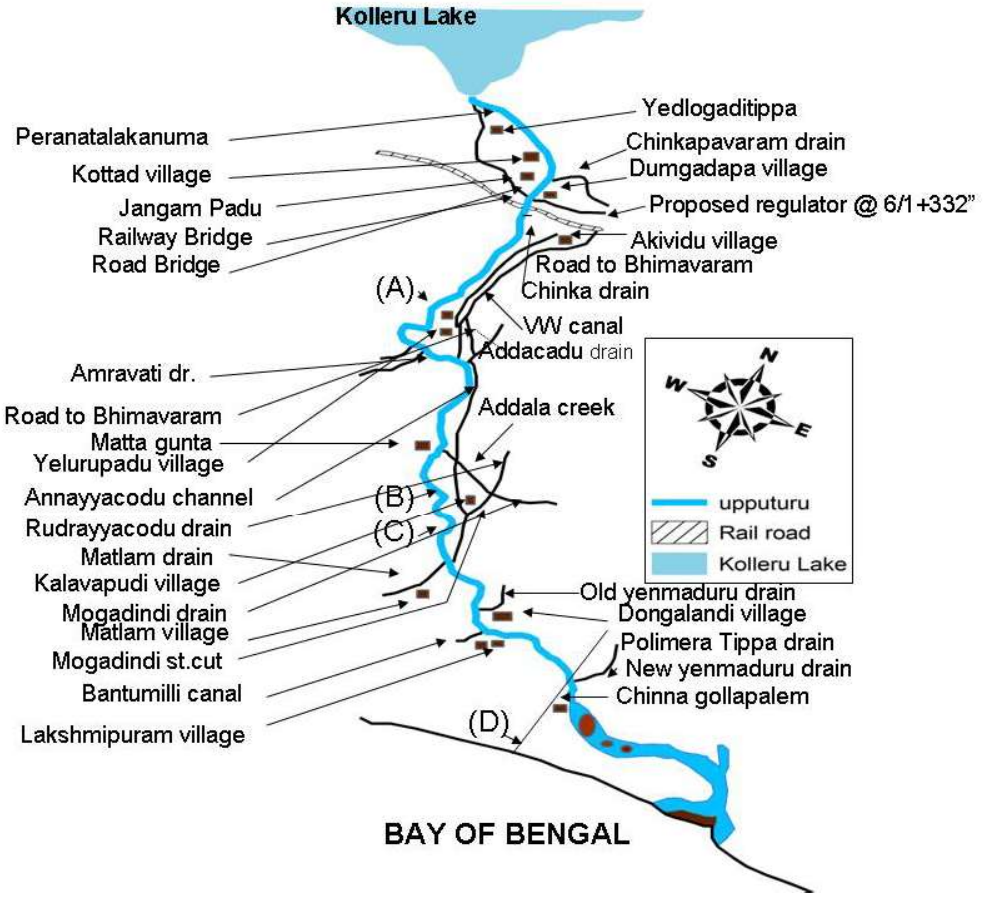

Figure 6: Diagrammatic representation of the Upputeru outlet

The landforms in the Kolleru basin are of different origin; fluvial, marine, fluvio-marine, and denudational (Ramana Murty and Reddy, 2010). Of the five strandlines seen in the Krishna-Godavari deltaic region, that indicates the five stages of deltaic growth (Biswas, 1993), the Kolleru lake lies in between Strandline 1 and 2 (Ramana Murty and Reddy, 2010). Major geomorphic features identified in the basin are palaeo-lagoons, palaeo-channels, beach ridges and swales, deltaic plains, and the palaeo-channels, a fluvial landform of significance, which are concentrated towards the east and south of the lake. Palaeo-channel (low) is within the frequently flooded region. Other landforms of fluvial origin seen in the basin include palaeo-channel bars, palaeo-islands, present-islands and swamps. Landforms of marine origin include the present extent of palaeo-lagoon, beach-ridge and swale. The fluvio-marine landforms include deltaic plains of three gradients; upper, middle and low. The upper limit of deltaic plain-upper closely follows a curvilinear path in the vicinity of Elluru

and Unguturu. The denudational landforms include pediplains of shallow, moderate and deep withering, pediment and residual hills. These landforms present in the north and the northwest of the Kolleru Lake, are of least significance (except deeply weathered pediplain) from the view of flooding.

3.3 Demography

Currently, the lake and its surroundings are inhabited by large number of people belonging to several villages (Figure 7, Appendix 3). There are 148 rural settlements (50 in lake bed and 98 in the belt area, spreading over the West Godavari and Krishna Districts. The Kolleru wildlife sanctuary is spread over 7 mandals (a revenue and development unit in Andhra Pradesh) in the West Godavari district and 2 mandals in Krishna District. In total, stretching across both the districts there are 64 revenue villages that cover 74 settlements and 66875 households (Table 1).

Table 1: Mandal wise demographic details of Kolleru wild life sanctuary

No	Mandal	Revenue villages	Settlements	Households	Population
West Godavari district					
1	Unguturu	1	1	2367	9520
2	Bhimadole	5	6	8731	34117
3	Pedapadu	2	3	2303	8627
4	Elluru	11	11	7973	31149
5	Denduluru	3	3	5012	18883
6	Nidamarru	11	11	9305	36310
7	Akiveedu	10	10	14896	59460
	Sub Total	*45*	*45*	*50587*	*198066*
Krishna district					
8	Mandavalli	8	8	2559	10316
9	Kaikaluru	11	21	13729	55995
	Sub Total	*19*	*29*	*16288*	*66311*
	Total	***64***	***74***	***66875***	***264377***

Source: Wildlife Management Division, Eluru

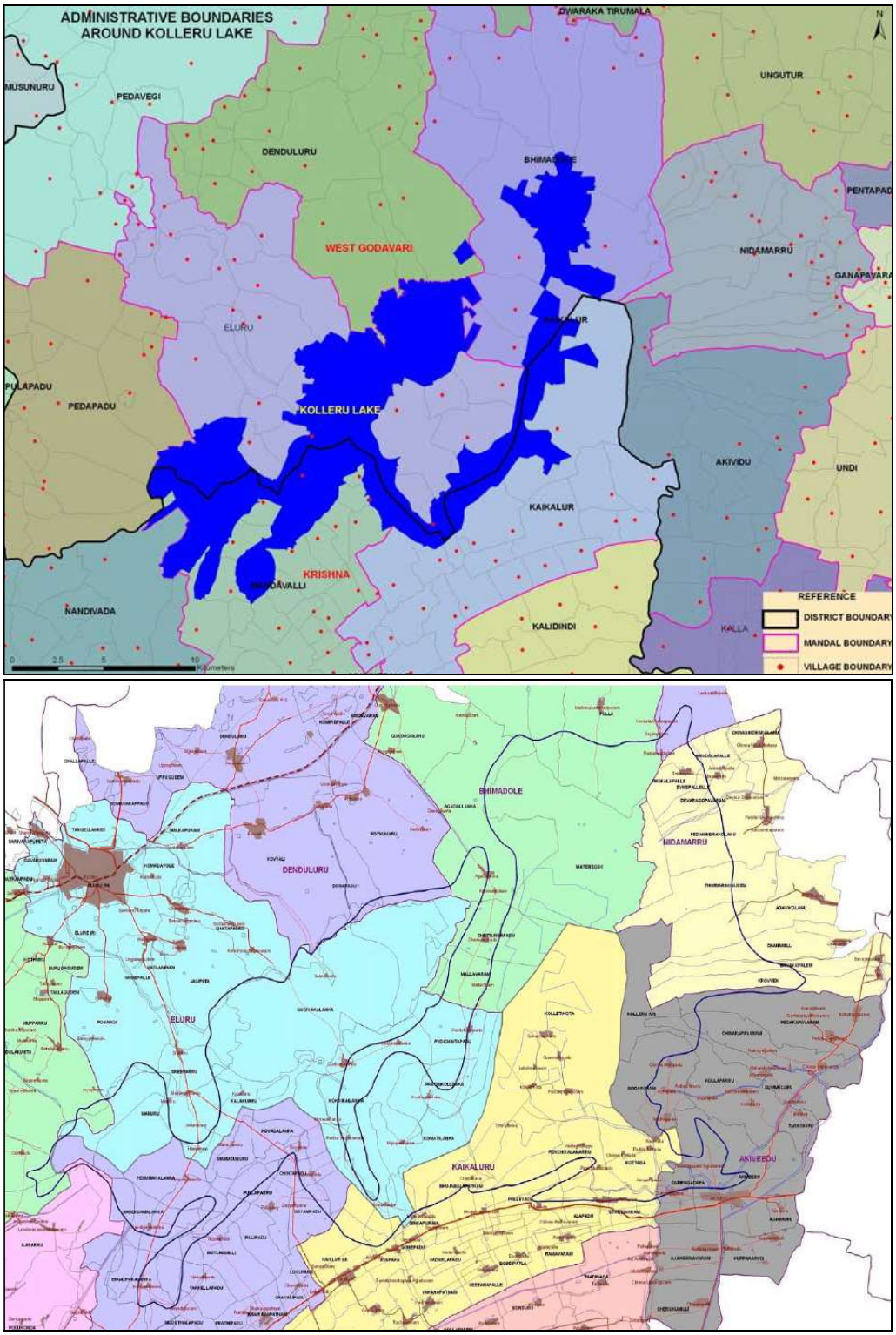

Figure 7: Mandals / Villages within Kolleru Lake
Source: Above - APSRAC; below - Conservator of Forest, Elluru

3.4 Socio-economic set-up and livelihood changes of the area

Human settlement in and around the Kolleru lake is spread over the islands, bed area and the marginal (borderline) area of the lake. Of almost 3 lakh people residing in the bed villages, islands and borderline villages and settlements in Kolleru lake area only about 10% belong to the Scheduled Caste (SC) and 0.54% belongs to the Scheduled Tribes (ST, Table 2). The percentage of SC and ST population is relatively high in the shoreline area of the lake (Mittal, 1993). Most the population in the area belongs to Backward Classes; the *Vaddi* community.

Table 2: SC/ST proportions in Kolleru habitations

Habitations	SC (%)	ST (%)
Bed villages	5.38	0.06
Belt villages	19.92	0.64
Total area	10.08	0.54

Source: Mittal 1993

Primary occupation of people largely belonging to scheduled castes and tribes, and backward classes living in the bed villages are fishing; agriculture being only the second priority. On the other hand, people living in the belt villages prefer agriculture as their primary occupation, fisheries being the second vocation. In addition to agriculture and aquaculture many of the villagers are rearing ducks (Kumar, 2010). Most of the bed villages lack private land for cultivation. In villages such as Prathikollalanka since there are no private lands, people have been cultivating in government owned bed lands in the lake (Mittal, 1993). The fisher folks belonging to backward community (BC) mostly use or have leased out their land for aquaculture whereas those from SC community prefer agriculture as their main occupation and source of income (Kumar, 2010).

Literacy rate among the villagers in and around the Kolleru is very poor (Table 3). Literacy as per 2001 population census for the whole district is much higher (Table 4). Studies have also reported high level of poverty in the rural households of Kolleru lake. Most of the wage laborers in the area are migrants from Orissa.

Table 3: Literacy in Kolleru region

Habitations	Male (%)	Female (%)	Total
Bed villages	25.53	9.98	17.8

Belt villages	21.98	11.34	16.7

Source: Mittal 1993

Table 4: Literacy rates for the districts

District	Literacy rate					
	Persons		Males		Females	
	1991	2001	1991	2001	1991	2001
West Godavari	53.38	73.95	55.75	78.43	43.3	69.45
Krishna	53.16	69.91	60.55	74.57	45.54	65.05

Source: Census of India 2001

3.4.1 Agriculture

The major crop raised in the area is rice. Rice cultivation in the region dates back to ancient periods; presently about 32908 hectares of land in the lakebed is being used for traditional farming of the local variety of rice *Yerra Var* (Irrinki and Irrinki, 2007). Rice cultivation in the catchment is done twice in a year; first crop during July to September (summer crop; *Kharif*), and second crop from November to March (winter crop; *Rabi*). Average yield from rice cultivation in the area is 1750 kg/hectare (Irrinki and Irrinki, 2007). It is reported that only second crop is possible between +3 and +5 feet contour (Federation of Retired Irrigation Engineers 2010). Within +5 to +7 feet contours both crops are possible while the first crop is highly prone for seasonal flooding.

The rice paddies of the Kolleru also support Duckary, second important livelihood for the villagers from which an annual yield of 710 lakhs of duck eggs were estimated to be produced. Ancillary benefits from duckary include about 37000 tons of duck droppings per year that help enriching the lake water with nutrients of biological origin. It is also believed that ducks in the area acted as agents of biological control for vectors such as mosquito and thus check vector borne diseases like malaria and filariasis. During last couple of years duck rearing in the lake has drastically decreased, perhaps due to encroachment and large scale conversion of rice paddies to aquaculture farms.

The variety of aquatic plants in an around the lake provide very good grazing for cattle belonging to the local households. Aquatic plants believed to be nutritious than hay are widely used as livestock feed. Harvesting macrophytes and grasses is also a

source of income for those living in the area. *Phragmites karaka, Typha* spp and *Cyperus* spp are extensively used by fisher folks for thatching roofs and making mats. They use *Alternathera sessilis* as leafy vegetable and rhizomes of *Nymphaea* sp as food supplement. *Salvenia molesta* is used as mulch in the gardens and compost made of water hyacinth is used in the coconut plantations.

3.4.2 Fishery and aquaculture

Capture fishery historically was an important means of livelihood for large proportion of the people residing in the area. However, during the last couple of decades the fisheries in the area have evidently shifted to a more capital intensive corporate fish farming. Aquaculture in Kolleru was started extensively in the eighties which later spread to other areas in the Krishna-Godavari delta (Katiha et al., 2010). Being a lucrative business, it is estimated to generate annual income to the tune of Rs 1500 to 2000/- crores (The Hindu, 2006) and attracts large number of investors to the area. According to Ramakrishna (2007), carp culture offers livelihood to thousands of people and numerous associated industries in and around the lake. Fish and prawn from the area are being exported to several states in India, especially West Bengal and other north eastern states and other countries (Anonymous – Industrial Profile of West Godavari District, Rao et al., 2008). Apparently Kolleru has turned into the 'fish bowl' of India, and 'Kolleru model' carp cultivation has become widely known. From 1999 to 2001 the West Godavari district has shown 24% increase in inland fisheries production, while Krishna district showed an increase of 56%, making these districts among the top in the state of Andhra Pradesh (Rao et al., 2008), especially for fishery growth in Kolleru lake area. However, this high interest in this trade and investments, and the captivating returns had other implications on the local socio-economic and ecological setup, conservation and management of the protected area. In the 15th Meeting of the National Board of Wildlife held on 17th July 2009, the Chief Wildlife Warden of the state stated that "*Because of lucrative commercial fishery being operated in the area, it is very difficult to do anything in the matter*", while discussing the issue of reduction of the area under the wildlife sanctuary.

58 Fishermen Co-operative Societies, having about 5500 members, were operating in the lake area. An average yield of 2500 to 3000 kg fish / hectare per season is reported from the area (Rao, 2005) and consequent high flow of money. Nevertheless, it seems

that there has been an unwelcome change in the socio-economic setup as the local residents have become more of daily wage laborers in fish farms, although legally owned by them and run by proxy in a corporate mode by outsiders, practically depriving them of their private holdings. Narender (1993) quotes Mr Anjaneyalu of Bhujapalapatnum "*the land has shifted from small time fisher folk to big land lords*"; in all likelihood without change in legal ownership. The corporate and intensive fish farms appear to have caused large-scale changes in the effective landholdings and land use in the area, with ecological, socio-economic, legal, administrative and political implications.

3.4.3 Lifestyle changes

The communities living around traditionally used the lake for fishing. Folk memories of the villagers from nearby areas reveal that they were seasonally migrating for over a century, if not more, to the Kolleru lake bed every season after the water level lowers down and lands become fit for agriculture. They were cultivating a local variety of paddy called *Yerra Vari* (red variety of Paddy) after December every year. Even though the agricultural practices adopted by them were not as sophisticated as of now, the yields were good thanks to the rich alluvial deposits brought in by the floods. Nevertheless, there was an element of uncertainty and risk in agriculture and fishing due to frequent floods and droughts.

In the course of history, during the colonial period, certain traditional fishers' populations called Vaddi (reportedly migrated from Chilika area in Orissa state) and relatively underprivileged people from the neighborhoods of Kolleru belonging to various castes recognized by the Constitution of India as Scheduled Castes and by state government as Backward Classes, after independence settled down around the lake. During our village level public meetings, elders recalled that they survived during their younger days on roots (local name *Urligadda*) and tubers, lotus seeds (*Allipakaya*) and snails and by fishing using small nets, fishing rod or basket traps in the drains and small dugout canoe (locally known as '*doni*' made by carving out the pith from the base portion of Palmyra trunk, *Borassus flabellifer*, Figure 8).

Figure 8: Canoe made by carving out the base portion of Palmyra trunk

Over the years, the settlements developed into permanent villages with the successive governments extending all weather roads and infrastructure such as schools, housing, health institutions, electricity and piped water supply. It seems that with the advent of commercial aquaculture in the area, flow of money and rise in ancillary industries there have been considerable improvement in the life-quality of the people. However, disparities have prevailed, leading to notable grievances and demands.

During the last two decades, changes have come about in marketing, commercialization of agriculture and fisheries. At the same time, intensive agriculture under various programmes such as IADP (Intensive Agriculture Development Program) promoted by the government to augment productivity of the lands in the deltas of Godavari and Krishna rivers also had their impacts. People in the Kolleru Lake were also influenced by other developments. Sugar industries, Paper Mills etc., were also established in these districts. The small towns in the district have grown in to municipalities and municipal corporations over the years.

3.5 Ecological set-up

Being the largest fresh water body in the country, the Kolleru wetland and its associated environs possess several commendable ecological characteristics and offer several ecological goods and services to human kind, other living forms as well as environment.

3.5.1 Hydrology and water storage

The lake receives water from several sources (Appendix 4, Figure 9, Figure 10). Of these, the streams Budameru, Tammileru (East and West branches), Ramileru, Gunderu and Bulusuvagu are natural and foremost in terms of water input. Minor streams, Jayanthi, Kattaleru, Ippalavagu, Telleru, Ballaleru and Nadimeru flowing through several mandals also join the lake Kolleru. The rest of inflow drains are largely manmade and contribute lesser inputs. The estimated total inflow via these sources is about 9.6 TMC (Thousand million cubic feet, Table 5) per annum. The Budameru flows through the taluks of Vijayawada, Gannavaram, Gudivada and Kaikaluru, while the rest of the streams flow through the West Godavari district. Tammileru originating from Bethupalli in Khammam district reaches Kolleru lake after passing through Nagireddygudem reservoir in Chintalapudi Mandal.

The lake Kolleru debouches into the Bay of Bengal, at Peranatalakanuma through the meandering channel called Upputeru which is about 65 km long (Figure 5). The channel is under strong tidal influence and turns brackish especially towards the downstream stretch. The Lake Kolleru is largely a freshwater body, except towards its south eastern portion where the water may turn brackish particularly during summer months due to salt water ingression through Upputeru. Around 26% of the lake area in eastern zone gets affected by high tides, particularly in summer (Amaraneni et al., 2004). A drain Yenamaderu, which does not join the lake, joins Upputeru about 8 Km upstream of its confluence with the sea. However, Yenamaderu drain with a maximum flood discharge of 20000 cusecs could affect the water level in Kolleru via the Upputeru.

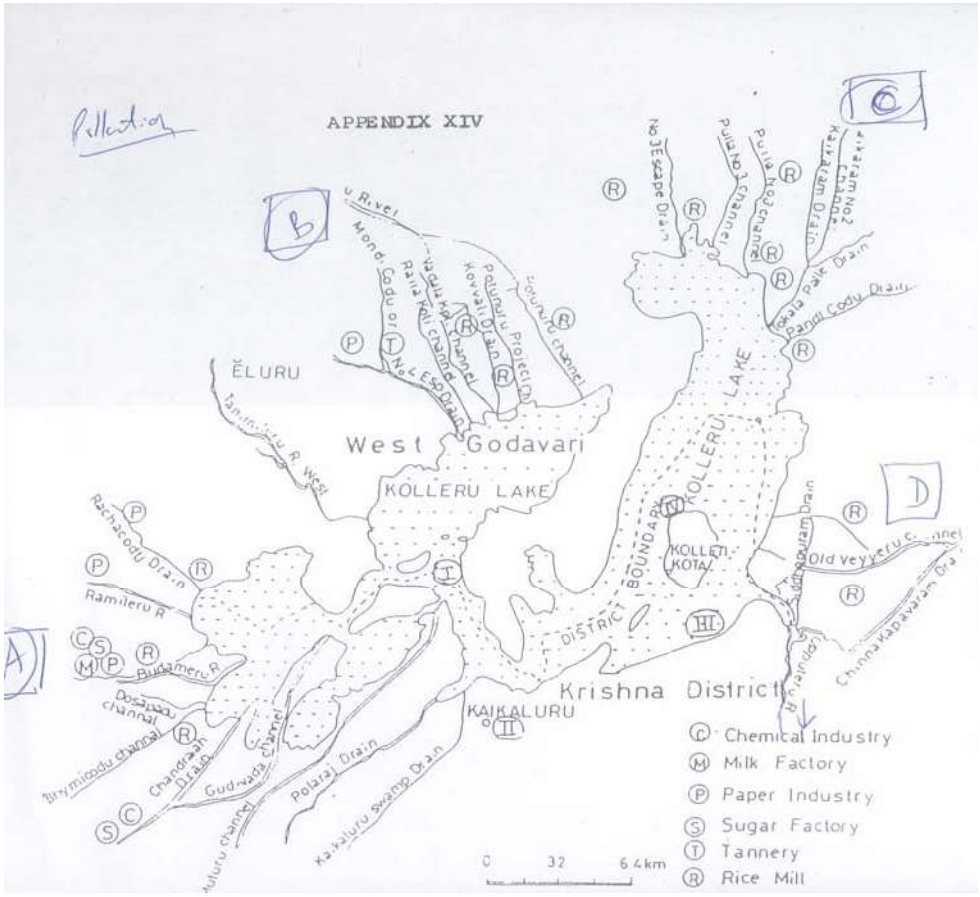

Figure 9. Major drains joining the Kolleru Lake

Table 5: Inflows into Kolleru Lake

Channel	Cusecs	TMC
West Godavari district		
1 67 drains	52166	4.51
2 Tammileru	23235	2.01
Krishna District		
3 Polraj major drain	2499	0.22
4 Chandraiah Major drain	3893	0.34
5 Bomicodu drain	476	0.04
6 Moturu Channel	1035	0.09
7 Budameru river	27687	2.39
Total	*110991*	*9.59*

Source: Executive Engineer, Drainage Division, Bhimavaram, TMC = Thousand million cubic feet

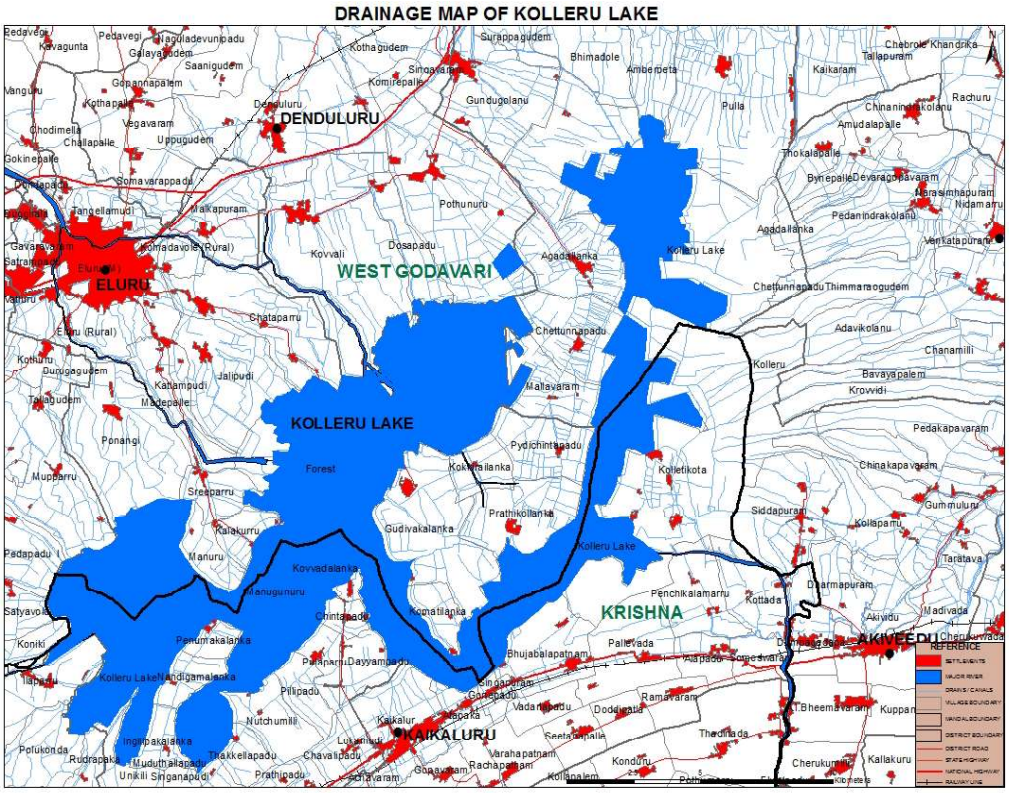

Figure 10: Drainage map of the Kolleru

The lake lacks definite boundary and has an irregular shoreline. In fact, the lake's boundary depends upon the rains, and related seasonal inflows and outflows. Broadly, the Lake Kolleru could be extending up to an area falling below +10 feet contour line above the MSL. At +10 feet contour, the water level spreads over 901 km^2. In summer it recedes down to +3 contour and 135 km^2 in area (Table 6) or lower at times. Accordingly the water storage also will change (Table 7). In certain drought conditions the water spread goes as low as 10000 acres (~ 4000 ha), getting limited to scattered fragments and pools (Figure 11) towards the lower contours. In 1964, during the flood season water swelled up to +10.7 feet contour, covering 954 km^2. At +7 feet contour, the lake extends over an area of 675 km^2. The fluctuating water spread with seasonal inflows enhances the lake's ecological significance as a wetland of vital importance. Moreover, it is the innate nature of a wetland to change its extent according to the hydrological regime.

Table 6: Water spread area of the lake Kolleru

Contour (feet)	Water spread (Km^2)
10.7	954
10	901

7	675
5	308
3	135

Courtesy: Ashok Kumar 2007

Table 7: Approximate water storage in the lake Kolleru

Contour	Storage (Mm^3)
+3 feet	150
+5 feet	300
+7 feet	508
+9 feet	1222

The run-off of about 5" rainfall in 24 hours from the catchment brings in an inflow of about two lakh cusecs. As the discharge capacity of the outlet, the Upputeru is only about 11250 cusecs the high inflow result in rise of the water spread and ensuing flooding of the neighboring lands. The discharges in past was in the range of 3200 to 21300 cusecs (Appendix 5). The Government of India appointed AC Mitra Committee in 1966 which recommended a straight-cut to augment the outflow and to restrict the highest flood level to +7 feet contour. As a result of straight-cut of Upputeru, construction of a reservoir across Tammileru at Nagireddygudem in Chintalapudi Mandal, diversion of part of Budameru water to Krishna river, water spread in most of the seasons were expected to come down to +5feet contour. This would mean covering only 308 km^2 out of the total 954 km^2 and consequently reduced water holding / storage capacity of the lake.

However, a point to be noted is the low hydraulic gradient of the Upputeru. Its hydraulic gradient is low at 1:25,000 (at +7 ft level) to 1:33,000 (at +5 ft level) compared to the smaller drains like Bondada drain which has a gradient of 1:18,000 at confluence with Upputeru. Hence, even after the suggested modification in Upputeru it is not known whether the designed discharge of 20,000 cusecs (the earlier discharge was about 10000 cusecs) could be achieved because Upputeru bed being deepened below the sea level is unlikely to improve the outflow of lake water into the sea.

Figure 11: Fragments and pools are important for birds and other species

3.5.2 Water quality

As stated earlier the Kolleru lake system is located amid the deltas of the rivers Godavari and Krishna and the lake is fed directly by several seasonal rivulets and is also linked to the Krishna and Godavari systems through several inflowing drains and irrigation channels. The lake is not directly connected with either Krishna or Godavari rivers. Nevertheless, the Kolleru wetland receives huge quantity of nutrient rich sediments from the flood plains of these rivers.

The data collected by Andhra Pradesh Pollution Control Board (APPCB) from twenty locations (8 located in the lake, eleven in inlet drains and one in the outlet) for the last eight years (2002-2009) shows a trend of decreasing pH levels of the lake water. The fall in pH level in most part of the lake happened just after the "Operation Kolleru" discussed elsewhere in this report. However, the pH again has started rising gradually. Total Dissolved Solids (TDS) in the water shows a trend of gradual decline till 2006 and the "Operation Kolleru". In 2006, after the demolition of fish tanks the TDS level decreased, followed by a gradual increase later. The DO levels in the lake were slightly lower than that at the sampling points at the inlets. COD and BOD levels of the lake water were also found slightly reduced after the Operation. Nutrient levels were high in the case of almost all the sample sites, especially Chandraiah drain, Polaraju drain, Pandikkodu drain, Bulusu drain, Chinna edalagadi site, Circar canal site, Gudivakalanka bridge site and Srungavarappadu drain sites. Similarly the total *E. coli* was found slightly high in almost all parts of the lake.

At various locations in the lake, the Upputeru and the Yenamaderu the water is contaminated with bio-degradable organic matters, nitrogenous fertilizers and sewage matters (Rao et al., 2006). High variation observed in total conductivity, and salinity in the water samples from Kolleru reveals salt water ingression during the dry months of the year. The samples collected from the Upputeru contain high CO_2 which is due to the decomposing organic matter. Similarly the dissolved Oxygen (DO) was very low in water from Yenamaderu, due to contamination from sewage. The high amount of phosphate and chloride in the lake water also relate to the greater levels of human activity and eutrophication status in the lake.

3.5.3 Meteorology

Meteorologically the Kolleru basin falls under semi-arid climate class, with three seasons, namely summer, monsoon and winter. The basin enjoys rainfall from both southwest as well as northeast monsoons. The rainfall was found to vary widely across the years (Table 8). The normal rainfall in the area is about 715 mm. Not much variation is seen in temperature across the seasons (Figure 12). Winter last for a period of three months (December – February) followed by summer, which lasts till June to mid July. Dry situation have been reported frequently in the uplands of the basin due to failure or delayed monsoon. Similarly flood due to depression (in the Bay

of Bengal) induced rainfall / storms are frequent in the basin generally during August to November.

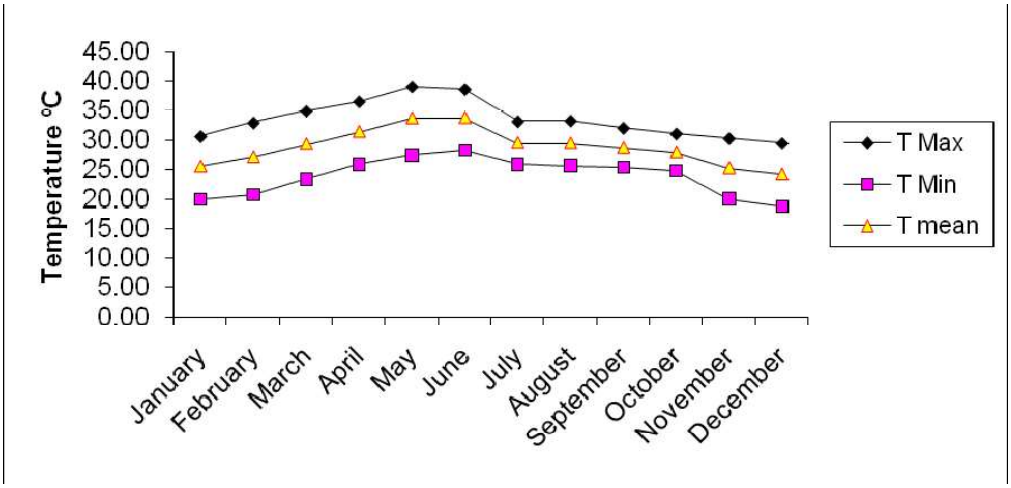

Figure 12: Temperature profile of the area
Source: India Meteorology Department

Table 8: Rain fall in the area (millimeters)

Year	Actual	Normal	%Deviation
2006-7	621.7	715.3	-13.1
2007-8	2133.7	715.3	198
2008-9	1558.2	715.3	118
2009-10	842.8	715.3	17.8
2010-11	971.9	725	34.1

Source: Chief Planning Officer, West Godavari

3.5.4 Avifauna

The comparatively shallow Kolleru lake ecosystem offers excellent habitats to plenty of resident and migratory avian species (Appendix 6). Birds in the area have been well documented by various authors (e.g. Neelakantan, 1949; Kannan and Manakkadan, 2005; Rao and Rao, 1987; Krishnan, 1981; Pattanaik et al., 2008). Several species seen here are also endangered or threatened. Kolleru is also listed as an Important Bird Area (IBA Site Code – IN-AP-04, Jhunjhunwala et al., 2001; Islam et al., 2004). According to the IBA document (Islam et al., 2004) the threats and conservation issues pertinent to the Kolleru IBA are i) expansion of agricultural activities, ii) pollution, iii) hunting, collection of birds' eggs, iv) removal of aquatic vegetation and v) growth of commercial fisheries, and vi) drought.

Table 9: Number of birds belonging to major families

Family	Years					
	1988	**1989**	**1996**	**2004**	**2005**	**2007**
Podicipedidae	20	22	48	20	40	230
Pelecanidae						1050
Phalacrocoracidae	15	60	55	250	70	830
Ardeidae	108	257	1117	1022	152	8329
Threskiornithidae	1000	15000	428	30	60	37060
Anatidae	15020	8361	23700			2704
Rallidae	302	188	160	20		616
Jacanidae	5	32	400	2		113
Haematopodidae						17
Charadriidae	2	9	20	80	2	29
Scolopacidae	315	237	25	12		2546
Recurvirostridae		48	84			1490
Laridae		2				
Sternidae	25	54	25	400	120	8455

Source: Wetland International (2008)

Avifauna of the area include a variety of water fowls, ducks, teals, storks, egrets, herons, ibises, bitterns, cormorants, and a number of waders. More than 200 species of birds were recorded from in and around the lake (Appendix 6, Table 10). Nine locations of bird congregation have been reported from the lake area, which include Atapaka, Agadalalanka, Pedayedlagady, Kolletikota, Adavikolani, Chinnamillipadu, Sidhapuram, Jayapuram and Chinthakodu (Ashok Kumar - Personal Communication). Of these, 6 congregations lie below +3 feet contour. The headquarters of the revenue villages, where these congregations are seen are shown in the map (Figure 13). Although these bird congregations said to be at nine places does not imply that the birds use only those areas. They depend on a larger extend of the wetland for their various resource requirements.

Table 10: Some locations of bird congregation in Kolleru

	Locations	**Co-ordinates**
1	Lakshmipuram	16°44’15.1, 81°16’17.5
2	Korakollu	16°44’54.6, 81°16’56.5
3	Nagarjuna tanks	16°42’21.7, 81°20’26.9
4	Karrakodu	16°41’46.2, 81°17’21.0
5	Jayapuram	16°36’56.7, 81°06’26.6
6	Chintakodu	16°42’01.8, 81°15’06.3

Source: Gracious P, Assistant Conservator of Forests (Retd), Elluru

Around 100 species of birds reported form the lake are migratory coming from different parts of Eurasia. Grey pelican, greater flamingos and lesser flamingos are

striking migrant species that regularly visits the area. Great White Pelican are also reported from the area (Taher and Mani, 2008). It is reported that Prof Bharathalaxmi (Andhra University) and Sri Ch Balasubrahmanyam (Retired Forest Range Officer, Elluru) sighted the critically endangered, globally threatened Spoon-billed Sandpiper *Eurynorhynchus pygmaeus* in July 2008 and November 2009 in Gudivadalanka and Pathikolla Lanka in Kolleru lake. Birdwatchers Society of Andhra Pradesh team while visiting the lake in February 2009 has also recorded Spoon-billed Sandpiper and Water Cock *Gallicrex cinerea* at Atapaka.

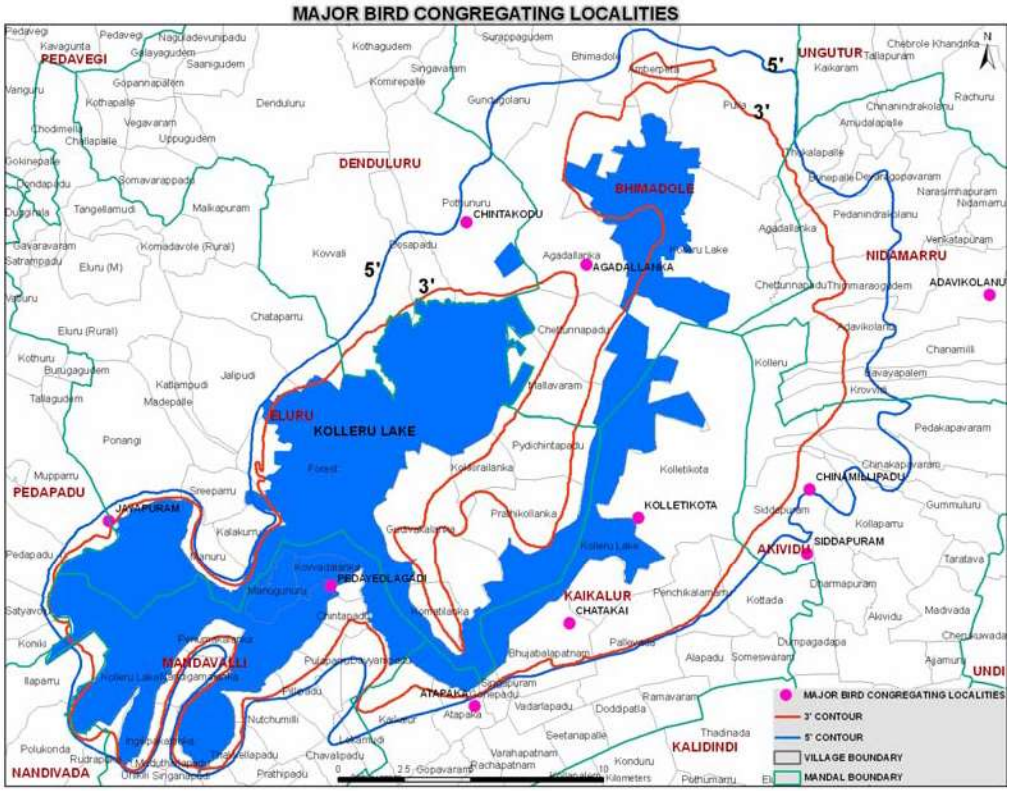

Figure 13: Major bird congregations in Kolleru

3.5.5 Other faunal forms

Other fauna including aquatic species reported from the lake range from various invertebrates, fishes, amphibians, reptiles, to mammals (Appendix 7, Ashok Kumar, 2007; Gopalakrishnayya, 1999; Dutt and Murthy, 1971; Chacko et al., 1952; Murthy, 1977; Dutt and Murthy, 1976a&b; Dutt, 1983; Dutt and Reddy, 1979; Dutt and Sharma, 1979). Among the invertebrates, the major are *Pila virens* (Apple snail, Figure 14), *Bellamya dissimilia*, *B. bengalensis*, *Indoplanorbis exustus*, *Melania*

striatella, *Thiara 1ineatus*, *T. scabra*, *Lymnaea luteola*, *L. acuminata*, *Cornicula atriatella*, *Lamellidens marginalis*, and *Parreysia corrugata* (Rama Raju, 1990). These mollusks form the staple food for several wild species, especially Open billed stork and about 7.4 lakh ducks in the lake area. Several prawn species are also reported from the area. During July-October prawns such as *Metapeneus monoceros*, *Macrobrachium malcomsonii*, *M. rosenbergi* and *M. rude* are harvested, while the Tiger prawn (*Penaeus monodon*) is cultured in the lake (Seshagiri Rao, 1988).

Figure 14: Dead apple snails, becoming rare

About 63 species of fishes belonging to 29 families have been recorded from the lake (Appendix 7). Of these, 44 are freshwater species. **The natural species composition of fishes in the lake would have considerably changed for various reasons including the frequent release** (The Hindu, 2007) of lakhs of commercial species. Japanese and Indian carps are cultured and species such as *Tilapia mossambica* is harvested mostly for preparing fish meal or also as a table fish (Seshagiri Rao, 1997). The major commercially important species are carps, catfishes, climbing perches and eels. Recently air-breathing fish such as *Anabas testudineus, Anabas oligolepis, Heteropneustes fossilis* and *Clarias batrachus* are also reported from the lake. It is

said that the fish yield has declined in the recent couple of years, supposedly due to large scale encroachment of lake bed and leasing of part of the lake for fish farms. According to Seshagiri Rao (1997) **15 species of fish have disappeared (**Appendix 8**) from the natural waters due to aqua farming and the lake waters is being dominated by air-breathing fishes, perhaps for the low dissolved oxygen in the water**.

Among reptiles Chequered keelback, rat snake, wolf snakes, spectacled cobra and several species of lizards have been recorded. Similarly mammals such as Mongoose, Fishing cat, Smooth coated Otter, Palm civet have been recorded consistently in the lake vicinity. The bottlenose Dolphin has been seen occasionally reported at the mouth of Upputeru. However, reliable documentation on reptilian and mammalian diversity is lacking from the lake environs.

3.5.6 Flora

34 species of plants are reported from Kolleru that include submerged, free floating, rooted floating and emergent macrophyte species (Appendix 9). Some of the common species are *Ottelia alismoides, Ipomea aquatica, Eichhornia crassipes* and *Typha* sp. (Seshavataram and Murthy, 1982; Seshavataram et al., 1982). Phytoplankton community of the lake is dominated by green algae, diatoms, desmids, myxophyceae and chlorophyceae. A few number of Chlorophyceae are recorded in spite of high nutrient content in the lake waters and phyto-plankton is poor since macrophytes use much of the nutrients (Y. Radhakrishna, 1989).

3.5.7 Ecological services

Besides offering critical habitats to several globally important faunal and floral groups, the Lake Kolleru offers many ecological services some of which are mentioned below;

- It offers water for irrigation; ensures soil moisture in its surroundings
- It helps in flood control, an ecological service that in recent years is getting hindered for various land use changes and interference with the natural hydrological regimes
- A primary source of drinking water to large segment of the populations
- Recharge of ground water; the great utilizable ground water resources in the district are due to recharge from this large water body

- Prevention of salt water ingression as the high hydraulic gradient reduces inland movement of salt water
- Capture fisheries is a traditional vocation for a large segment of the population
- The large water body sets the environmental milieu suitable for large scale culture fisheries
- The lake is an important means for transport; movement of people and materials
- Offers several aquatic food species, both of animal and plant nature
- It helps in regulating local climate
- Growing macrophytes also help in carbon sequestration
- The Lake offers immense recreational / aesthetic values

Considering that the lake also functions as a flood-moderating reservoir between the Krishna and Godavari deltas and that it supports several vulnerable species like grey pelican and many water fowl including a variety of resident and migratory birds, the state government of Andhra Pradesh declared the lake as Bird Sanctuary under India's Wild Life (Protection) Act, 1972 during 1999 (Appendix 11) and later in 2002 as a RAMSAR site.

Water birds, grasses, weeds, phytoplankton, zooplanktons, fishes, prawns and mollusks play an important role in maintaining the ecological uniqueness of the lake that has evolved since time immemorial. It has prevented loss of native species of fish, birds and aquatic micro fauna. For ages, it has been the traditional resource base for the economy of the local villagers especially the traditional fisher folks. In view of its importance as a wetland ecosystem and since it supports certain vulnerable species and more than 50000 waterfowl, Ramsar Convention has accorded it the status of Ramsar site (No.1209) in 2002 and as a wetland of international importance (Ashok Kumar, 2007). The convention offers a pragmatic model for the nation with the aid of international cooperation for conservation and wise use of wetlands and their resources.

However, the chronic and recent indiscriminate exploitation of the Kolleru area evidently have caused depletion of many ecological goods and services derived from

it, leading to unwanted flooding and other negative consequences. Anthropogenic pressure such as cultivation in the lake bed, unrestrained use of fertilizers and pesticides, large-scale encroachment of lake bed for aqua farms, fishpond discharges, domestic wastes and sewage from three municipalities / discharge of industrial effluents and agricultural run-off carrying inorganic nutrients have seriously affected and altered the ecological character of the wetland.

4 LAND USE CHANGES AND ASSOCIATED THREATS TO THE KOLLERU ECOSYSTEM

In reality, the lake system has been subject to severe pressure in recent years from anthropogenic activities. It is stated that that if human induced degradation continues the lake will soon vanish (Jayanthi et al., 2006, Nageswara Rao et al., 2004). The changing socio-economic and political milieu of the state in general and the region in particular has brought enormous alteration to the lake area and consequent higher pressure on the ecosystem. Land use changes associated with the aquaculture boom during the last couple of decades, industrial development and contemporary chemical intensive agriculture practices in the wetland area are some of the troubles affecting the well being of the ecosystem and its functions. Infrastructure development in the form of roads and bunds (Appendix 12, Figure 15) fragments the entire wetland and restrain its natural hydrologic regime. Some of the major land use changes happening and their ecological implications on Kolleru are discussed below.

4.1 Land use changes at Kolleru on government initiative

Several studies have been conducted by various authors to estimate the trend and extent of the land use land cover (LULC) changes in the Kolleru area for the last several years. Rao et al., (2000) analyzed the land use changes that happened in the lake during 1989-1999; Nageshwara Rao et al., (2004) analyzed land use pattern for the year 2001; Jayanthi et al., (2006) examined it for the 1967 to 2004 period; Nagabhatla et al., (2009) analyzed the LULC during the period 1977-2007; Nageshwara Rao et al., (2010) reported the land-use changes during 2004-2008 and Pattanaik et al., (2010) examined land- use changes for the period 1977-2000.

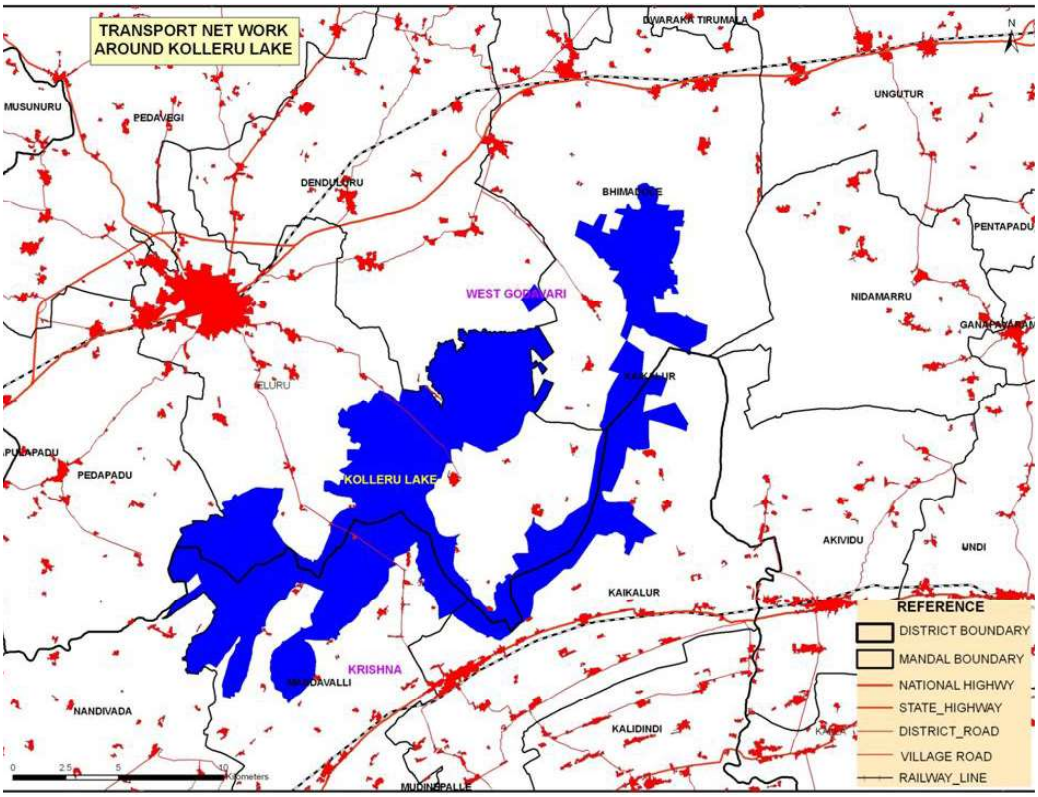

Figure 15: Road network in and around Kolleru

The roads (National highway, State highway, and district and village roads) and settlements (red patches) are delineated based on the SOI toposheets and updated with high resolution satellite data. Source: APSRAC

As per the study by Nagabhatla et al., (2009) while the agriculture land has decreased drastically, the land under aquaculture increased (Table 11); while no land was under aquaculture in 1977 it reached 15854 hectare in 2000. The 'Operation Kolleru' that demolished aquaculture farms in encroached areas in 2005 is reflected in the drastic decline of area under aquaculture in 2007. During the same time the area under aquatic vegetation and open water showed an increase. Notable rise in land under residential / settlements was also noticed during the period. This trend is explained as consequence of influx of rice farmers during the late 80s when the aquaculture started booming in the area and consequent shift in land use from rice culture to aquaculture. Similar observation of increase in the area under aqua farms has been reported by almost all who have examined the LULC in the area (Ramana Murty et al., 2010, Nageswara Rao et al., 2004). The lucrative business of aquaculture made far reaching consequences on the habitual land use in the lake area. **Encroachment in the wild life sanctuary and conversion of rice paddies to aquaculture farms appears to be**

a common story in the Kolleru region. Studies also report increase in encroachment in Kolleru wild life sanctuary between 1999 and 2005 for aquaculture farms (Appendix 10). An examination of the different types of areas under different contours (Table 12) also shows more or less a parallel trend.

Table 11: Land use land cover changes in Kolleru lake area (in hectares)

Land cover/ use units	1977	1990	2000	2007	%Change*
Aquatic vegetation	7245	3358	6530	10685	47
Marshy land	11455	17761	5610	6432	-44
Open land	1509	2978	3196	4655	208
Agriculture	12798	4787	4656	4413	-66
Open lake with floating vegetation	3099	2578	1359	6673	115
Aquaculture	0	5699	15854	1496	**
Settlements	1241	533	531	2623	111
Cloud cover	345	0	0	694	101
Total area			37699		

*Change from 1977 to 2007, ** all new, based on Nagabhatla et al., 2009

Table 12: Area under aquaculture within different contours

Contours*	Total area	Area under aquaculture (Km^2)		
		1995	1997	1999
Below 3feet	341.00	28.00	70.36	104.36
Between 3 to 5 feet	144.00	26.90	32.20	42.81
Total below 5 feet	485.00	54.90	102.56	147.17

*Contours based on the map by the Public Works Department, AP Government, Courtesy – APSRAC

4.1.1 Privately owned lands

During several interactive public meetings (Figure 16) it was claimed by many that in 1940s the British government had granted pattas (titles given by government for land ownership) to them charging market value. But, on further enquiries with the revenue officials it was reported that they have not come across any such pattas granted during the British period. The people and their community leaders who talked about the matter in the public meetings, held during 20-25 September 2010, were requested to furnish at least a copy of one such registered document. However, they could not produce a copy during the one week stay of the committee in the area. Nevertheless, the specific year from which they held the titles is not really important as they are in possession of those lands before the date on which the notification under Sec 18 of

Wild Life (Protection) Act, 1972 was issued by the government vide GO Ms No 76 Environment, Forest, Science and Technology (For III) Department, dated 26-9-1995. This was confirmed from the notes submitted by the District Collector and Conservator of Forests to the Committee. The details of land ownership in the sanctuary area are given in the Table 13 and Table 14.

Meeting with the district officials

Figure 16: A view of the public meeting

Table 13: Patta (Zerayati or Ryotwari) lands falling in the sanctuary area (below +5 feet MSL Contour)

No	Mandal	Villages	Ryots	Extent involved (Acres)
West Godavari District				
1	Eluru	7	399	823.61
2	Pedapadu	3	199	496.52
3	Denduluru	2	111	380.28
4	Bhimadole	5	1167	2426.87
5	Nidamarru	11	4126	6150.63
6	Unguturu	1	30	146.46
7	Akiveedu	10	1981	3475.10
	Sub-total	*39*	*8013*	*13899.47*
Krishna District				
1	Kaikaluru	10	125	571.45
2	Mandavalli	5	71	390.41
	Sub-total	*15*	*196*	*961.86*
	Total	***54***	***8029***	***14861.33***

Source: Wildlife Management Division, Eluru

Table 14: Ownership Patta (Zerayati or Ryotwari) lands falling under +3 feet MSL Contour

District	Extent involved (in Acres)
West Godavari District	1061

Krishna District	134
Grand Total	**1195**

4.1.2 Lands assigned on temporary patta for agriculture

As per official records, it was reported that in 1955 itself Government of Andhra Pradesh had authorized the District Collector, West Godavari to grant permission to raise the second crop in the lake bed area (GO 1162, Revenue Dept, dated 20-05-1955). However, floods (Table 15) posed threat to raising second crops in most of the area. Floods are reported to be occurring frequently in the area. In 1964, high floods inundated even +10 to +12 feet contours. It was reported to us by the public that paddy cultivation, taken up as second crop until 1969, was given up as heavy floods washed away the crops in that year. It seems that recurring floods was an important reason for paddy cultivation to be less preferred. For example, the inundation that happened in 2010 in Kaikallur mandal, just before the field visit of the committee is given in the Table 16. Several submissions were made by elected representatives in various forums to district administration and government about the loss of livelihood due to flood and natural calamities. However, subsequent pro-tem relief measures could not bring people out of sufferings and poverty.

Table 15: Villages that falls in flooding zone at different contours

	Contour	Villages in	
		West Godavari	**Krishna**
1	Upto +5 feet	38	22
2	+5 to +7feet	10	-
3	+7 to +10 feet	23	-

Source: Executive Engineer, Drainage Division, Bhimavaram

Table 16: Paddy crop inundated in September 2010, Kaikallur Mandal

	Village	Area (Acres)	Hectares
1	Gonepadu	73.87	29.9
2	Narasaipalem	11.00	4.5
3	Varahapatnam	20.00	8.1
4	Kottada	14.00	5.7
5	Vemavarappadu	50.00	20.2
6	Seethanpalli	35.00	14.2
7	Doddipatla	16.00	6.5
8	Gopavaram	80.13	32.4
	Total	***300.00***	***121.4***

Source: Mandal Agricultural Officer, Kaikaluru

4.1.3 Lands assigned for fisheries and agriculture

Several land assignments have been happening in Kolleru area for the last several decades. These have been happening as per government orders for specific purposes, either to improve agriculture or to improve fishery as discussed below.

4.1.3.1 Land for fisheries

The 1976 visit of Sri Jalagam Vengala Rao, then Chief Minister of the state, to Kolleru areas and the impetus and direction it gave to the economy of the villagers was widely cited in the submissions from the people during our public meetings. The then CM is reported to have encouraged people to take up fish tanks by granting official permission. The Collector of Krishna district in 1976 proposed assigning lands in Kolleru lake bed villages at the rate of 50 cents to each Fisher to develop fisheries and to enable them to secure institutional credit, from Central Land Mortgage Bank and other cooperative financial institutions, mortgaging these lands. The District Collector had also requested the government to relax its earlier orders permitting use of the land only for agriculture. Accepting the proposal the AP government directed both Krishna and West Godavari Collectors [GO Ms 118 Revenue (Q) Dept dated 24-01-1976] to assign 50 Cents of land in each case free of cost whenever necessary for fisheries development stipulating the following:

i) That the land would be liable to be resumed not only if they are alienated or transferred but also used for purposes other than fisheries development;
ii) That the area chosen for the assignment for the fisheries development should be the area identified and determined by the special team appointed by the Government in GO Ms No 664 irrigation and power department dated 9-8-1975; and
iii) That the land will not be utilized for cultivation purposes

On a further proposal by the District Collector, Krishna, Government of Andhra Pradesh amended the condition (iii) above [GO Ms 438 Revenue (Q) Dept dated 13-03-1979] as "*That the land will not be utilized for cultivation purposes other than raising coconut plantation or similar horticulture activity on the banks of the tanks*"

4.1.3.2 D-form pattas

Based on the above orders of the government, the District Collector, West Godavari, assigned conditional pattas (popularly known as D-Form pattas) as follows to an

extent of 2974 acres to 5714 members of 89 Fishermen Cooperatives (Table 17, from the note from the District Collector, West Godavari) which now fall in the notified sanctuary area.

Table 17: D-form Pattas in the sanctuary area

	Mandal	Fishermen Cooperative Societies	Extent of D-Form Patta Lands (Acres)	Members	Average Holding (acres)
West-Godavari					
1	Eluru	40	1485	2619	0.57
2	Bhimadole	20	550	1099	0.50
3	Pedapadu	3	100	251	0.40
4	Denduluru	9	225	441	0.51
5	Unguturu	2	100	212	0.47
6	Nidamarru	7	297	697	0.43
7	Akiveedu	8	217	395	0.55
	Sub-total	*89*	*2974*	*5714*	*0.52*
Krishna					
1	Kaikalur	NF	NF	NF	NF
2	Manadvalli	NF	NF	NF	NF
	Sub-total	NF	NF	NF	NF
	Total	NF	NF	NF	NF

NF = Not furnished

A perusal of the Society information (Ref: Page 20 to 24; note from the District Collector, West Godavari) shows that the individual holdings varied from 25 Cents to 1 Acres and 1 cents. A copy of the D form Patta issued to Sri Jonnalagadda David S/o Raghavulu, Komatilanka Village issued in 1976 assigning 47 cents of government lands contains the following conditions:

i. The land assigned is heritable but inalienable;
ii. The land should be brought under agriculture within three years of allotment;
iii. The land should be cultivated by family members of the assignee or through labour under the supervision of the family members;
iv. If the land is acquired for public purpose, no compensation will be paid and
v. No compensation will be paid for the expenditure made by the assignee for the development of the land assigned.

Similar conditions were already applicable in the D form pattas issued in 1975 as seen (for example) in the case of Sri Kuriti Appa Rao S/o Seeta Appanna, Adavikolanu village assigning 30 cents of surplus land under Andhra Pradesh Land Reforms (Ceiling on agricultural land holdings) Act, 1973. The subsequent amendment order in 1979 says that the lands will not be utilized for cultivation purposes other than raising coconut plantation or similar horticulture activity on the banks of the tanks. The orders issued subsequently in 2006 state that the land would be liable to be resumed not only if they are alienated or transferred but also used for purposes other than fisheries development. This means that government was encouraging use of assigned lands for fisheries only, even though the lands were originally allotted for agriculture. This is further confirmed from the fact that fisheries department gave training to farmers, supplied fish seed and organized loans from cooperative banks.

A note from the officials of Fisheries Department shows that government liberally gave loans through Cooperative Land Mortgage Banks over the last three decades for development of fish tanks and pisciculture. The required technical guidance was provided by fisheries department. While at the same time animal husbandry department promoted duck rearing, the agriculture department encouraged farmers to go for intensive agriculture as part of Intensive Agriculture Development program (IADP) in the district. However, IADP programs had little impact as the crops were not profitable or were being damaged because of frequent floods and farmers shying away from intensive agriculture. In brief, it could be stated that starting with 1976 continuing to eighties and later on the changes in land use pattern were at the initiative of the state government.

4.1.4 Further changes in land use pattern

Financial help was provided by the government of AP to construct fish tanks upon pledging the patta lands to Cooperative Land Mortgage Banks. Even though technical help was provided by the fisheries department, the income was low due to poor maintenance and low productivity of the tanks and as a result the fisher folk could not repay loans. Two cyclones and floods during this period also played havoc and made their lives miserable. It is at this time, that the private investors and ‘proxy / benami’ land holders entered the scene taking lands on lease by paying Rs 10,000/- to 17,000/- per acre per annum. With this money, the local farmers have reportedly cleared their

loans to Cooperative banks and became perpetually indebted to the private investors and proxy land lords. In the 1970s even while the richer locals took hold of lands on lease from the poor cooperatives the lands remained formally in the name of poor "beneficiaries". "*While the real fisher folk are legally entitled, in effect they are reduced to wage earners on their own land, the rich not only taking over all control of the cooperative societies, but also spreading illegal encroachments to other areas*" (Rama Rao et al., 2006). Consequently, from this time on, the lake suffered from the un-satiated greed of the moneyed people leading to a situation called by Ramakrishna (2007) "aquaplosion". The changes brought in by the so called aquaplosion has been widely documented (Ramana Murty et al., 2010; Ramana Reddy and Reddy 2010; Pattnaik et al., 2008; Nageswara Rao et al., 2004; SreeKrishna (undated); Nagabhatla et al., 2009; Nagabhatla and Sellamuthu, 2008; Jayanthi et al., 2006)

Added to this are the industrial effluents released in to the catchment of the lake from paper and sugar industries in Krishna and West Godavari districts (Appendix 13) and the municipal wastes from Vijayawada, Elluru and Gudivada towns flowing in to the lake Kolleru. There are averments from some corners that pollution from the industries and municipalities is several times higher than the pollution caused by aquaculture in Kolleru, which needs to be verified scientifically in the field in view of the large number of aqua farms. However, there is likely to be qualitative differences in pollution resulting from each source as aqua farms are likely to release feed wastes, antibiotics and pro-biotics.

The continued change in the land use towards aqua farms is reflected in the fish output from the area. According to Narayana (2006) about 600,000 tons of fish was being produced in 2006, valued to the tune of Rs 2,000 crores, compared to 15,000 tones earlier. Narayana (2006) also states that from the lands given to dalits and backward classes within the sanctuary area alone, annual fish production was about Rs 500/- crores. The veracity of the claim is to be verified.

4.2 Encroachments and associated issues

Encroachments of the lake area for aquaculture and agriculture activities are widely reported, as mentioned earlier. Aquaculture is mostly cited as the main reason for

encroachments. The Principal Secretary, AP government, EFS&T Department in the replies to the CEC dated 14-2-2006 has stated that in West Godavari District "*the commercial activities have been taken up by the rich persons and powerful persons in the guise of livelihood needs of the poor. The rich people who took the assigned lands from the assignees by way of 1ease / Government lands by way of encroachments have converted the lands into fish tanks according to their convenience. The leaseholders of fish tanks who are getting Rs 50,000.00 to Rs 1,00,000.00 per acre as net income are paying rentals / lease amounts to the local small ryots whose lands were leased out for Rs 5000.00 to Rs 10,000.00 per acre. As such it is only the rich and powerful persons who are getting benefit from this area*."

Aquaculture helped largely proxy farmers than the real owner farmers. But there is no officially recorded evidence to this effect as the lease agreements are mostly verbal understandings, without written agreements, made in presence of village elders and some times before the village deity. Moreover, the traditional village community administration called 'Kattubatu' is so powerful that the individual villagers are powerless to disobey their leaders. This is in spite of mechanisms being available for replacing the leader or calling for explanation from him if an individual felt that the person is not justifiably carrying out the role. The farmers while agreeing privately to the fact that they have leased out their land to outsiders informed that they had to do so initially to get cleared of their debts and the lands continued to be leased out due to their unending poverty. They have also found the practice advantageous, in the given circumstances, getting two incomes; one from leasing out lands and the other from working as wage labor.

4.3 Water diversion and water pollution

The Kolleru wetland drainage system is highly interposed by roads, bunds and other structures (Figure 15) causing interference and diversions of water flow regimes. The South Central railway passes from north and south of the lake. Particularly diversions were found to be more in number below the +7 feet contour, intending to reduce inundation of the agricultural fields in those areas. Channels, to enable quick lowering of water levels and transferring the discharge head to Perantalakanuma and subsequently to the sea were also created in the lake bed. To support the agriculture of

the area the AP Government had recommended reducing inundation between +5 and +7 feet contour during 1970s and later to between +3 and +5feet contours. It is estimated that only 31% of the total run off (1560 Mm^3) is received in the Kolleru due to the diversion and embankments (Wetland International, 2008). The water holding capacity of the lake is also found significantly reduced which has led to fragmentation of wetland into at least three distinct compartments.

4.3.1 Drainage and channelization

The entire drainage system of the lake has developed in view the water retention capacity of the lake. As mentioned earlier, some rivulets and several drains empty into the lake and the lake waters gradually flow into the sea through Upputeru. **The natural drainage pattern, design and mechanism has been grossly interfered by constructing high bunds around the fish farms, unauthorized and illegal encroachments along the outlet channel, and laying of roads to a length of about 180 km disregarding the water flow pattern, of which more than 35 km are incorrectly aligned**. Roads have been also laid leading to the fish tanks which were operating and still reportedly thriving in Bhimadole and Nidamarru mandals. The culverts along the roads are grossly inadequate for free flow of flood water, which would invariably result in longer withholding of flood waters, increasing inundations and disparities in the water level as hydraulic contact was lost among the artificially fragmented zones. **The Wetland International (2008) has found the need to erect 339 vents to facilitate water flow**.

As noted earlier, the lake covers about 901 km^2 within +10 feet contour, 673 km^2 within +7 feet contour, and 135 km^2 within +3 feet contour. In monsoon the lake spreads generally over +5 feet contour with a water holding of 300 Mm^3. Every alternate year, the lake spreads over +7 feet contour and the storage of water at this level would be 508.4 Mm^3. On an average once in eight years the lake fills to above +9 feet contour, holding up to 1222 Mm^3 water in contrast to the storage of about 150 Mm^3 at near about +3 feet contour.

If the lake is resized by reducing its effective functional area, inflow during rains would spread far wider and away into upstream areas submerging bed and belt villages (Table 16), and at times the towns of Eluru, Gudiwada and Vijayawada. The

elevated water level will remain for a longer period as it is to be drained only by one outlet, the Upputeru that as of now is ill equipped to convey all the waters. On the other hand Upputeru water may backflow entering Kolleru Lake (Venkata Rao and Malleswara Rao, 2009) and drains joining it because of the low effective hydraulic heads. The loss of gradient in Upputeru and minor drains is evident from reducing velocities of their flows resulting in longer periods for recession of floods.

Areas aside the course of Upputeru also would be inundated with flood waters for longer duration damaging kharif crop there. Rabi is now permitted in parts of the delta only in alternate years due to inadequate water in the rivers. Thus, lakhs of people living in the regular ayacut in the two deltas and in the belt villages will face severe difficulties and pressure on their livelihood.

As the Upputeru drain is subject to tidal activity, and since its hydraulic gradient is relatively low the time taken for discharge of water per day is subject to tidal dynamics with back and forth movement of water switching direction every 6 hours. There will be more than two pulses of the flow front moving in the same direction at any day. At a hydraulic head of +7 feet with an approximate velocity of 0.5 m/sec, it takes 28 hours for the lake water to reach the Bay of Bengal.

There are reports of several deltas world over, including Krishna-Godavari delta, sinking for various reasons of sediment compaction (Syvitski et al., 2009). Some records show that West Godavari delta has already dipped by 0.5 feet to 1.5 feet. Universally, natural gas exploitation in delta regions is inferred by Syvitski et al., (2009) as one of the few reasons. Associated with other local causes, the ground water in the wells has turned saline and high tide sea water spreading longer distances have turned agricultural fields saline. The reported sinking of the delta would exacerbate the flood situation in the lake and requires further scientific investigations.

It is apparent that the lake is unable to accommodate the inflows due to encroachments and perhaps also because of rising lake bed due to increasing siltation. The high flood line (Figure 17) has been progressively increasing causing major floods. **Water stagnating in the fields for several days even after demolition of fish tanks in some areas of the lake bed testifies for the alarming situation arising**

from the incomplete removal of obstructions to the water flow and from decreasing gradient of the delta lands, and its effect on the flood recession.

Owing to the insufficient outflow of waters from the drains and flood, and perhaps for the decreasing water holding capacity of the lake due to accumulation of high silt load, water stagnate for longer duration and wider spread. Taking advantage of the situation, the plea that traditional farming is not possible is advanced to justify aqua farming.

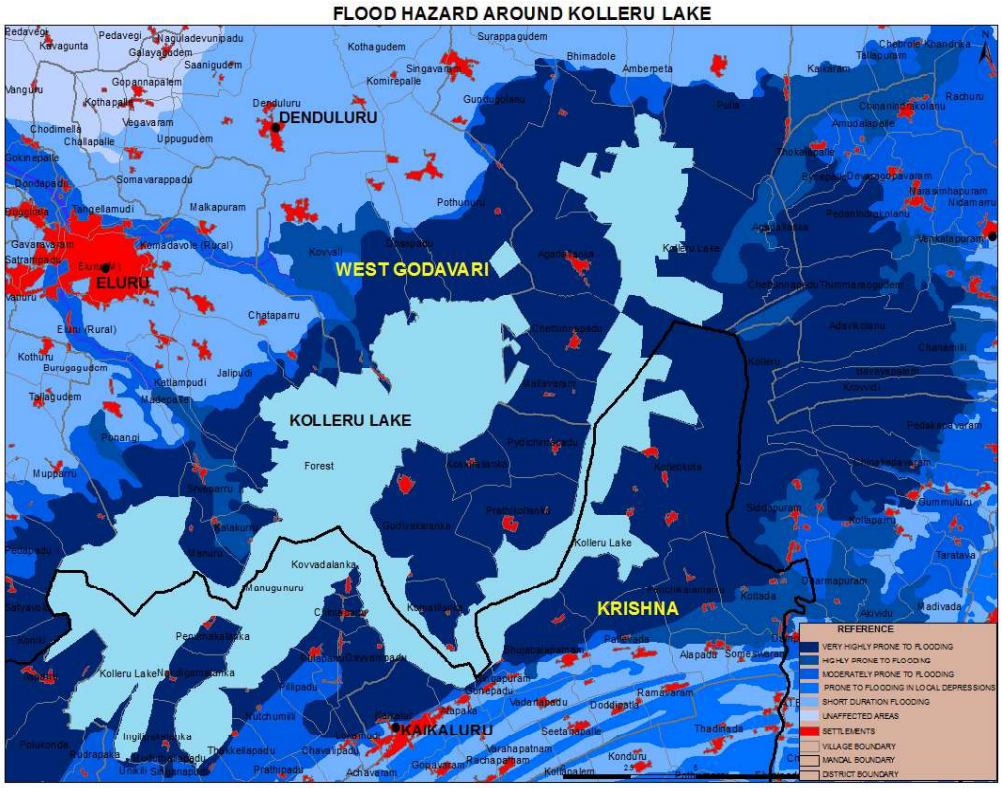

Figure 17: Flood hazard around Kolleru

4.3.2 Pollution

Decades ago the lake largely was a clean and safe fresh water body. Sri Anjaneyalu of Bhujabalapatnum, a Fisher said "*As a child, I have seen that place full of freshwater. The water would be crystal clear and we would swim, bathe and catch fishes. But today, you don't see water at all. The lake bed has shrunk because of the vagaries of nature and as humans saw this place as a resourceful one, they flocked to it like sardines*" (Narender, 1993). In due course of time activities such as agriculture and

industries came along in ever-growing intensity in the catchment of the lake. Consequently, the drains and rivulets carry in to the lake substantial quantity of various types of pollutants forcing the lake to be a sink for the pollutants. **The major sources of pollution are agricultural run-off containing residues of several agrochemicals, fertilizers, fish tank discharges containing antibiotics, pro-biotics, food wastes and others, industrial effluents containing chemical residues and organics of different types and municipal and domestic sewage**. As a result, the water of the lake turned more alkaline in nature, turbid, nutrient rich, low in dissolved oxygen (DO) and high in biochemical oxygen demand (BOD). Changes in total dissolved solids (TDS) and salinity imbalance in the lake has been reported (Rao et al., 2006). **Water borne diseases like diarrhea, typhoid, amoebiasis and others are said to be common among the local inhabitants who are unaware of the state of pollution in the lake water. Vector borne diseases also would have come up in higher frequency.** During the last two years the prawn and fish have been found to be affected by diseases leading to some farms being abandoned. The lands thus abandoned are useless for agriculture as well, since the soil and water have been contaminated and changed from their original characteristics.

4.3.2.1 Agricultural run-off

As noted above, the lake has a catchment of upland and deltaic region known for intensive agriculture. Annually around 116800 tons of inorganic fertilizers are used there, of which about one fourth ends up in the lake via run-off and leaching (Gopalakrishnayya, 1999). Besides, natural nutrients from the vast catchment, from the natural levees of Godavari and Krishna rivers, drift down to the lake taking along 68,000 tons of cattle manures as deltaic area is dense with cattle population. The vegetation along the river banks also contributes substantially to the nutrient load, while their litters decay. In addition, about 7.4 lakh ducks (Gopalakrishnayya, 1999) also was known to enter the lake adding on their excrements. High levels of organic pollutants are also reported from the Kolleru Lake (Rao and Pillala, 2001)

The total organochlorine pesticides used in and around the lake area is estimated to be about 1600 tons / year. Residues of methyl parathion used in the first cropping season find its way into the lake, and is another major source of pollution threatening the biota with residual effects. The study conducted by the School of Chemistry, Andhra

University concluded that the contamination of pesticide in the ambient air of the lake may be due to uncontrolled use of pesticides in agriculture and aquaculture (Sreenivasa Rao and Rama Rao, 2000). Poly cyclic hydrocarbons are also reported from sediments of Kolleru Wetland (Amaraneni, 2004). High levels of organochlorine (OC) pesticide residues in water samples collected about 50 km upstream of the opening of the Tammileru River into the Kolleru Lake were also reported (Murty and Veeraiah 1990 cited by Wetland International 2008). Even in the waters at Sriparru village where the river enters the lake, they have recorded high levels of isomers of HCH, endosulfan, p-p-DDT and p-p- DDE in the tissues of some common fishes like *Labeo rohita, Catla catla* and *Mystus* sp., of the Kolleru Lake. Rao and Rao (2000) and Toxic link (2006) have reported detectable levels dieldrin from the Kolleru Lake. **The prawn cultivated in the area had high concentration of pesticides, PAH and heavy metals above the permissible levels stipulated by the WHO** (Wetland International, 2008). **The large scale commercial exploitation of Apple snail (*Pila virens*) resulted in reduction of calcium content in the bed sediments, besides siltation, triggering chain reaction leading to pollution** (Seshagiri Rao and Varahala Raju, 1996).

4.3.2.1.1 Fish tank discharges

Fish tank discharges contain high organic load, chemical fertilizers and pesticides, feed wastes, antibiotics and pro-biotics. Super phosphate and nitrates, and tons farm yard manure are applied to treat the tanks for enhancing plankton production in fish farms. Application of about 1200 metric tons of fertilizers in one year leads to accumulation of phosphates which have high affinity to bind with soil leading to algal and ultimately cultural eutrophication. An analysis conducted by Andhra Pradesh Pollution Control Board (APPCB) shows high phosphate levels in lake waters.

Pesticides such as malathion, methyl parathion, which are notified by WHO as extremely hazardous, and endosulfan are indiscriminately used to kill fish parasites such as Argulus, Dactylogyrus etc. Furthermore, fish feed such as De-Oiled Bran (DOB), groundnut cake, farmyard manure and poultry manure are used to augment plankton production. **It is stated that each hectare of a fish pond exchanges at least 15900 cubic meters of effluents every month and the actual pollution load from the fish ponds seems to, if not higher, high as that from industries and local**

bodies. These higher concentrations of nutrients and organics from the discharges cause bacteria (which play a crucial role in decomposing organic matter) to proliferate and consume oxygen at a faster rate thus depleting the DO vital for aquatic life.

4.3.2.1.2 Industrial effluents

According to Narender (1993) about 7.2 million liters of industrial effluents from eight industries including paper and pulp, sugar, distillery, milk and chemical industries containing suspended solids, colloids, foam, organic acids, lignin and resin acids are let into the lake. It is observed that most of the industries discharge effluents to the lake. Along the course of Budameru alone there are five industries. These effluents impart dark color to water and interfere with natural aquatic photosynthesis. High organic load induces a decrease in pH leading to high oxygen demand by bacteria which lowers the dissolved oxygen.

4.3.2.1.3 Municipal and domestic sewage

Untreated municipal sewage from Vijayawada, Gudiwada and Eluru and domestic sewage from other human habitations on the sides of the inlets, flows into the lake. **It is reported that the Eluru Municipal Corporation alone discharges around 24 MLD untreated sewage to the lake.** Organic rich wastes cause various changes in water quality including depletion of oxygen levels leading to fish kills and bacterial contamination. Fecal waste in water leads to the proliferation of pathogens such as Salmonella, *Escherichia coli* and *Vibrio cholerae*. High phosphate input from the wastes leads to eutrophication.

Fish which are exposed to the effluents coming from various sources experience hypoxic stress and oxygen deficiency. Depletion of DO deprives aquatic species of vital oxygen resulting in their death, perhaps one of the reasons for increasing number of air breathing fishes. It was reported that Effluent Treatment Plants (ETP) are functioning and, even so, it is doubtful whether the effluents at the final outlet of ETPs meet the statutory standards. Exposure to organics such as antibiotics and pro-biotics frequently used in fish farms makes the natural fish highly prone to infections, diseases and morbidity, not to speak of their ill effects on the species higher in the food chain.

4.4 Other threats

The lake ecosystem confronts several other threats of which siltation, excavations, clogging of drains and eutrophication are very significant, compelling and apparent.

4.4.1 Siltation

Rivers and drains flowing down from the catchment of the lake, agricultural run-off, laying and repair of roads in the upland areas carry large amounts of silt and top soil every year during the monsoon season. Roads, totaling about 180 km long, have been laid within the lake. Coupled with this, periodic repairs to these roads which often get damaged during the monsoon also add to the silt load reaching the lake. The paddy cultivation in the lake bed in summer also contributes silt.

Intensive use of inorganic fertilizers and other activities in the catchment and in pisciculture farms would also add to the increased nutrient and silt load, and consequent reduction in storage capacity of the lake. The reduction from 1900 to 1976, is reported (Conservator of Forests, Eluru), to be almost 31% due to combined effect of erosion and development activities. It is also reported that the lakebed has risen from -3 feet (-0.91 m) in 1900 to +1 - 2 feet (0.3 - 0.6m) in 1972-73. The lake bed also gets exposed at several places, more than what has been happening earlier, perhaps for excavations somewhere and deposition of silt elsewhere. The lake substratum seemingly has undergone considerable changes. Some estimates shows the lake bed as raising at the rate of 0.025m / annum which works to about 8.6 million cubic meters of silt calculated at the +0.91 meter contour level (Gopalakrishnayya, 1999 and Y. Anjaneyulu, undated). Accumulating organic matter such as decomposing macrophytes and agricultural waste are another contributory factor for raising lake bed in certain areas coupled with poor flushing action. Decaying organic matter is also an important contributor to the nutrient levels in water (Kulshreshtha and Gopal, 1982a & b; Azeez et al., 2007; Azeez and Prusty, 2008; Prusty et al., 2009).

Overall, presently the lake seems to be under serious threat of excessive loading of silt and nutrients, uncontrolled use of fertilizers and pesticides, fish pond discharges, domestic wastes and sewage from human settlements and municipalities and low flush-out process. These accelerated inputs have speeded up

the ageing of the lake and in turn succession from wetland to waterlogged or later relatively more exposed area and later dry lands.

4.4.2 Excavations

Another important issue that the lake has experienced is random excavation for making 3 to 4 meter high bunds and embankments, roads and aquaculture ponds. The bed of the lake is excavated at numerous places to build embankments (Figure 18) for fish farms, and to form pathways and then roads. **These excavations necessarily would have changed the bathymetric profile of the whole system and consequently the water flow pattern. The contour lines** (Figure 19), **upon which the entire issue of boundaries in Kolleru depends upon, become practically unjustifiable in view of all these changes.** The excavations would have also caused sediment layers getting mixed up; bottom layers brought up and upper layers brought down. Excavated bottom layer piled as embankments, exposed to atmospheric elements would hasten oxidation of organics and release of nutrients that were to an extent immobilized in the bed sediments.

Figure 18: Embankments are made around aqua farms

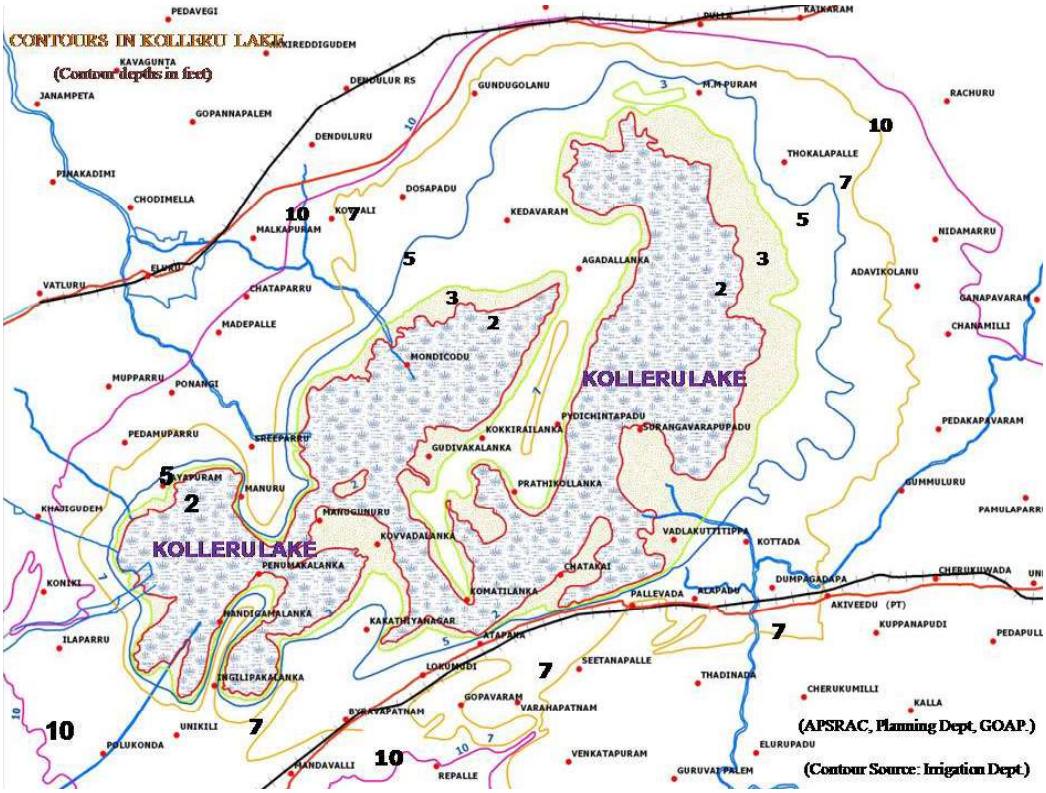

Figure 19: The contours in Kolleru Lake

4.4.3 Clogging

Excessive nutrient addition, especially from anthropogenic sources, lead to explosive weed growth. The explosion of the aquatic floating weeds especially *Eichhorrnia crassipes* (water hyacinth, a widespread and aggressive exotic weed originally from South America) affects fish and other aquatic life (Malik, 2006), impede drains, shuts out sun-light to phytoplankton and submerged hydrophytes, and offers breeding ground for certain vector insects. The floating weeds are also known to increase evaporation and evaporation from water hyacinth is estimated to be ~3.7 times higher than evaporation from free water surface (Venkateswarulu, undated). Such weeds are also known to cause depletion of dissolved oxygen by way of their decay and aid siltation by trapping suspended solids and dust. Manually removing this weed, as has been tried in many other large wetlands such as Keoladeo National Park at Bharatpur (Rajasthan), has not been found successful. According to the Collector, West Godavari even when employment was offered under National Rural Employment Guarantee Scheme (NREGS), villagers are not forthcoming to take up manual de-weeding. Bio-control has been tried in some water bodies such as Loktak Lake,

weevil species such as *Neochetina eichhorniae* and *N bruchi* introduced in two phases have almost controlled the weed perhaps an exercise that could be explored for a tryout in Kolleru. Another insect found effective on water hyacinth is flee-beetle (*Agasiches hydrophille*). *Pistia stratiotes* and *Salvinia molesta* are other exotic, one originally from Africa and the other from South America, free floating and fast growing weeds that are likely to spread far and wide in the Kolleru water body enriched with free nutrients.

Extensive growth of floating, rooted and submerged macrophyte species such as *Phragmites karka*, *Ipomea aquatica* and *Nymphaea* interfere with navigation (Figure 20), although they offer important habitats for a large number of birds such as Jacanas. The IBA document brought out by the BNHS (Islam et al., 2004) cites removal of aquatic plants as a possible conservation threat. However, their controlled removal needs to be considered. Nevertheless, prior to their removal appropriate assessment has to be done and areas have to be identified with respect to its impacts on birds using these plant patches. It is also pertinent to note that large scale de-weeding may result in loosening of sediment and stabilized mud banks, and in turn increase in macronutrients levels.

4.5 Recap of major drivers for the land use changes

The lake Kolleru and its basins have been experiencing considerable changes relating to social, economic, political and ecological aspects of the area. While deliberating upon the history of the area the changes that have happened during the earlier period up to 6^{th} century AD has been hinted. Since millennia there have been influxes of people to the area, especially from Orissa. Later on many of the people permanently settled here of which the most notable was of those from Orissa called *Vaddis*, who were originally into capture fishing. The subsequent actions and changes in brief are given below as a recap.

- Since 1940, whilst the British government granted *pattas* (title deeds) on payment of market value for the lands, cultivation within the lake area increased.

Figure 20: Vegetation growth in the area

- In 1954, the government accelerated the rice cultivation and initiated cooperative farming in the region by introducing 93 farming societies on 850 km^2 of the lake bed. Subsequently native paddy varieties were gradually replaced with shorter, high-yielding varieties that required high dosages of chemical fertilizers and pesticides.
- In 1969, almost entire lake was brought under cultivation and bunds constructed to keep water out to protect the crops. During this period several measures were also initiated to protect the rice cultivation from the annual flood. However, the cyclone in 1969 devastated the agriculture. By the time flood control measures were completed, most of the people had become skeptical to agriculture and abandoned it.
- At this point, the better-off sections of community entered the scene and took the land / water area on lease from the society members for periods ranging up to five years. Till 1990, these influential classes, also comprising of those who have successfully done with the original beneficiaries, were only involved in fishery, an activity that requires fresh water.
- The infrastructure development coupled with increasing demand for fish created a new avenue for the villagers by late 1970s. Then chief minister Mr J Vengal Rao, encouraged Fishers to form registered cooperative societies and loans were

provided to members for seasonal cultivation of one hectare dry land per family. In due course, the principal land use became pisciculture which swiftly became profitable. By 1984, 5,000 acres of government land within the lake bed was converted to fish tanks under the management of cooperative societies. **Diverting the wetland widely and arbitrarily for aquaculture regardless of the natural hydrologic regimes, and introduction of contractors and private entrepreneurs into the lake area were the events that happened during the time, which brought devastating effect on the natural flow system**. The trend still continues.

- The private entrepreneurs including well-off section of the local society were actually harvesting the land under the name of unprivileged local "beneficiaries" who legally own the land. In return, members from the local community work for a wage of about Rs 20/- a day for women and Rs 40/- for men. As Narender (1993) quotes Anjaneyulu "*The land has shifted from small time fisher folk to big landlords*".
- In 1982, the Andhra Pradesh government set up the Kolleru Lake development committee (KLDC) and earmarked Rs 300/- crores for a master plan for Kolleru development. The plan suggests that the lake level be maintained at +5 feet above MSL, and irrigation and drainage regulators be constructed across the Upputeru channel. It also calls for checking encroachments, regulate and monitor pollution, clear the lake of weeds and use them as compost and raw material to produce biogas. Pisciculture, a bird sanctuary and tourism were also on the cards. The government, however, did not allot funds for these activities.
- In 1986, the MoEF, GoI identified Kolleru as a wetland of national importance for intensive conservation and management purposes under National Wetland Program for its ecological and socio economic importance.
- In 1999, the state government declared Kolleru as a wildlife sanctuary (by the GO Ms No 120 dated October 4) and delineated the area up to +5 feet above MSL (~30855.20 ha) as protected area.
- In 2002, the wetland was identified under Ramsar Convention as a wetland of international importance, covering the total lake. The Kolleru Wildlife Sanctuary forms an integral part of the wetland system.

4.6 Ecological impacts of changing environment

The changing environmental set-up of the Kolleru Lake has brought in notable consequences to the faunal and floral components of the ecosystem.

4.6.1 Eutrophication

The lake's eutrophication and deterioration in ecological health has occurred steadily and consistently. As discussed earlier Kolleru lake receives large quantity of nutrients, leading to eutrophication. Eutrophication is known to cause wide changes in structure and function of aquatic systems (Smith et al., 1999). **Rise in turbidity, increase in phytoplankton biomass, blooms of toxic or inedible phytoplankton and gelatinous zooplankton, decline in the biomass of benthic and epiphytic algae, changes in macrophyte species composition and biomass, fall in dissolved oxygen, fish kills, change in species composition of fish and other fauna, reductions in harvestable fish and shellfish and fall in aesthetic value of the water body are some common consequences of eutrophication.**

Variations in water level, human pressure on land and increasing landscape modification have added to further deterioration of the lake. Huge quantities of inorganic fertilizers are used in the catchment area for agriculture which is likely to increase with augmented irrigation as and when the Polavaram right canal becomes functional. As a result of leaching and run-off, it is estimated that about one fourth of the fertilizers will end up in the lake (Gopalakrishnayya, 1999). Within the lake area also considerable quantities of fertilizers and pesticides are used in agriculture. Added to this are the fish tanks discharges with high nutrient content and other residues.

The nutrients such as nitrates and phosphates are recorded very high in the lake leading to various consequences including luxurious growth of macrophytes which have adaptive advantage of drawing nutrient from the lake sediments as well as water column. The expanding rooted and floating weeds aid trapping suspended sediments and other materials, and reduce the flow of water augmenting further eutrophication of the lake.

4.6.2 Flora

As noted above the Kolleru is rich in floral biodiversity. But the land use changes, changes in water quality and other environmental changes is reflected in floral composition as well. **Invasive species such as *Eichhorrnia crassipes*, *Pistia stratiotes* and *Salvinia molesta* have spread over the lake, clogging many areas and filling several open water areas. The spread of floating weeds would have serious impacts on the submerged, algal and epiphytic flora as well.** However, such changes in Kolleru so far remain largely un-documented and needs further investigations. *Phragmites karka* seems to have invaded all the exposed areas in the lake especially towards the lower ends.

4.6.3 Avifauna

The Lake Kolleru has been habitat for a variety of waterfowl; resident, migratory, rare and endangered species since time immemorial. It acts as a staging post and refueling station for migratory birds on their onward journey. Birdwatchers have been conducting bird census in January of every year in different parts of the lake. The data available on bird census is shown (Figure 21) below:

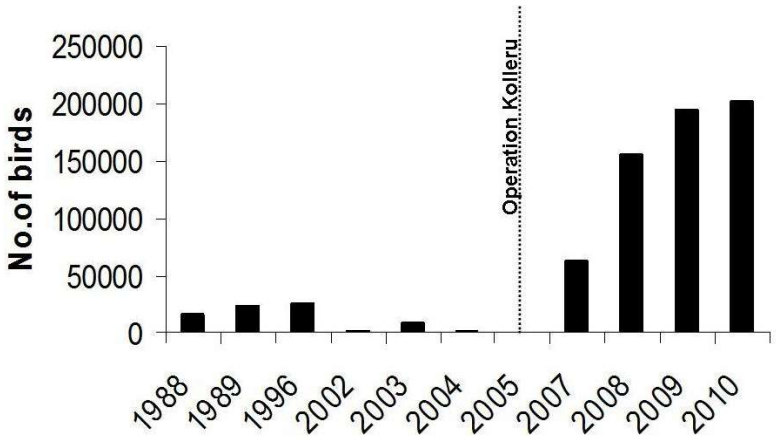

Figure 21: Bird abundance recorded in Kolleru
Source: Data from Wildlife Management Division, Eluru

The conspicuous waterfowl in the lake include ducks, teals, storks, egrets, herons, ibises, bitterns, cormorants and a number of waders (Figure 22). Large numbers of Lesser Whistling teals were recorded in 1997. Rare and vulnerable species seen here

are the Garganey, Shoveller, Redcrested Pochard, White-eyed Pochard, Tufted Duck and Ruddy Shelduck. Gulls, terns and some raptors were also recorded.

Figure 22: A mixed flock of birds in the lake Kolleru
Source: Mr AK Sinha, Conservator of Forests, Eluru

Mr Mackenzie, then collector recorded in the Manual of Krishna District in the Presidency of Madras (1883) that colonies of Pelicans were fostered in several villages. In 1949, Prof Neelakantan discovered breeding colonies of Spot billed Pelican at Kolamuru, Aredu and Sarepalli which continued till about 1970. Lamba (1963) found many more breeding areas in and around the lake. 3000 pelicans were recorded by Gee (1960) during his visit to Kolleru in January. In 1972, Mr Pushpa Kumar, the then Chief Wildlife Warden, recorded some pelicans. But, on visiting again in 1973, he could not find any pelicans. Guttikar visited the lake in 1975 and reported that the pelicans had deserted the area (Guttikar, 1978). In 1979, Mr S Ashok Kumar, Life Member, Birdwatcher's society of AP, visited the lake; however could not find a single bird. Spot billed Pelican (*Pelicanus phillippensis*) is a species included in Schedule I of the Wildlife (Protection) Act, 1972 and in the Red Data Book. It is a resident species considered endangered based on six years of census in India. Rose and Scott (1994) while reporting Spot billed pelican population in South and South East Asia to be around 11500 noted a perceptible trend of decrease in its population. The species is considered a “globally threatened species” under the category “vulnerable” (BirdLife International, 2001; Mistnet, 2003).

The Pelicans also lost Matlam-Pedalanka and Garisipudi-Ollanka-Nidamarru mangrove forests for the area was de-reserved and converted into agricultural fields. Earlier the villagers protected the birds but later on they became indifferent. The false notion that the guano of the birds encouraged weed growth, and the birds alight in the paddy fields at night to catch fish damaging the crop led to the villagers replacing dominant Palmyra with coconut palms on the bunds. There was low availability of fish in the lake water for various reasons such as pollution and habitat changes discussed above. The change in tree cover in the belt area and outer fringes of the lake bed deprived the birds of nesting material and nesting sites. Large scale poaching of the birds with nets, shooting, poisoning and theft of their eggs also forced the birds to desert the area.

Subsequent to the Operation Kolleru, the pelicans appeared again there, after almost three decades (Figure 23). During the visit of the committee in September 2010, we could find about a dozen of these birds in the area. Prof Bharathalaxmi, Sri Ch Balasubrahmanyam and Birdwatchers Society of Andhra Pradesh team recorded the presence Spoon-billed Sandpiper and Water Cock post “Operation Kolleru”. During our visit, Bank mynas which were relatively rare were also sighted. In all 117 species of birds were spotted in three days. The team also noticed significant decrease in coots and black winged stilts. After the “Operation Kolleru”, the Forest Department raised some bunds in the areas frequented by birds and planted *Acacia* sp. Some of these bunds were still seen in the Atapaka area. Raising of these bunds and planting of trees such as *Acacia nilotica*, *Barringtonia acutangula* and *Borassus flabellifer* has to be taken up on a larger scale to provide growing demand for nesting material and nesting sites for birds.

Figure 23: Pelicans / birds have returned

4.6.4 Other faunal forms

The changes in the floral and environmental changes had apparent impacts on the faunal forms of the lake. Species such as apple snail has reduced considerably. Apple snail is one of the important food species for storks. **Similarly several fish species have reportedly disappeared and the fish species composition has changed skewed towards air breathing species.**

After establishment of shrimp farms, Apple snail (*Pila virens*), the staple food of Asian Open billed stork (*Anastomus oscitans*), was being collected for feeding tiger shrimp (*Penaeus monodon*) to fatten it. Consequently large-scale commercial

exploitation of this snail in and around Kolleru has led to 60% destruction of its population (Seshagiri Rao and Varhala Raju, 1996). Impacts of shrimp farms on wetlands has been documented widely (E.g. Thornton et al., 2003)

Culture fisheries operations on such a large scale have actually affected the native species in the lake resulting in their decline or local extinction. According to Dr Seshagiri Rao (Former Head of the Zoology Department, DNR College, Bhimavaram) **nine species belonging to Cyprinidae family, one species belonging to Cyprinodontidae family, three species belonging to the Centroponidae family and two species belonging to Mugilidae family have either became rare or disappeared from the lake due to the inland aquaculture**. This would have affected the livelihood of the traditional fisher-men living on the lake and prey availability to piscivorous birds.

4.6.5 Submersion of paddy fields in the belt villages

Many of the belt and bed villages in Kolleru are prone to flood and submergence of their crops as shown in the Table 15. As discussed earlier for various reasons floods are frequent. Several committees (Mitra, 1966; Pandurangan, 1976; Ramakrishnan, 1980; Sivaramakrishnaiah, 1980) have been constituted to identify and propose actions for development of the area and to mitigate the troubles from floods. They came up with several recommendations, many of which still remain only on paper.

During the heavy rains that lashed West Godavari and Krishna districts from 16th to 19th September and 15th to 17th of October, 2005, farmers in belt villages, beyond +5 contour levels, were badly affected due to submersion of their paddy crops. The then Chief Minister made an aerial survey of the submerged area in 20 affected villages. This was followed by a visit by Group of Ministers (GoM) to some of the areas around the lake in both the districts on 23-10-2005 and interaction with the affected farmers. A review meeting was also held by the GoM chaired by the Honorable Minister for Agriculture on the same day. Further, a high level meeting was conducted with the top officials of revenue, irrigation, forest and police departments on 27-10-05 at Hyderabad on ways and means of draining out of the flood waters from submerged areas beyond +5 feet contour for an immediate relief to the affected farmers.

On 29-10-2005, a meeting was held under the Chairmanship of District Collector, West Godavari at Eluru with police, forest, revenue, irrigation and roads & buildings department officials of both the districts on removing obstructions and barriers that curbed free flow of water of the lake into the Upputeru. To deal with the problem of inundation 45 Action teams were formed by the District collector, West Godavari (vide Rc D4/7009/05 dated 14-11-2005). The Collector had also supervised the works of removal of obstructions for allowing free flow of water.

In the replies submitted to the Central Empowered Committee, the Principal Secretary, EFS&T Department, AP Government in the letter dated 14-2-2006 stated that the '*adjacent agricultural fields of Kolleru area were inundated / submerged during heavy rains in almost all years due to backflow of waters from the 67 in falling drains of Kolleru which are being obstructed by existing fish tanks below +5 contour resulting in the occurrence of low profitability / loss. The area of submersion and submergence of paddy fields by rain / flood water has been increasing year by year. During 2003-2004 inundation continued for 15 days with little crop loss but during 2005-2006 this period lasted for 60 to 75 days resulting in heavy crop loss. This is due to increase in number of fish tanks in Kolleru belt and bed villages which obstructed flood water draining into the sea*'. A four member team headed by Mr Dharmendra Sarma, Joint Secretary, Ministry of Home Affairs, Government of India, also visited the flood hit areas.

As proliferation of fish tanks with high rise bunds below and above +5 feet contour had aggravated flooding, "Operation Kolleru" was undertaken in 2006. Despite large number of demolitions of fish farms there are several reports that the fish tanks were formed afresh and operating. Added to this, nearly ten consecutive low pressure formations in the Bay of Bengal in July, August, September and October 2010 close to the Andhra coast kept the monsoon vigorous resulting in incessant rains. Consequently several rivulets and steams like Tammileru, Jalleru, Errakalva, Bayyeru, Sanga, Pulivagu and Kovvada canals carried heavy flood flows.

Tammileru drains into Kolleru after passing through the Nagireddygudem reservoir. Because of the sudden inflow of 21000 cusecs of water from this reservoir into the

lake, on the 29-8-2010 night, the causeways across the Tammileru linking Eluru to Ammannapeta, Ponnangi, Kothuru and Sreeparru were submerged disrupting traffic. The localities on the outskirts of Eluru were also submerged.

At the field meetings (during the visit of the present Committee on 20-25 September 2010) some speakers pointed out that even after demolition of the tanks, there is flooding (Table 16**) which is mainly because the drains and vents are choked and that flooding was not due to fish tanks. This is far from truth as even today, fish farms are thriving in Nidamarru and Bhimadole mandals and would have reasonable role in impeding the flood flow and in the submergence of the area around the sanctuary.** The recent heavy rains have highlighted the need for appropriate channelization, clearing debris from demolition of fish tanks, clearing extensive weed growth and removal of all the fish tanks.

5 KOLLERU LAKE - CONSERVATION AND MANAGEMENT HISTORY

The lake Kolleru has an eventful conservation and management history, perhaps starting in the late nineteenth century with Mr Mackenzie's visit. In late forties of the last century the pioneer bird watcher Prof Neelakandan, made extensive investigation and spotted an active pelicanry in the "outskirts of Sarepalli to Aredu" in the area. Further to that several eminent wild lifers and ecologists of the country visited the area, explored and documented the avian richness and habitat uniqueness of the area. As noted earlier the conservation importance of the lake has been relatively well documented. The importance of the lake both from the point of view of its ecological services and socio-economic and cultural importance also have been well apprised of. The need for declaring the area as a protected area was well recognized. That led to the declaration of the Kolleru Wildlife Sanctuary in 1999. Further, in due course of time a larger extent has been declared as Ramsar Site and also has been identified as an important bird area. However, the conservation action has led to a series of litigations and interventions by the high court of Andhra Pradesh and later Supreme Court of India. A brief chronology of events is presented below.

- 1995: A notification under Section 18 of the Wild Life (Protection) was issued (GO Ms No 76 EFS&T dated 25-09-1995) by the Government of Andhra Pradesh declaring the areas specified in the Schedule as a Wild Life Sanctuary called as "Kolleru Wild Life Sanctuary". The Schedule indicated the boundaries and mandal wise list of villages. At the beginning of the notification, 10 mandals were mentioned. However, only 38 villages classified as bed villages (Inside) and belt villages (in the periphery and above +5) in 5 mandals were mentioned in the last paragraph of the GO. There appears some discrepancy in the list of areas covered by the GO. Name of Nandiwada mandal that appeared in the first paragraph of the GO is not found in the last paragraph of the same GO. The details of villages are another discrepancy. The rationale for choosing +5feet contour was also not stated in the GO.
- 1998: A writ petition was filed in High Court of Andhra Pradesh by Dr. Patanjali Sastry, Environmentalist from Rajahmundry (WP No 33587 of 1998) requesting for a direction to the state government to stop pollution of lake

from discharging industrial effluents, to stop construction of houses and roads, to check the conversion of hundreds of acres of land into fish ponds and to check bird hunting in the catchment of the lake.

- 1999: GO Ms No 120, Environment, Forest, Science and Technology (For. III) Department dated 4-10-1999 published in the AP Gazette on 5-10-1999 was issued notifying the Sanctuary. The notification was issued under Section 26-A of the Wild Life (Protection) Act, 1972. 308 km^2 of the lake, falling below +5 feet contour, was declared as Wild Life Sanctuary (Appendix 11, Appendix 14). Of the sanctuary area 62276.55 acres was government land and 14861.33 acres private patta land (Source: Presentation by JC, West Godavari on 25-09-10 at Eluru Collectorate before the Committee and note from the Conservator of Forests, Eluru). However, in connection with this declaration, no attempt is known to have made to conduct a proper survey of the whole area focusing on its wetland / ecological characteristics, depth profile and re-confirmation of the so-called contours.
- In the boundary description in the GO 120, it was mentioned that the boundary runs along the contour +5 feet MSL. Mandal wise details of area in hectares covered by the Sanctuary in both the districts were also mentioned (Table 18) in the Government Order. While the preliminary notification mentioned 38 villages falling in five Mandals, 74 villages in 9 Mandals were notified in final notification. However, the reasons for these variations were not mentioned in the final notification.

Table 18: Mandal wise boundary discrepancies of the Kolleru WLS

Mandal		Village as per GO 76	Village as per GO 120	Area (hectare) as per GO 120	Area (hectare) as to be amended*
District Krishna					
1	Kaikaluru	13	21	4117.81	6692.6
2	Mandavalli	08	08	2943.81	3442.20
District West Godavari					
3	Elluru	10	11	9560.00	9560.00
4	Bhimadole	04	06	8129.00	8129.00
5	Nidamarru	03	11	2735.30	2735.30
6	Akiveedu	Nil	10	2765.62	2765.62
7	Denduluru	Nil	03	234.23	234.23
8	Pedapadu	Nil	03	315.72	315.72
9	Unguturu	Nil	01	53.71	53.71

Total	***38***	***74***	***30855.20***

*Source: Letter from DFO (Wildlife Management Division, Eluru) Ref No 374/2002/WLM dated 28/04/2002

- 1999: By the time the area under the sanctuary was notified, 27,910 acres of government land and 19,565 acres of private land i.e. a total of 47,475 acres is under occupation leaving only 29,663 acres without any encumbrances (Lr from Principal Secretary, EFS&T dated 14/02/2006 to the CEC). This includes also the encroachments to an extent of 8724 acres that took place after 1995 notification leaving an effective area of 20,939 acres without any occupations.
- 1999: The Kolleru Fishermen and Small Scale Farmers Association also filed a writ petition before High Court of Andhra Pradesh complaining that government was not taking steps to stop pollution of the lake by industries and municipalities.
- 1999-2000: The Kolleru Fishermen and Agricultural Small Farmers Association (Prathikolla Lanka, Eluru Mandal), Dr Ambedkar Harijan Fisherman Cooperative Society Ltd (Bogapuram village, W.G. Dt.) and Dr Ambedkar Co-operative Collective Farming Society Ltd (Bogapuram village), filed writ petitions (WP Nos 23210 of 1999 and 4350 and 4375 of 2000) seeking to declare the notification of the Government (GO Ms No 120) as illegal, unconstitutional and violative of Articles 14 and 21 of the Constitution and consequently to set it aside.
- 2001: Two residents of Vadlakutitippa village, Kaikaluru Mandal, Krishna District, filed appeals (WP No 2354 of 2001) questioning the action of interfering with repairing works undertaken to their fish / prawn tanks and praying for direction declaring the action of interfering with the rights of the petitioners to repair their fish/prawn tanks in the lands to the extent of Acres 7 and Acres 6 (in S Nos 116/1A, 117/1 to 7) of Vadlakutitippa village, h/o Penchikalamarru, Kaikalur mandal, Krishna District as arbitrary, illegal and violative of the Articles 14, 19, 21 and 300-A of the Constitution of India.
- 2001: Sri Yerneni Nagendranath, a former member of the State Drainage Board sought (WP No 12497 of 2001) in larger interest of preserving the lake to
    - remove all encroachments of Kolleru lake bed area up to +5 feet contour level according to the GO Ms No 120,

- direct to remove all obstructions to free flow of water in Kolleru lake at its normal monsoon level (+7 Contour) in pursuance of the international obligations on India being a signatory of Ramsar Convention,
- prevent discharge of untreated urban sewage, industrial effluents and residues from fertilizers and pesticides used in aquaculture etc., into the lake, and
- remove obstructions to the natural course of rivulets and other sluices to all roads laid and proposed to be laid in the lake area.

- There was several further judicial and other interventions regarding the lake system as listed below:
  - 2001: High Court dismissed the petition of 1999 and advised the government to adhere to the standards laid down by Ministry of Environment and Forests regarding lakes and effluents.
  - 2002: Kolleru Fishermen Cooperative Society moved Supreme Court seeking to protect people's right to life in the area.
  - 2005: Restoration work for the Lake started
  - 2005: Sri Pranay Waghray approached the Supreme Court for implementation of the High Court order
  - 2006: The Central Empowered Committee (CEC) appointed by Supreme Court directed the state government to remove all encroachments in the Kolleru Lake area
  - 2006: The Supreme Court upheld the directions issued by the Central Empowered Committee
  - 2006: Demolitions of aqua farms completed by 15-06-2006
  - 2006: Certain schemes for providing better livelihood were promised by government for the affected population and Alternate Livelihood Programmes were implemented

Despite all issues related with the declaration of the sanctuary, its management, and conflicts with the local residents, it is amusing to be intimated that, except for the higher officials, the rest of staff including forest guards and other field staff managing the Kolleru Wildlife Sanctuary are temporary employees. Nevertheless, 744 forest offences were booked and 1278 persons were arrested and sent to judicial remand as

on 06-10-06. Six check posts (4 in West Godavari and 2 in Krishna) were also established and ex-servicemen were posted to man these check posts.

6 LEGAL ISSUES RELATED TO THE SANCTUARY NOTIFICATION

Kolleru has gone through wide changes in land use, ecological setup and such like as discussed earlier, and has also experienced various actions of legal nature with wide implications on the ecological, conservational and socio-economic aspects of the area. A brief on these issues are given below.

6.1 Legal history of Kolleru Sanctuary

The legislative history of Kolleru lake is important to understand especially the manner in which the state has treated the lake over the years. This will put in right perspective, the recent issues relating to the Kolleru.

6.1.1 1951: Kolleru Lake Bed Area, not desirable to assign land; efforts of Revenue Department

The erstwhile Government of Andhra Pradesh issued a notification way back in 1951[1] in which the Government considered that it is not desirable to assign the land in the Kolleru lake bed area to anybody.

6.1.2 1955-1961: Lease subject to conditions for the lake bed areas of Kolleru

The process of assigning the lake bed areas started in 1955 where the Government changed its earlier stance and orders were issued prescribing conditions for assigning the kollair lake bed lands[2]. This was applicable only to the West Godavari District which was later made applicable to Krishna District in 1961[3].

6.1.3 1963: Closed Area in 1963 under Wild Birds and Animals Act of 1912; The larger universe of Kolleru

Subsequently, the Government of Andhra Pradesh declared an area of 20 miles radius from lake Kolleru as a closed area for protection of Grey Pelicans under Sections 2 & 3 of the Wild Birds and Animals Protection Act, 1912[4]. Clearly the area was thought to be important even before the enactment of the Wildlife Protection Act in 1972[5].

[1] G.O. Ms No. 551 Rev dated 8.3.1951
[2] G.O. Ms. No 135 Dated 18.1.1955
[3] G.O. Ms. No 665 dated 14.4. 1961
[4] vide GO MS. No. 1986 F&A Department dated 11.09.1963
[5] Source: Application of Pranay Waghre et al in the CEC C.W.P. 202 of 1995

6.1.4 1976: Revenue Department's Largesse without taking into cognizance of the closed area

While the state thought, on one hand about the ecological importance of the lake, on the other, this was followed by Collector Krishna's proposal submitted to the Government of Andhra Pradesh on 30.5.1975[6] to the Government to assign such bed lands of Ac 0.50 cents of land in each case to fishermen for the development of fisheries in Kollair (now Kolleru) and also to enable the beneficiaries to secure the institutional credit on the security of these lands from the Central Land Mortgage Bank and other Cooperative Financing Institutions and hence the request to relax the GO of 1951 mentioned above. Thus the administrator considered livelihood equally important. This proposal was accepted by the Board of Revenue[7] where the above proposal was approved; however it was subject to certain conditions:

a) That the land would be liable to be resumed not only if they are alienated or transferred but also used for the purposes other than fisheries development.

b) That the area chosen for assignment for fisheries development should be the area identified and determined by the Special Team appointed by the Government[8].

c) That the land will not be utilized for cultivation purposes.

The Government recommended such proposals and directed that Ac 0.5 cents of the land of Kollair (now Kolleru) lake bed area be assigned free of cost wherever necessary to fishers for fisheries development. It further directed that the assignees be permitted to mortgage these lands to secure institutional loans from the Central Land mortgage Banks and Other Cooperative Financing Institutions.

6.1.5 1976: Wetland of National Importance

Interestingly in the same year (1976), the same area was declared as a wetland of national importance.

[6] Collector's Krishna Lt No. 6676/74 dated 30.5.1975
[7] Board of Rev Ref 13/959/74 dated 26.11.75
[8] Special Team appointed by the Government in GO Ms No 664 Irrigation and Power Department dated 9.8.1975

6.1.6 1979: Exceptions to conditions on cultivation in lake bed areas; Coconut plantation and similar horticulture allowed

In 1979 the conditions to assignment of land in the tank bed area was modified and coconut plantations and similar horticulture activities were permitted on the banks of the tanks.

6.1.7 1984-1986: Assignment of Lands; D Form Patta lands

In 1984, Government Orders were issued where Government lands were assigned "D" Form Patta to landless poor persons[9]. What is equally important to understand is that such Pattas are allotted with conditions. A typical patta clearly states that:

Conditions of a D –Form patta

1. *The land shall be used for agricultural purpose only. It shall not be used for any other purpose.*
2. *The land handed over shall be enjoyed by his heirs and it shall not be alienated. As per A.P. Prohibition of transfer of government agricultural land, the land handed over shall not be transferred.*
3. *The person to whom the above land has been handed over, either under his personal supervision or the supervision of his family members should cultivate the land engaging agricultural labour. The land handed over shall be cultivated within three years from the date of issue of this patta.*
4. *According to Land Revenue Legislation, as amended from time to time, all taxes, local taxes shall be payable.*
5. *The handed over land shall not be kept waste or abandoned or damaged by excavating earth etc from the land.*
6. *If it is found that handing over of this land is illegal or approved by oversight or based on wrong report or deceit or the officer authorised to hand over the land has exceeded the powers vested in or if it is found that there are irregularities in procedure, this patta is liable for cancellation. In case of such cancellation, the person possessing this patta shall not claim any compensation for the improvements made to the land.*
7. *The customary rights of the government or the easement rights of the people with regard to use of roads, tracts, streams, canals or drains in the land or around the land handed over shall not be violated.*
8. *The government shall have the right over underground minerals and other natural resources.*
9. *For violation of any or all the above mentioned conditions, the government shall have the right of resumption. After resumption by the concerned government officials, the land shall be under the full control of the government.*
10. *The government shall take possession of the land in case the land is required for any project or for any public purpose. In such an event, no compensation shall be payable. The decision taken either by the government or by the authorised officers that the land is required for a project or for a public purpose shall be final.*

This land cannot be sold or purchased.

[9] G.O. Ms. No 180 Rev (n) Dept., Dt. 9.2.84 and G.O. Ms. No. 603 Rev (B) Dept., 28.5.1986

6.1.7.1 Compensation for resumption of government assigned land for public purpose; submergence of assigned land in major and medium irrigation and power project[10]*:*

The assignment of D form pattas to landless poor which may come under submersion due to major, medium irrigation and power projects or industrial projects may be resumed and the assignees shall be paid compensation on "compassionate ground" a the market value similar to patta lands that have been acquired under the Land Acquisition Act as applicable in Andhra Pradesh. The rationale of the government is ensuring livelihood by virtue of such resumption and the order mandates that ex-gratia equivalent to the market value should be paid subject to certain conditions. The conditions are as follows:

Conditions of Compensation:

a. *That the amount is to be treated as ex-gratia*
b. *That the assignees would not be entitled for marking references under section 18 and section 28 A of the Land Acquisition Act to the courts.*
c. *An amount equivalent to 15% for the lands resumed prior to 30-4-82 and 30% after that date on the market value payable under Section 23(1) of Land Acquisitions Act may be considered for being included in the total ex-gratia payable to the assignees is solatium.*
d. *That the assignees will not be entitled for interest or an additional market value under the Land Acquisition Act.*
e. *That the above conditions shall be made applicable to all the assigned lands resumed on or after 9/2/1984 (i.e. the date of issue of G.O.M.S. No. 180, Revenue dated 9/2/84, in supersession of G.O. Ms. No. 43, Revenue (s) Department) dated 23/1/88.*

In case of irrigation projects, specific GO was issued in 2001[11] *where the categories of enjoyers / encroachers of government lands were prescribed. This was reconsidered and a generic GO was issued in March 2010* [12] *where three categories of persons are described for payment of ex-gratia in case of acquisition of such land as follows:*

Category A: To pay ex-gratia for the lands to DKT pattas holders

Category B: Un-objectionable land under the enjoyment of eligible encroachers for a long period without "D" form pattas and whose possession is confirmed by entries in 10(1) and the Adangal accounts they may be paid ex-gratia which is equivalent to market value without Solatium.

Category C: Unobjectionable lands under enjoyment of the eligible encroachers and whose names are recorded only in the Adangal; they may be paid ex-gratia which is 50% of the market value for deprivation of livelihood. No. Solatium would be payable.

[10] See G.O.M. S. no. 1307 dated 23.12.1993 (Revenue Assignment (1) Department)
[11] See G.O. Ms. No. 639, Revenue (Assn. IV) Department dated 20.9.2001
[12] G.O. MsNo. 243 dated 27.03.2010 (Revenue (Land Acquisiton) Department)

Category D: Persons who have purchased assigned lands from DKT Patta holders, will not be entitled to any ex-gratia as it amounts to violation of the conditions of assignment and contravention of the provisions of AP Assigned lands (PQT) Act, 1977
The payment of ex-gratia / compensation for the eligible encroachers covered under items (ii) and (iii) above may be made after the personal inspection by the Joint Collector of the concerned district.

6.2 The process of making part of Kolleru a Protected Area under the Wildlife Protection Act

6.2.1 1995: Intention to Declare a Sanctuary; Consequence

After the passage of the Wildlife Protection Act in 1972 which was made applicable to the state of Andhra Pradesh in 1973, through an Intention Notification under Section 18 of the Wildlife Protection Act, the area was proposed to be declared a sanctuary on 25/09/1995. It's important to understand the consequence of intention notification under the Wildlife Act and in fact the settlement of rights process under the WLPA. This is most crucial to understand as the entire dispute in Kolleru seems to revolve around the rights of various stake holders within and around the Kolleru Sanctuary.

6.2.2 Settlement of rights process under the Wildlife Protection Act and its status in Kolleru

Let us understand the settlement of rights process under the WLPA and its implication and status in Kolleru area.

The settlement of rights within protected areas including sanctuaries is a mandatory requirement for it to be finally notified especially in the wake of 1991 amendment to the WLPA[13]. Broadly, the settlement of rights process may be classified into six stages:

6.2.2.1 Stage I- Intention and Bar of accrual of any new rights

Firstly there is an intention notification which describes any area which may be of ecological, faunal, floral, geo-morphological or geological, natural or zoological significance that is proposed to be a Sanctuary. In the case of Sanctuaries any such proposed area does not include Reserve Forest (RF) and Territorial Waters. There is a

[13] Prior to 1991, any land could be declared as a finally notified sanctuary and the rights within it cold be settled subsequently.

separate procedure for declaring RF and Territorial Waters as Sanctuaries[14]. The intention notification is required to describe the situation and limit of the proposed protected area by roads, rivers, ridges etc., under Section 18 of WLPA. The consequence of intention notification for a Sanctuary was that the provisions of sections 27 to 33A (both inclusive) shall come into effect forthwith (i.e., restrictions on entry, regulation of permit, destruction within a sanctuary, prohibition on fire or use of weapons or injurious substance that may affect wildlife, or regulation of grazing and livestock would come into affect despite the fact that the settlement of rights within such areas have not been effected. As stated earlier, the intention notification for Kolleru Sanctuary was issued on 25/09/1995[15].

- *Bar on Accrual of any new rights after intention notification:*

Further after the issuance of Section 18 notification under Section 20 of the WLPA, no right shall be acquired *in, on, or over* the land comprised within the limits of the area specified in such notification. The only exception to this general rule is those rights that accrue vide succession, testamentary or intestate. Thus it is clear that there is complete bar on accrual of any new rights in a proposed sanctuary and any change in that area would be a legal violation of such a notification.

By this statutory provision, any new aright between 25/09/1995 and 4/10/1999 would be illegal. Two temporal maps between these two significant legal dates clearly suggests that several illegal rights or entitlements were created between these two dates owing to the delay in settlement of right process.

6.2.2.2 Stage II-Determination of Rights by the Collector

This stage is extremely crucial as the Collector of the district is mandated to inquire into and determine the existence, nature and extent of right of ***any*** *person* (emphasis given) within the limits of such proposed sanctuary under Section 19 of the WLPA.

[14] Note that this was not the situation pre 1991 where any area including reserve forests or territorial waters could be declared a sanctuary. The 1991 exception was under the assumption that there was an existing process under the Indian Forest Act or respective state Forest Acts

[15] See G.O Ms. No. 76 Environment, Forest, Science and Technology (Forest-III) Department dated 25.09.1995.

6.2.2.3 Stage III-Proclamation Notification

The District Collector or any officer so authorized is required to issue a proclamation notification under Section 21 of the WLPA. Such proclamation is required to be published in regional language in every town or village or in the neighborhood of the area specifying the boundaries of such a proposed protected area. Under the said notification any claim under Section 19 is required to be submitted within two months from the date of such proclamation. The 'claim' includes the nature and extent of such rights in a written form and in a prescribed manner. Interestingly, no time limit was prescribed between the intention and proclamation notification prior to 2002[16].

The proclamation notifications for Kolleru by district collectors of West Godawari and Krishna were issued on 17/1/1997 and 9/1/1996 respectively[17].

6.2.2.4 Stage IV- Inquiry

Section 22 of the WLPA describes the process of Inquiry by the District Collector or authorized Officer. This inquiry includes the claims under Section 21 as well as claims under Section 19 which may exist as per the Collector but not claimed. Here again the inquiry is to be done 'expeditiously' but no time frame is given. The primary bases of the claims under this Section are records of the Government and evidence of any person acquainted with the same. For the purposes of the inquiry the Collector is vested with the same powers as are vested in a civil court for the trial of Suits[18].

6.2.2.5 Stage V- Acquisition of Rights

The claims under Section 19 are dealt with in a manner described under Section 24 of the WLPA. Under the said Section the Collector is empowered to pass an order which may admit or reject a claim in whole or part. If such claim is admitted wholly or partly then such land may either be excluded from the limits of the protected area or acquired by the State. Such acquisition may either be under an agreement between the right holder and the Government or where such right holder has agreed to surrender his right to the Government in lieu of compensation as per the Land Acquisition Act

[16] Now within sixty days after Section 18(1) vide Amendment Act, 2002
[17] As per counter affidavit filed ny respondent No. 1 i.e. Governmetn of A.P. on 15.04.1998 in WP No. 14/80 of 1997 between Kakarala Subhash Chandra Bose v. Governemnt of A.P.
[18] Section 23 (b) of the WLPA.

1894. In case of Sanctuaries the Collector has been given special powers under Section 24 (2) (c) to allow any right over any land in consultation with the Chief Wildlife Warden of the State. This special power is the most significant provision that distinguishes Sanctuaries from National Parks. No such right is allowed in National Parks. A close look of Section 24 reveals that no guidelines or grounds have been enumerated for acceptance or rejection of such claim. Further, the role of Chief Wildlife Warden is unclear in case of allowance of any right in a Sanctuary. The Act is silent on the question as to whether his views are binding or not. Consultation in this case need not connote concurrence.

6.2.2.6 Stage VI- Final Notification

A Sanctuary may be finally notified under Section 26-A of the WLPA only after the period of claim has elapsed and all other claims have been disposed of. In the case of Reserve Forests and Territorial Waters which may be proposed to be included in a Sanctuary the State Government may directly notify such RF as Sanctuary and in the case of territorial waters the limits of the area so included in a Sanctuary shall be determined in consultation with the Chief Naval Hydrographer and with prior concurrence of the Central Government. Such inclusion of territorial waters needs to take adequate measures to protect the occupational interest of the local fishermen. The right of 'innocent passage' of any vessel or boat through the territorial waters shall not be affected.

6.2.3 1999: Final Notification of Kolleru Sanctuary; Its consequence

The Kolleru sanctuary was finally notified in 1999[19] thereby concluding that the rights have been settled of the communities and other stakeholders within such proposed sanctuary.

The said notification, apart from notifying the exact area and boundaries and villages, delineated the existence nature and extent of rights within the sanctuary as determined by the district collectors of Krishna[20] and West Godawari[21] was as follows:

[19] Vide Notification No G.O.Ms. No. 120, Environment, Forest, Science and Technology (FOR. – III), 4th October 1999
[20] Vide proceedings no. E6/1236/97, dated 1.09.1998
[21] Vide reference no. D6/11717/96 dated 08.08.1999

Existence, nature and extent of rights in Kolleru sanctuary

1. *Right to do fishing with traditional methods using mavus nets of size (which does not cause damage to seed but catches only fish of harvestable size) which will be specified separately by the Chief Wildlife Warden of Andhra Pradesh.*
2. *No person shall form any tank for Aquiculture or for any other purposes.*
3. *Wherever Pisciculture was existing in private lands, as on the date of forest notification, fishing in traditional methods shall be permitted, without causing environmental hazard, till the Government acquires such private lands.*
4. *Right to do traditional Agriculture without using pesticides and chemicals.*
5. *Right to use the ordinary boats without motor for the movement of the people.*
6. *Right of way with existing roads connecting main habitations and their maintenance by providing sufficient number of vents for the roads existing at the time of Notification of Kolleru Wildlife Sanctuary U/s 18 of Wildlife (Protection) Act, 1972 without permitting new roads and culverts.*
7. *Right to maintain existing water courses and drains necessary to avert submersion of agricultural lands surrounding Kolleru Lake.*
8. *Other rights and conditions as specified U/s 27 to 34 and other provisions of the Wildlife (Protection) Act, 1972.*
9. *Electricity connection shall be given for domestic use only and not for Aquaculture or any activity connected therewith.*
10. *The D form pattas granted or lease of land allowed in the area in favour of any assignee or lessee as the case may be including three societies viz. Gangaraju Fishermen Cooperative Society, Srungavarappadu; Sringavarappadu Fishermen Cooperative Society; Sanjay Gandhi Fishermen Cooperative Society, Srungavarappadu of Krishna District will be cancelled. The claimants are not entitled to any compensation under Wildlife (Protection) Act, 1972 as they were assigned the lands by the Government on free of land value.*
11. *D-Farm pattas to the extent of Ac.2882.00cts issued to the individuals as per GO .Ms. No. 118 Revenue (Q) Dept., dated 24.01.1976 in West Godavari District wherein they were permitted to construct fish tanks on the said lands are liable to be cancelled and these lands will be resumed under the provisions of Wildlife (Protection) Act, 1972. These D-Farm patta holders are not entitled for any compensation except ex-gratia as provided by the Government.*
12. *The annual Licences which are being issued by the Fisheries Department for fishery purpose indicating the areas allotted are to be discontinued.*

13. *Encroachments in conditional patta lands of Siddapuram village of Akiveedu Mandal are to be evicted.*
14. *The village site Poramboke of Siddapuram village of Akiveedu Mandal measuring Ac. 16.67 cts is hereby excluded from the jurisdiction of the Sanctuary.*
15. *Any other encroachments / activities which are not permitted specifically are liable to be removed / stopped forthwith.*

6.2.4 Consequence of a Finally Notified Sanctuary

After the final notification of the sanctuary, "*No alteration of the boundaries of a sanctuary shall be made by the State Government except on a recommendation of the National Board"*[22]. Clearly this will have a huge bearing in any decision relating to alteration of boundary of Kolleru.

6.3 2001: Reconfirming S. Jaganath vs. Union of India applicability on agriculturists to carry out prawn culture, shrimp culture or other types of aqua culture on private agriculture land

In several petitions filed before the High Court of AP, in 2001 among other things it was confirmed by the High Court of AP that the state should not allow any person to carry on the activities of the shrimp culture or prawn culture or any type of aqua culture without obtaining the prior permission from the competent authority.

6.4 April 2002: Boundary correction of Kolleru: Formal recognition of administrative faults: Inclusion of certain villages missing in the list of villages

There were certain discrepancies in inclusion of villages in the Mandavalli Mandal of the Krishna District. There were area discrepancies as well in Kaikaluru Mandal[23]. Clearly the Final Notification of the Kolleru Sanctuary Notification has to be amended to reflect these positions. It was also contended that such inclusion shall not attract the provisions of alteration of boundaries under the WLPA as there was no

[22] Prior to 2003 amendment it read as under: No alteration of boundaries shall take place except on a resolution passed by the State Legislature under Section 26 A (3) of the WLPA.
[23] See letter Ref No 374/2002/WLM, dated 28.4.2002 from DFO Eluru to CF Rajahmundry

alteration of boundary but only correction of administrative errors. This is still pending and needs urgent correction.

6.5 August 2002: Designation of Kolleru as Ramsar Site

The Kolleru lake was given international recognition on 19th August 2002 considering its ecological significance as a natural flood balancing reservoir between deltas of two rivers and the fact that it supports vulnerable species such as Grey Pelican and harbors variety of resident and migratory bird and support more than 50 thousand water fowls and a large number of species of fishes and prawns[24].

6.5.1 2003: Removal of Encroachments on tanks, kuntas, ponds, lakes etc under "Neeru- Meeru" programme and subsequent inclusion in prohibitory order book

Realizing that the tanks, kuntas, ponds, lakes etc are the sources of irrigation and these water bodies help maintain ecological balance including augmenting ground water potentialities and are indispensable for protection and improvement of environment the state government issued instructions [25] for removal of encroachments in the tanks and to identify the encroachments and to protect water bodies under the "Neeru-Meeru" programme. A month later through another reference[26] by the CCLA the collectors were informed that apart from the removal of encroachments identify and include all lands covered by water bodies in the prohibitory order book i.e. such land covered by tanks, kunta, ponds, lakes, vagu, vankas, river, projects and reservoir porambokes.

6.5.2 April 2006: Judgment of the Supreme Court for removal of all fish tanks and transportation of inputs for pisciculture in Kolleru lake

The Supreme Court by upholding the final notification of 1999 declaring the Kolleru sanctuary and in view of the limited rights within the finally notified Kolleru sanctuary, ordered for removal of all fish tanks and transportation of inputs for pisciculture in Kolleru lake[27].

[24] See information sheet on Ramsar wetlands
[25] Govt. memo No. 24140/Assn. I (1) / 03-3,Revenue Department, dated 22.08.2003 addressed to the Chief Commissioner of Land Administration and copy to all district Collectors.
[26] Reference No. B2/2225/2003 dated 20.09.2003
[27] See Judgment dated April 10, 2006 in I.A. No. 1486-87 in CWP no 202 of 1995

6.6 July 2006: Permission for traditional fishing and traditional agriculture by PCCF-Wildlife

It is interesting to note that immediately after the Supreme Court's judgment in April 2006, three months later, the PCCF-Wildlife, delegates his powers to the DFO to issue permits for carrying out traditional agriculture and traditional fishing in Kolleru Sanctuary subject to certain conditions including aperture size of the net, ban on pesticide use, permits not to be used in spawning season etc[28].

6.7 2006: Letter of Collector, Krishna District and Advocates' Committee Report to High Court of AP

The boundary and map discrepancies between various line departments was reiterated by the district collector of Krishna district in a letter in 2006 which also refers to an Advocates Committee Report on Boundary Disputes: in C.W.P No 25087/2005 appointed by the High Court of AP[29]. The discrepancy of records of the forest, revenue and irrigation departments regarding the area and villages of Kolleru lake was brought to the notice of the High Court through the above writ petition. It was submitted to the court that the map submitted by forest, irrigation and revenue department do not tally with each other. Further, there are also discrepancies in the boundaries as mentioned in the GO 120 i.e. the final notification. The collector, Krishna district has given a detailed account in the above said letter[30]. Violations of the Supreme Court order of rebuilding of fish tank were also noted by the three member advocates committee. It is also noted by the collector that the difference between the irrigation map and revenue maps which were followed for demolition of fish tanks had no rationale explanation. It has also observed that the adoption of CRZ map for demolition purpose is not appropriate. The suggestions of the then Collector, Krishna district needs to be taken into account while fixing the boundaries of the Kolleru lake.

[28] See Procd. No. 11982/1999/WL.1
[29] See Report of the Collector , Krishna dated 11.10.2009
[30] See reference no. E 2/697/2006

6.8 April 2007: Review meeting of Kolleru lake post demolition[31]

After the demolition, the then Chief Minister undertook a review and discussed various aspects including allowance of traditional agriculture subject to a legal opinion whether it is allowed in a sanctuary, demarcation of the sanctuary itself as the boundary is still not clear; right of way including temporary black topping of roads; desilting of drains, check posts and mobile patrolling; allocation of bamboos to traditional fishermen and most importantly payment of compensation to the lands located within the Kolleru Sanctuary.

6.9 September 2007: Permission for Freshwater Aquaculture and a due process

As stated earlier, the High Court had ordered prohibiting any person to carry out activities of shrimp culture or prawn culture or any type of aquaculture without obtaining the prior permission of the competent authority. The state through a GO in September 2007[32] constituted a district level committee chaired by the district collector along with members from the revenue department, fisheries department, ground water department and irrigation department for regularizing the existing freshwater aquaculture and permitting of setting up of new aquaculture unites in fresh water lands. It also formulated guidelines to be followed by the district level committee for according permission. This GO was amended in 2009 where membership and certain other additional guidelines were issued including extension of time limits for regularizations of ponds[33]. This was again revised in April 2010 whereby the time limit was further extended, the membership of the District Level Committee was revised, and guidelines were re-issued for according permission. A detailed process was formulated for according permission including processing fees, certificate of registration etc[34]. This was further revised as late as May 2010 which included additional requirements and parameters for according permission for aquaculture.

[31] See Memo No 5876/For.II.2/06 dated 11.4.2007
[32] G.O.Ms. No. 83 dated 12.09.2007
[33] G.O. Ms. No. 18 dated 26.03.2009
[34] See G.O.Ms. No. 24 dated 09.04.2010

What is surprising in these developments is the fact that a small window by the High Court has given way to an elaborate process of seeking permission, regularization of encroachment and also fresh licenses for doing aquaculture in the Kolleru lake.

6.10 Ramsar Site: extent and national obligations; reactions from the Head of Asia Program, Ramsar Convention

On a query[35] from one of the petitioners regarding the extent of Kolleru Lake, the Head of Asia Program-Ramsar Convention confirmed that the whole of the lake is a Ramsar site as per the Ramsar Site Information Sheet submitted by the Government of India (about 90100 hectare, up to a maximum flooding level of the lake) and as a contracting party to the Ramsar Convention the Government of India is responsible to the Convention itself which states specifically under

"*Article 3*

1. *The Contracting Parties shall formulate and implement their planning so as to promote the conservation of the wetlands included in the list, and as far as possible the wise use of wetlands in their territory.*
2. *Each Contracting Party shall arrange to be informed at the earliest possible time if the ecological character of any wetland in its territory and included in the list has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference. Information on such changes shall be passed without delay to the organization or government responsible for the continuing bureau duties specified in Article 8.*

Article 4.

1. *Each Contracting Party shall promote the conservation of wetlands and waterfowl by establishing nature reserves on wetlands, whether they are included in the list or not, and provide adequately for their wardening.*
2. *Where a Contracting Party in its urgent national interest, deletes or restricts the boundaries of a wetland included in the list, it should as far as possible compensate for any loss of wetland resources, and in particular it should create additional nature reserves for waterfowl and for the protection either in the same area or elsewhere, of an adequate portion of the original habitat".*

[35] See Email correspondence between Dr Patanjali Sastry, president Environment Centre (petitioner in the case) and Dr Lei Guangchan, Head of Asia Department, Ramsar Convention in email dated 14.6.2007

Further regarding the nature of commercial activities it was stated that as long as the commercial activities does not harm the wetland ecosystem characters and its functions such commercial activities may be allowed.

6.10.1 November, 2007: The Kolleru Development Society petition to the Centrally Empowered Committee to declare 5 Km as ecotone or ecosensitive zone around Kolleru Sanctuary

In November, 2007, the Kolleru Development Society of the West Godavari District petitioned the Centrally Empowered Committee (CEC) to declare 5 km around Kolleru Sanctuary as ecotone or Ecosensitive Zone[36]. This request was forwarded by the CEC to the AP Forest Department for consideration and comments.

6.10.2 2008: Zirayati Lands or Ryotwari Lands in Kolleru Sanctuary

One of the most contentious issues is the fact that there are ryotwari or zirayati lands as they are called in Andhra Pradesh or in simpler terms private lands which are still within the sanctuary limits and also within the Ramsar site beyond the sanctuary limits. The fact is also that such lands have not been acquired under the settlement process under the WLPA as noted in the review meeting mentioned earlier and also official documents stating the extent of such lands within the sanctuary limits. One such table is reproduced (Table 13) from an official record of the Eluru Wildlife Management Division[37].

6.11 2010: The coming of Wetland Regulations, 2010 under the Environment Protection Act and its legal implications on Kolleru lake

The coming of Wetlands (Conservation and Management) Rules, 2010 will have huge implications on the Kolleru lake. Apart from recognizing the ecological significance and the threats to wetlands the rules draws strength from the Ramsar Convention, the National Environment Policy and most importantly the Environment Protection Act, especially Section 25 and Section 3. The rules significantly define for the first time the ecological concept of wetlands. Notably it excludes coastal wetland which is covered under the CRZ notification of 1991 under EPA. Further, the rules create statutory authority, give effect to international conventions such as Ramsar and

[36] See Letter No F.No. 2-21/CEC/SC/2006-Pt.II dated 16.11.2007
[37] See Table formulated by the Eluru Wildlife Management Division dated 17.5.2008

UNESCO and create protected zones and regulate the activities within such zones. It further describes a process for identification of wetlands under different categories and fixes responsibilities for enforcement. It is important to examine how this framework will impact Kolleru.

6.11.1 The concept of Protected Wetlands

The rules create a category called protected wetlands[38] within which the wetlands categorized as Ramsar Wetlands of International importance and as specified in the Schedule would be considered as protected. Significantly the list contains the Kolleru lake[39]. It further includes the wetlands which have been declared as sanctuaries among others. Clearly, Kolleru is a protected wetland under the most recently formulated rules. It is important to examine the regulatory implications of such protected wetlands.

6.11.2 Regulation of Protected Wetlands

There are prohibited activities, there are permissible activities and then there is a provision to permit any of the prohibited activities by the central government subject to the recommendation of a statutory central wetlands regulatory authority constituted under Rule 5. Any in-depth reading therefore suggests that every activity subject to a regulatory scrutiny may either be permitted by the state or the centre. Without getting into the merits of such a permissible regime let us examine the implications on Kolleru within its various categories as of today.

6.11.2.1 Prohibited Activities

i) Reclamation of wetlands

ii) Setting up of new industries

iii) Manufacture or handling or storage or disposal of hazardous substances under various rules or under EPA

iv) Solid waste dumping with a caveat that existing practices would be phased out within a period not exceeding 6 months i.e. April 2011

v) Discharge of untreated wastes and affluent from industries, cities or towns and other human settlements with a caveat that existing practices would be phased out within a period of one year i.e. October 2011.

[38] Rule 3
[39] See serial no. 10

vi) Any construction of a permanent nature with the exception of those constructions for boat jetties within fifty meters from the mean high flood level observed in the past ten years calculated from the date of commencement of these rules.

vii) Then a residuary clause of any other activity is likely to have an adverse impact on the wetland eco-system and which is specified in writing by the authority.

6.11.2.2 Permissible Activities; Prior approval of the state is mandatory for

i) Withdrawal of water or the impoundment, diversion or interruption of water sources within the local catchment area of the wetland ecosystem;

ii) Harvesting of living and non-living resources:

iii) Grazing to the level that the basic nature and character of the biotic community is not adversely affected;

iv) Treated effluent discharges from industries, cities or towns, human settlements and agricultural fields falling within the limits laid down by the Central Pollution Control Board or the State Pollution Control Committee, as the case may be;

v) Playing of motorized boat, if it is not detrimental to the nature and character of the biotic community;

vi) Dredging, only if the wetland is impacted by siltation;

vii) Construction of boat jetties;

viii) Activities within the zone of influence, as per the definition of wetlands, that may directly affect the ecological character of the wetland;

ix) Facilities required for temporary use such as pontoon bridges, that do not affect the ecological character of the wetland;

x) Aquaculture, agriculture and horticulture activities within the wetland;

xi) Repair of existing buildings or infrastructure including reconstruction activities.

xii) Any other activity to be identified by the Authority.

What is crucial is the fact and as stated earlier is that the central government may permit any of the prohibited activity or non wetland use in such protected wetlands on the recommendation of the Central Wetland Authority[40].

6.11.3 Environment Impact Assessment (EIA)

The rules also mandate that a detailed EIA is carried out. What is not clear is whether it is for any activity and its environmental impact or it is required for the Environmental Clearance to allow any prohibited activities by the Authority or it is about the environmental impact of such protected wetlands themselves. This needs to be clarified for the state to take action.

6.11.4 Conversion of Wetlands to Non wetland use

Public interest and reasoned order are two criteria that the Authority can recommend to convert wetland into a non wetland use[41]. It is clear from the above that a number of activities that are prohibited, given good reasons, public interest, state discretion, and the reasoned order of the Wetland Authority, every possible activity including converting wetland to non wetland use is possible. The framework of a due process is envisaged. But the Wetland Rules falls short of that specific due process that needs to be followed. Given the above the Kolleru lake now comes under the strict scrutiny of the forest department, the nodal departments holding the land and most importantly the Central Wetland Authority. It's important to examine this in some more detail and its implications on Kolleru.

6.11.5 Apex Body is Central Wetland Regulatory Authority (CWRA)

The CWRA is a statutory authority which comprises five official and five non government representations. Its functions include appraisal of new and proposed wetlands, projects and activities; interface with local authorities for enforcement; grant clearances and in consultation with the local authority; determine zone of direct influence; and finally have the power to issue directions to the state governments, as a residuary function for conservation, protection and wise use of such wetlands[42]. Apart from the above, the authority also is mandated to periodically review the

[40] See Rule 3
[41] Rule 5
[42] See Rule 5(3)

wetlands as specified and specify the threshold of the activity to be regulated including the mode and methodology of activities[43].

6.11.6 Due process for identification of wetlands

The Rules also provides for a due process for identification of wetlands including categories, role of state, role of authority, role of state government, role of Central Government and also a time period for completion of the due process[44].

6.11.7 Authorities, Jurisdictions and Statutes

The Wetland Rules also attempt to delineate the statutory obligations for respective areas as well as the nodal enforcement departments depending on the land or resource controlling authority. These include the following situations:

6.11.7.1 Protected Areas under the WLPA

In the case of the sanctuary as in Kolleru or other categories of protected areas, the institutions under the WLPA shall be in charge i.e. Chief Wildlife Warden and Officers designated on his behalf and primarily the Forest Department.

6.11.7.2 Protected or Notified forest

Such areas will obviously be governed by Indian Forest Act and Forest Conservation Act. The remaining lands will be regulated under the EPA; again by the Forest Department.

6.11.7.3 Gap Areas

The gap in WLPA and the forest laws shall be covered by the EPA for those areas which do not fall directly under the respective zones. And the areas that are outside the notified or protected forests shall be governed by the EPA.

What is not clear from the above is how to deal with a situation where a sanctuary such as Kolleru where there are no notified forests or protected forest within such wetland. **In fact Kolleru is a peculiar case where the land is not within the control of the Forest Department,** although there are many government lands within the sanctuary area, while the Rules specifically says that such areas shall be governed by the nodal department or the local state agencies as designated by the state government

[43] See Rule 5(4) and (5)
[44] Se Rule 6

within a specified time period of six months[45]. The Rules also state that wetlands within the protected areas such as sanctuaries and national parks shall be governed by the WLPA and by implications the institutions under WLPA; the FD and its hierarchy[46]. **This anomaly in Kolleru clearly needs to be corrected and while the sanctuary area need to be completely under the charge of the FD, the remaining area need to be regulated by EPA through nodal agencies or local authorities with specialist input from the FD**. This situation needs urgent attention as it is clear from the various interactions that the FD is by and large not interested in managing Kolleru given its current complexity, although the new wetland rules too does not absolve them of the responsibility. The entire wetland (as told to Ramsar) is now a protected wetland.

6.12 Some legal concerns and legal implications of the findings in the field

6.12.1 Final Notification: is it bad in law?

The Final notification of Kolleru with incorrect boundaries could be termed as bad in law and it needs revision to streamline the area and the jurisdictions as pointed out in various letters and submissions.

6.12.2 Doubts on method adopted for determining the Contour boundary

Serious concerns have been raised about the method adopted for determination of the boundary along the 5th contour. The reliability and accuracy of the so called contours are doubtful for various reasons such as random excavation for making aqua farm embankments, large scale silt load carried in by the drains leading to rise in the lake bed, reported sinking of the east costs and absence of a bathymetric and land survey in view of the wildlife sanctuary notifications are some of the reason for doubting the contour as boundary. Further the Contour lines not necessarily mark an ecological boundary of an area. In case of ecologically important area, to essentially identify appropriate management strategy and to avoid controversies and difficulties in properly managing, the boundary needs to be ecologically pertinent. Of course it is possible that in case of wetland the contour may reflect an ecological boundary. However, it is learnt that no dependable exercise was done to scientifically justify the 5 feet contour line prior to fixing it as the boundary of the Kolleru Wildlife Sanctuary.

[45] See Rule 8 (2)
[46] See Rule 7(1)

6.12.3 Measurements of boundaries

The efficacy of the hand held GPS instrument used for determining the positioning of the rare boundary pillar was also questioned by technical persons. A variation of more or less 10 meters or even more is innate, for security reasons, in common handheld GPS equipment compared to the ground reality. That means a great deal to many underprivileged people living near the boundary and their livelihood. A scientific land survey using appropriate survey methods, including differential GPS or any other traditionally proven and robust methods, should have been undertaken prior to notifying the boundary of this wetland wildlife sanctuary. More over the lower level staff of the revenue and forest department who demarcated the boundary were reported to be not appropriately trained and were in a hurry to complete the work due to pressure from top.

As the area is thickly populated and the average land holding is around 52 cents and a major segment of the people have only small holdings of 25 Cents of D form Patta, it is quite possible that several parcels of lands may incorrectly fall within the sanctuary or out of it for the inherent error of the machine and absence of proper surveys which will be further aggravated by lack of expertise of the staff handling the instrument. There is an urgent need for conducting a survey and fixing the boundaries by using sophisticated, advanced or reliable instruments and methods.

6.12.4 Inadequate consultation process

Several people complained that a genuine consultation process did not take place as per the provisions of the Wild Life (Protection) Act as they were not informed about the preliminary notification and its implications on the livelihood of the people. Narayana (2006) also holds similar view in a news article written after touring the area. The officials seemed to be in a hurry to issue the final notification to meet whatsoever implicit obligations.

6.12.5 More area than notified was taken over

It was represented in various meetings that 77,138 acres was notified in GO 120 but Forest department took possession of 84,000 acres, thus denying rights and livelihood in about 6862 acres. This excess has reportedly occurred in Kaikaluru Mandal of the Krishna District. Taking into consideration on an average half an acre land holding per farmer, as is mostly the case, this would amount to nearly 14,000 farmers being

deprived of their livelihood. This being a serious issue was repeatedly represented in various meetings. While this is so, the affected people have complained that the fish tanks in these areas have been blasted even before the amendment was done. The Honorable Members of Parliament Mr Kavuri Sambasiva Rao and Mr K Bapi Raju, the Honorable Member of Legislative Assembly from Kaikaluru Constituency Sri Jayamangala Venkata Ramana and Member of Legislative Council from West Godavari District Sri M. Laxminarayana, highlighted this issue in their written and oral representations. It was also noted from the minutes of the review meeting held by the Honorable Chief Minister with officials on 30-03-2007 that it was decided to restrict the sanctuary area to that prescribed in the GO 120. The discrepancy in land inclusions is an issue that needs to be addressed urgently.

6.12.6 Settlement of rights

The Kolleru sanctuary has gone through a series of legal process largely under the Wildlife Protection Act, 1972 (WLPA) related to the declaration of the sanctuary and environmental issues. The intention notification (under Section 18 of the WLPA and the settlement of rights process (under Section 19-26) have been made. Further the final notification (under 26A) has also been issued under the Wildlife Act and also has been validated by the Supreme Court. However, several areas have not been acquired and were demolished too. Either a strong monitoring mechanism or the private areas must be acquired for the sanctuary.

Further, due process under the WLPA in terms of providing information and processing claims should have been followed. Ideally the Collector's award should describe these processes. There is a lot of ambiguity in the information that was provided to the community (as per interaction in the field) regarding the Wildlife Sanctuary formation.

6.12.7 Was there adequate ecological data prior to declaration of sanctuary?

The formation of the sanctuary presumes that there has been adequate ecological data that have been adduced prior to declaring the intention to constitute the Kolleru sanctuary.

6.12.8 Extreme flip flops on Kolleru

In 2002, Kolleru lake was declared a Ramsar site as a wetland of international importance. Appropriate documentary support has been adduced to make the case for upgradation of this wetland. This also establishes the Government's intention to protect such an area. Nevertheless, the later actions and happenings at Kolleru were not in accordance with that spirit, and any subsequent decisions to the contrary should be put to strict scrutiny.

6.12.9 Least attention to management

A management plan has also been prepared by Wetland International (2008), under an assignment from Forest Department, Government of Andhra Pradesh (GoAP). However it is not entirely clear whether the said management plan is the approved management action plan for the sanctuary. Further, it would be important to ascertain the implementation plan which gives effect to the said management plan and what resources have been put into for the purpose.

6.12.10 Monitoring the Rights and Privileges under the statutory notification

The final notification under Section 26A of the WLPA which has been issued, lists out certain conditions for creating the sanctuary. However it is not clear as to what is the operational mechanism for managing / monitoring such conditions as per the notification of 26A under the GO 120.

6.12.11 Compensation for proposed acquisition of land

There are several issues related to fixing of compensation for the lands proposed to be acquired. Some of the important issues to be addressed are a) the mechanism of fixing the value of Zirayathi lands, b) how often is the circle rate of a given area (Kolleru area in this case) revised, c) the current circle rate or market value, d) the actual market value and e) the general principles of compensation followed in this area. Then there are several standards methods and principles of compensation that may be followed to arrive at a fair market value. Some of them include: *Principle of Prudent purchaser*; Reasonable market value; Future Potential Value of Land; Comparative Sales Method; Methods of capitalization of the net income as an alternative method*;* Willing Purchaser and Willing Buyer and Principle of Deduction among others.

6.12.12 Pollution Concerns

Issues such as measures to be adopted to prevent pollution due to chemical industry, sugar industry and also prawn, fish and other processing industries specially chemicals introduced for commercial farming (fish and agricultures) need to be urgently addressed. The new Wetland Rules further provides teeth through the EPA.

6.12.13 Reduction and submergence: is there a correlation?

It is doubtful how reduction of sanctuary (more or less unanimously demanded by the people in the public meetings) help or reduce submergences as we saw several areas falling under +6 and +7 feet contours submerged. It is an issue not acceptably substantiated. On the hand field observations and imageries hint at other reasons for submergences. Nevertheless, the concept of contour and ecology do not match and correcting this have to be done in the long term interest of the ecological survival of the sanctuary.

6.12.14 Alteration, legal consequences and obligations

As regards the control of land within the sanctuary as mentioned elsewhere there are broadly two types; a) Zirayathi land, b) D form patta land. Any reduction / addition in the area would amount to alteration of boundary under the WLPA and will come within the purview of the 13/11/2000 order of the Supreme Court in C.W.P. No. 337/95. The permission of the Supreme Court is therefore a condition precedent for any finality in this regard.

6.12.15 Role of Centrally Empowered Committee: Exceeding Jurisdiction?

It is still not clear why the CEC needed to examine this case especially when there is a separate case in the Supreme Court (CWP No 337/95 titled CEL-WWF-India vs. Union of India and Others) that is exclusively dealing with settlement of rights issue. In fact, the highest administrative authority is the National Board of Wildlife and the Supreme Court in the above mentioned cases, and its orders are binding on the state governments. Further it is also seen through the records that CEC has been issuing orders. In our humble view CEC is a recommendatory body and is not empowered to issue directions. At best it can issue advisories. Note that this is without any prejudice to any authority but only stating the correct position in law. The argument becomes stronger as there is no forest land involved in this case and the CEC has been primarily constituted to look into the violations of Supreme Court orders in the ongoing forest case more popularly known as Godavarman case (CWP No 202 of

1995). These questions need to be raised for complete clarity of jurisdiction and authorities who are responsible for overseeing legal violations in a given state context.

6.12.16 Consequence of removing from "Prohibitory Order Book"

As per information, mentioned elsewhere, the entire Kolleru area comes under "Prohibitory register" for lands. This aspect needs further examination as to the parameters or conditions that are applied to change the land use from the prohibitory register land to any other use. Currently any alteration would bring it out of the purview and the consequence of the same needs to be brought out clearly for any future precedence.

6.12.17 Demolition of private lands: Legal recourse available

It was informed that certain fish farms under zirayathi or private lands, with which loans were secured, have been destroyed. Any demolition of private land is illegal. Legal recourse is available to each zirayathi land owner - either as a civil suit for compensation or even for criminal trespass. Further a compensation measure with a fare assessment need to be worked out.

6.12.18 Section 20 violations; bar on accrual of new rights after notification under Section 18 is issued

Any accrual of rights or change of land use under the WLPA can also be established through satellite imagery as well. For this 3 reference maps would be useful; a) Map of date of Intention notification i.e. 25/09/1995, b) Map of date of final notification i.e. 04/10/1999, c) Map of date of Kolleru committee visit i.e. September 20, 2010. This will establish the Section 20 violations. Appropriate actions must be taken in this regard under the WLPA.

6.12.19 Potential use of forest rights act and Wildlife Protection Act

The state Government has the power under the WLPA (Section 36A) to declare conservation reserve. Apart from the Wetland Rules, the WLPA may also be used to protect the area around the sanctuary as conservation reserve under the WLPA. Further certain ecologically sensitive areas may be declared as Critical Wildlife Habitat (CWH) under the Forest Rights Act (FRA) so that no diversion of such critical lands is possible in future and the lake is saved for posterity. The buffer areas may also be declared as community Forest Resource under the FRA or as conservation reserve under the Wildlife Protection Act. In fact, private land owners

may also be provided incentives to declare certain critical areas of Kolleru as community reserve under the WLPA, if they could be persuaded to do so. Otherwise lands may be acquired between the +3 and +5 feet contours. Above the +5 feet contours the choice may be left to the landowners.

7 OPERATION KOLLERU

As discussed earlier the sanctuary area had large number of aqua farms. Nageswara Rao et al., (2004) estimated more than a thousand fish tanks occupying 42% of the lake area. As per the directions of the Supreme Court, to demolish all fish tanks inside the sanctuary with effect from 20-04-2006, the AP government took the action of demolishing and evacuating the unauthorized aqua farms constructed in the Sanctuary area. The Operation lasted 55 days, in three phases starting from 16 February 2006 and was completed on 13 June 2006. A brief of the execution of the demolition plan executed in the area and its implications are briefed below.

7.1 Demolition of aqua farms and unauthorized constructions

As proliferation of fish tanks with high rise bunds below and above +5 feet contour had aggravated flooding, "Operation Kolleru" (Nageswara Rao et al., 2010) was undertaken in 2006 in three phases spreading 55 days from February 16 to June 13 2006. In all 1776 large fish farms spread over 44726 acres in both the districts were demolished (Figure 24), sometimes even using explosives. It is alleged that fish tanks belonging to persons having high connections were not destroyed. CEC in its Lr No l-5/CEC/SC/05/Pt VI dated 1-2-2006 has observed that from the details made available and the site visit, it is seen that in spite of specific orders of High Court of AP and in blatant violation of Supreme Court's orders and provisions of the WL (P) Act and other relevant Acts, commercial activity on a massive scale by way of pisciculture were allowed to continue. The High Level Committee of Advocates appointed by the High Court found fish tanks within +5 contour. There are several reports in the press that the fish tanks were formed afresh in Nidamarru and Bhimadole Mandals. A comparison of the spread of aquaculture before and after the operation is given below.

Lands cleared of constructions related to aqua farms (including more than 15000 acres of Zirayathi Patta and 10000 acres of D Form Society Patta). 1140 fish tanks in West Godavari and 636 in Krishna Districts covering 28949 acres in the former district and 15775 acres in the latter were completely demolished by 16-06-2006 (Report from Conservator of Forests, Eluru, page 7). Reportedly 89.08 lakh cubic meters of earth

forming the tank bunds were also removed. However, the debris was left uncleared after the demolitions, blocking free flow of water and extending the threat of flooding.

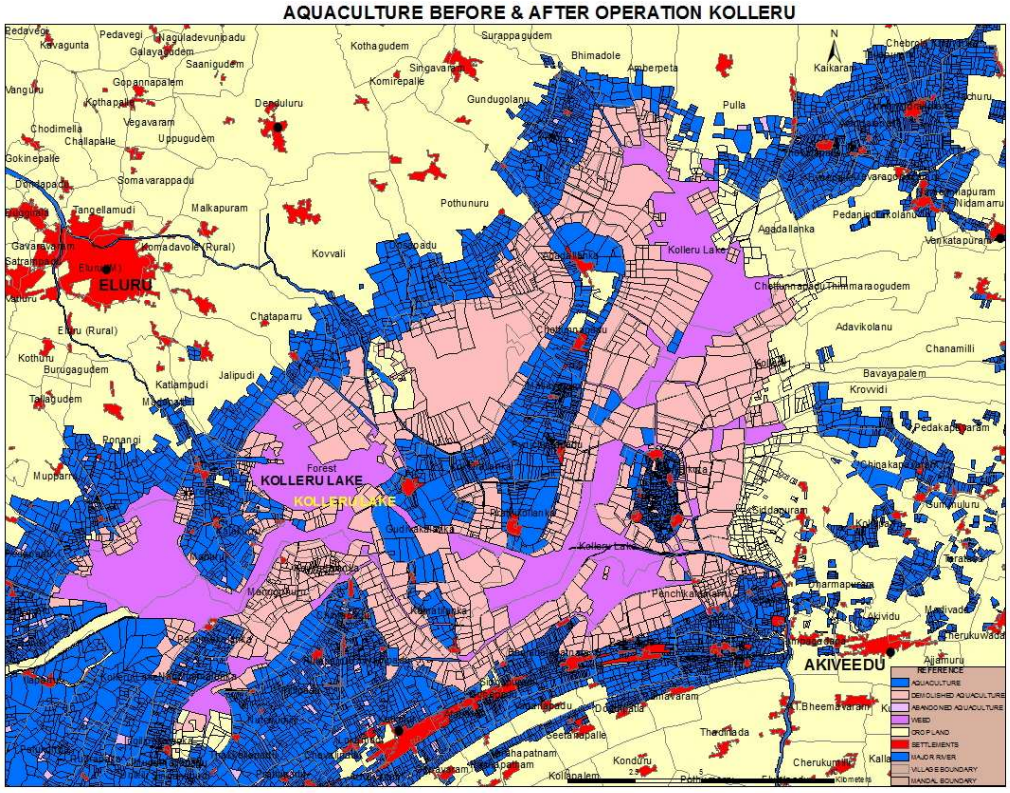

Figure 24: Aquaculture before and after the operation

7.1.1 Resultant trauma

As already discussed, the two major sources of livelihood for the locals are fishing during rainy season and agriculture in summer. The districts in which the lake is spread over are relatively prosperous and the socio-economic impact of this prosperity on Kolleru villagers is reflected in their aspirations for better livelihood. During the last two decades, the agriculture and fisheries development have reached higher technological and productivity level that the villagers are financially benefited more than earlier even though 'benami' cultivators are reported to have been benefited several times more. With the gains in income, sizeable of them were able to educate their children in better private schools, own better houses, wear better clothes, acquire consumer goods and maintain a social and economic status on par with the middle class farmers of the neighboring areas. However, as per the conditions laid down in the GO relating to the sanctuary, they were allowed to continue fishing and

agriculture only using the traditional method that their forefathers practiced decades ago. Going back to a period by the force of law, after enjoying the fruits of change encouraged by the government, has come as a shock and the people are yet to come out of this. Many of the farmers who witnessed their tanks being destructed by dynamites could not forget the horrifying scene. "*It was a night mare*"; said many. They complained further that they are able to catch only Rs 50/- worth of fish a day now, which in no way is sufficient for their livelihood, using the traditional fishing nets / traps due to the overgrown weeds. They feel that the fish do not grow in polluted water as effluents are still flowing uncontrolled from industries and municipalities.

The other reason for their dismay is the reversal of land reforms policy of the government. The governments for the last thirty to fifty years were conferring regular titles on lands initially distributed as D-form patta for vacant government land or lands resumed under the Agricultural Land Ceiling Act as part of the land reforms. It is also a practice for the government to regularize occupations of vacant government lands held by the landless. It was a very big program in Andhra Pradesh in which lakhs of acres were distributed to landless poor as part of land reforms over the decades, which included regularization of occupations as on that date. Even the rights of tribals on forest land in Agency areas of the West Godavari district under their occupations over generations and their traditional community rights were recognized by Recognition of Forest Rights Act, 2006. Patta conferring heritable and inalienable rights were conferred over lakhs of acres. While thousands of people in the district received titles for lands, the people of Kolleru lost their lands held legally without compensation for the sanctuary; a contradiction the affected people resent, and were not able to bear.

Government of Andhra Pradesh in 1993 (through GO Ms No 1307, Revenue (Assignment-1) Department dated 23-12-1993) ordered paying ex-gratia in lump sum equivalent to the market value to the assignees whose lands are acquired for projects and other public purposes. Equivalent amount to the value of orchards, other structures, wells and the like were also allowed. As this is a well-liked approach of the government, the informed public and elected leaders expected similar dispensation for D-Form patta holders of Kolleru Lake as well. But no compensation was incorporated

in the GO 120 issued six years later and all D-Form Pattas in the Sanctuary area were cancelled. "*What is the sin we have committed for losing land while other poor are given titles for lands held by them by the government?*" asked Sri Jayamangala Venkata Ramana, the Honorable Member of Legislative Assembly, Kaikaluru, who hails from the Fishers community of the area. Thus, for sure there is a need to re-examine the whole issue of compensation.

In 2004, when the Congress government was formed after a long gap, a new programme of distribution of one lakh acres per year was announced as a pro-agriculturist measure which was an important item of agenda of Congress before elections. People were approaching Sri Rajasekhara Reddy during his long march before 2004 elections representing their grievances. He after becoming Chief Minister for the second term in 2009 promised to do justice to all poor agriculturists in Kolleru area. Sri N Chandrababu Naidu in whose regime the GO 120 was issued was reported to have been convinced of the problems of displacement due to sanctuary and before the 2009 elections is said to have committed to reduce sanctuary boundary to 3rd Contour level.

Both the people and elected representatives have represented that NREGP which guarantees a minimum of 100 days of labor is not being implemented at all in the Sanctuary area due to lack of coordination between Forest Department (WL wing) and Rural Development Department (DRDA) at district level. It was also said that there is tremendous scope for implementing NREGP for manual removal of weed (Phragmites, Eichchornea, Ipomoea etc) every year; although as per officials people are coming forth for such works. That would provide additional employment to the poor and facilitate catching fish with traditional methods by the local Fishers. De-silting the drains and removal of debris urgently required to avert floods will also provide much wanted employment to the poor. Such works are expected to engage them for several months in a year and avert emigrations. Nevertheless, there were also statements from officials that people are not coming forward to take up the job under the NREGP scheme when offered.

It is most appropriate time for government to educate the farmers on eco friendly traditional agricultural / fisheries practices and show ways and means to earn better

incomes and provide required finances. Until then, it is also necessary to evolve a policy to compensate the loss of income due to sudden and forced shift from modern agricultural/ pisciculture practices to traditional practices.

7.1.2 Social Impact

The social and economic impact due to loss of livelihood in the last four years of demolition is felt by both the owner-cultivators and D Form patta holders even though not as severe and universal as made up. The lessees and outside investors also would have felt some losses. In almost all the meetings, almost all speakers mentioned about their decreasing financial abilities to providing good education to children and to marry off their wards. It is said that parents were not willing to offer their daughters for marriage to these villages as they would be likely or forced to migrate to earn their living. It is also said that boys from other villages are not willing to marry from this village as their parents have become poorer and will not be able to conduct marriage on a required scale and offer sufficient dowry. The impact of economic deprivation is also reflected in the reported migration of families as labor to other districts in the state or other states. This has an impact on the social fabric and family relations that were intact when they were eking out their livelihood in their traditional villages over generations. Even the very strong and male dominated village level traditional political setup (Kattubatu) is showing signs of weakening due to migration of male members for work.

Several "last and final" notices were reported to be issued by banks for recovery of loans. In one of the '*last and final*' notices served by Indian Overseas Bank, Pedanindrakolanu, to Sri Meesala Simhachalam S/o Sri Dalaiah, Binepalli village (notified as Sanctuary village in G.O 120) in Nidamarru Mandal, in West Godavari district with a copy to his brother who stood guarantee that an amount of Rs 3/- lakhs taken for fisheries on 10-10-2005 should be paid back immediately, warning that otherwise legal action will be initiated. His brother who stood surety for the bank loan is also worried. It is pertinent to note that the loan was sanctioned by the Bank after the final notification of the sanctuary and but ahead of blasting the fish tanks. It is justly for such a person to bemoan "*how can I repay the loan without a fish tank?*" The fisheries department or bank, who should be aware of the rules and its implications of the notification, should have rightly advised the farmer against

availing such loans. It is also possible that a 'benami' cultivator would have obtained the loan amount and notices are served on the real owner on whose name the loan was sanctioned; not uncommon in programs meant for weaker sections. Such trends of deprivations, if continued further, are bound to have serious negative consequences on the local communities. Therefore, it is crucial to start a viable rehabilitation package immediately.

7.1.3 Stigma attached to the check posts

The concept of a check post is new to these areas as there were no restrictions on their movements till declaration of the sanctuary. The villagers are prejudiced against check posts and associate them with smuggling timber, poaching or to control criminal gangs. When the personnel manning the check posts (especially ex-service men) check the villagers and their belongings, they felt as if treated as criminals or smugglers and consider it dishonorable. There is need to educate both the public and officials manning the check posts on this misconception and to handle situation amicably. In the CM's meeting held on 30-03-2007, it was instructed not to hassle people at check posts. However, this was rarely followed; people complained.

7.1.4 Effect on ancillary industries

The big trade of fish from Kolleru Lake over the last two decades developed several auxiliary activities providing employment to several people. These include transport, ice industry, cold storage, manufacture of plastic trays and packaging, fish seed, feed, fish food processing industries and such likes. Transport of fish extends from village level up to West Bengal where the fish is reported to be marketed. The sudden crash in fish production with the demolition of the farms would have left its mark on all such auxiliary activities and hence, upon the whole society. However, proper documentation of such issues needs further detailed investigations.

7.1.5 Ecological impacts

The demolition of a large number of aqua farms had serious effects on the socio-economic and political milieu of the area, as articulated at the public meetings. Similarly it would have its effects on the ecosystem, its various components and functions. According to certain reports the demolition was the way for Kolleru to regain its grandeur (Pattanaik et al., 2008), a statement that appears premature and not entirely substantiated in view of the ecological state of the lake after the operation.

Obviously it had some benefits. The bird species shows a discernible increase after the operations. It could be not only for the physical removal of the embankments of the aqua farms and opening up of the area, but also for the absence of nets covering the formerly impoundments meant for fish farming making the whole area visibly accessible for birds and other faunal forms.

Looking at its execution, demolition appears to be achieved in a rough and largely unscientific manner; explosives were used and the debris was largely left in-situ. The embankments were burst, but water flow was not smoothened, obstructions not eliminated and flow path not completely established. The impacts of the operation on several aspects of the ecosystem structure and functioning need further examination. Recovery of the natural hydrological regime, elimination or control of rooted and free floating weeds such as Eichchornea, reviving the water quality of the lake, control of other pollution sources etc will require several more actions.

Further, the achievement from the "Operation Kolleru", as far its aim in spirit is concerned, is yet to be ascertained. In fact the CEC (its Lr No l-5/CEC/SC/05/Pt VI dated 1-2-2006) had observed that, from the details made available to it and site visits, in spite of specific orders of High Court and in blatant violation of Supreme Court's order and provisions of the Wildlife (protection) Act, 1972 and other relevant Acts, commercial activity on a massive scale by way of pisciculture have been allowed to continue.

7.2 Compensation and R & R Policy issues

Although in the present case the provisions of the Wildlife Protection Act are applicable it would be informative to look at other relevant policy provisions. The people are not physically displaced but economically displaced / deprived. Therefore, in order to maintain the sanctuary at +5 contours as per notification, R&R package was required to be implemented for all affected population.

The National Policy on Resettlement and Rehabilitation (R&R) for Project Affected Families-2003 (NPRR-2003) is applicable to projects displacing 500 or more families in the plain areas may be examined for its applicability in the case of Kolleru. The

policy aims at providing better standards of living to the Project Affected Families (PAF). The Wild Life (Protection Act) provides for recognition of all rights of people. In the CM's review meeting held on 30-03-2007 on Kolleru issues it was decided among other things to acquire Zirayathi lands, falling under the sanctuary, as per the provisions of the Land Acquisition Act.

One of the important aspects of the R&R Policy as enunciated in Para 6.1 of the NPRR – 2003 says "*each PAF owning agriculture land in the affected zone and entire land has been acquired may be allotted agricultural land or cultivable waste land to the extent of actual land loss subject to availability of government land in the district*". Further, as per the para 6.14 of the R&R policy "*each PAF belonging to the category of agricultural labourer or non-agriculture shall be provided a onetime financial assistance equivalent to 625 days of the minimum agricultural wages*", and "*250 days of Minimum Agriculture Wages as subsistence @ 20 days per month*". However, no substantial steps appear to have taken for the loss of land and livelihood in the case of Kolleru Wildlife Sanctuary, evoking the wrath of the people against the protection of the ecologically important area, the lake. The whole exercise was done in a manner that alienates the people and makes them antagonistic to the cause and needs of conservation.

7.3 Post operation Kolleru and media coverage

Some of the farmers, after the first phase of the operation bridged the breaches and filled the tanks with water for resuming aqua-culture. It was also reported that during the operation some fish tanks were left only partly damaged for pressure from influential persons, as reported in the Times of India daily (dated 28-11-2006).

As cited earlier, the CEC (its Lr No F l-5/CEC/SC/05/Pt VI dated 1-2-2006) had observed massive scale pisciculture being allowed to continue, after the operation. It was also reported by the Times of India (13-9-2007) that the High Level Committee of Advocates appointed by the High Court has also identified illegal cultivation in some tanks. Committee found fish tanks within +5feet contours in Chatakaya hamlet of Natta-Gullapadu in Kaikalur Mandal and also found cultivation of banned catfish**.**

The Telugu daily Sakshi 24/7 (West Godavari Edition dated 6-3-2010, 7-3-2010, 8-3-2010, 12-3-2010 and 13-3-2010) reported that in Bhimadole Mandal, fish tanks have come up again in Agadalalanka, Chettunnapadu, Mulki Mohammedapuram; in the Lanka villages of the same Mandal; in Gudiwakalanka, hamlet of Ponnangi and Kalakurru in Eluru Rural Mandal; in Gudipadu, Jayapuram and Veerammakunta of Pedapadu Mandal; in Dosapadu of Dendulur Mandal and in Sayannapalem of Bhimadole Mandal. The Forest check post at M M Puram was forcibly removed by the villagers and consequently the fish farms in Bhimadole and Nidamarru Mandals are thriving.

Although the present committee reached Sayannapalem, M.M. Puram, Kalakurru, Gudipadu, Jayapuram, Dosapadu, Agadalalanka, Pudichintapadu and Chettunnapadu villages, we could not visit the tanks. It was also reported to us that a corporate group continues commercial fisheries in the lands between Agadalalanka in Bhimadole Mandal and Pydichintapadu in Eluru Rural Mandal. Though the committee members reached these villages, the farm could not be visited and status ascertained for logistic reasons. Fish tanks with 10 to 15 ft high bunds and pumps, and pucca buildings ware reported adjacent to Chintakoduru drain in Pothunuru village within +5 contour. Though we could reach the drain, we could not reach to the fish tanks with high-rise bunds for unsure reasons.

'Vanitha T V' a Telugu Channel in its news bulletin at 9.00 pm on 8-8-2010 had shown earth moving machinery (JCBs) at work in Gudiwakalanka making fish tanks. In fact when this village was visited, the Committee members saw a JCB parked aside the road, perhaps suspending the work in view of our visit.

NTV Channel, another Telugu Channel in its regional edition at 7.00 pm on 9-8-2010 has also shown earth movers working in Gudiwakalanka. This channel has alleged that the lower staffs of revenue, forest and police departments are in connivance with the encroachers for wrongful considerations. High race was also reported among the lower cadres from these departments for getting posted in Kolleru lake area for self-explanatory reasons.

HMTV Channel in its news telecast at 9.00 pm on 19-8-2010 has shown visuals of the lake and emphasized the importance of the lake and also referred to the demand for resizing. ETV2, another Telugu Channel in its news bulletin at 7.00 pm on 20-8-2010 has shown hutments and roads of Kolleru villages in Krishna district affected by flood waters. ETV2 in its Telugu news bulletin at 6.00 pm on 4-11-2011 has also reported paddy fields under submersion in Pothunuru due to recent heavy rains being inspected by some public figures.

However, the Committee could not visit the areas in Nidamarru and Bhimadole Mandals where fish tanks still operate, as we were intimated that the roads are flooded and not motorable. Similar was the case of the kutcha road from Manugulur to Kowadalanka, Nandigamalanka and Inglipakalanka. This is the area where about 7500 acres of excess land is reported to have been taken over by the Government during Operation Kolleru.

Thus it seems the success of the "Operation Kolleru" remains unsubstantiated and need further detailed investigations. The reported re-formation of fish tanks with impunity and possibly with the connivance of field staff shows the colossal failure of the State Government to carry out the specific directions of the Supreme Court. The recent satellite imagery also proves that fish tanks still exist in some of the areas.

7.4 Government's commitment to restore and protect the lake

The Principal Secretary to the Government of AP FES&T Department in the replies dated 14-2-2006 categorically stated that Government's commitment to implement GO Ms No 120 and to restore the pristine glory of the lake. A Group of Ministers (GoM) had a meeting with different stakeholders and concerned officials on 6-12-2005, discussed the issue in depth and appraised the honorable Chief Minister (CM). The CM reviewing the progress of Kolleru Operation with GoMs and officials on 17-1-2006 agreed to their recommendations.

The GoM visited some of the areas around the lake in both the districts on 23-10-2005 and 6-12-2005 and interacted with the farmers affected by the submergence of their paddy fields beyond +5 feet contour during the heavy rains in September and

October, 2005. A high level meeting was conducted with the top officials of revenue, irrigation, forest and police departments on 27-10-2005 at Hyderabad regarding draining out the flood waters for immediate relief to the submerged fields. On 29-10-2005 the District Collector, West Godavari held a meeting with the police, forest, revenue, irrigation and R & B officials of both the districts regarding the removal of obstructions and barriers that impeded the free flow of flood waters into Upputeru and 45 Action teams were formed for the purpose.

State High Level Committee presided over by the CM in December 2007 decided to take up restoration of Kolleru Lake. It was noted that as a result of fish farms, 1.50 lakh acres of surrounding delta lands lost their first crop worth Rs 1000/- crores every year attributable to inundation during the rainy season. The CM directed the District Collector, West Godavari to begin work of fixing boundaries in December 2007 and to complete it by March 2008. The CM also reviewed the issues relating to Kolleru with the concerned Ministers, MPs and MLAs and the District Collectors.

As mentioned earlier the "Operation Kolleru" lasted for 55 days. The then Secretary, EFS&T Department toured the area to oversee the operations. Action was taken to disconnect power supply, to set up check posts to disrupt movement of fish seeds, fish feed, diesel etc. CEC visited Gudiwakalanka, Dumpagadapa and Agadalalanka in Bhimadole Mandal. A rehabilitation package for the Fishers was prepared and the government had released 40 crores. A special cell was ordered to be formed to monitor Operation Kolleru and the rehabilitation process of the displaced.

The Principal Secretary to Government, EFS&T Department in the replies dated 14-2-2006 stated that counseling was conducted with the elders of Agadalalanka and Chettunnapadu of Bhimadole Mandal by the Special Team constituted with the forest, police and revenue officials on 15-2-2002 and it was impressed up on them about the impact of environmental loss caused by disturbing the lake ecosystem.

A Sub Committee with Sri Raghuveera Reddy, Agriculture Minister, P Venkateswara Rao, B Satyanarayana, Minister for Marketing and S Vijayaramaraju was constituted

and this Committee suggested erection of two regulators across Upputeru, at a cost of Rs 65/- crores, to prevent salt water polluting the lake.

At the meeting convened by the CM on 6-5-1994 it was decided to evict all encroachments below +5 feet contour, and all eligible encroachers among the evicted shall be resettled between +5 and +7 contour in government lands freed from the ineligible encroachers.

Government has also admitted that due to contamination of water birds including the migratory ones have ceased to visit this area as the environment is not conducive to them. Action against polluting industries was initiated under the Water Act by the AP Pollution Control Board. Apart from the industries, several fish tanks and parboiled rice mills have contributed liberally to the pollution of the lake water which ultimately stagnates in the lake.

Having made several commitments as detailed above regarding implementation of GO Ms No 120 and restoring the lake, the state government all of a sudden made a volte-face, perhaps an act of knee jerk reaction to the statement made by the Leader of Opposition on the lake Kolleru. This change of heart of the government encouraged the political leaders to demand reduction of boundary which culminated in the unanimous Assembly Resolution on 4 September 2008.

7.5 Review of post operation alternative livelihood programmes

As noted in the above section there was some proposals for rehabilitation package for the fisher folks after the Operation Kolleru. The section below briefly examines the supposedly implemented rehabilitation and alternative livelihood programs in the context of Kolleru Wildlife Sanctuary and its management.

7.5.1 Programs implemented

Aggrieved by the loss of livelihood, the people started agitating and the state responded by implementing an alternative livelihood programmes called as Special Package for the Kolleru Poor (SPKP). 35 teams consisting of officials from forest, revenue, agriculture and irrigation are reported to have conducted Gram Sabhas

(Village/habitation level meetings) to identify the affected families. The following were the criteria adopted to identify the beneficiaries under this programme.

7.5.1.1 Eligibility criteria for the beneficiary

- All of them should be Below Poverty Line
- Families having legally held own land (called locally as Patta land) in areas below 5th Contour
- Families having Zirayathi land in areas below 5th Contour
- Members of Fishermen Cooperative Societies in areas below 5th Contour

7.5.1.2 Criteria for ineligibility

- People living in bed villages and working as labourers in the fish tanks or agriculture in areas below 5th contour and lost livelihood due to demolitions as part of restoration of Kolleru Lake Sanctuary.
- Persons who are migrants or purchased shares from original members of the Societies and all those above Poverty Line are not eligible

7.5.1.3 Unit Costs

The families who are already members of Self Help Groups (SHG) get the assistance in the form of Bank linkage. The break-up of the unit cost is as follows:

- 10% - Beneficiary Contribution
- 50% of the unit cost or Rs 25,000/- whichever is less as government subsidy
- 40% of the unit cost or remaining portions of the unit cost whichever is higher as Bank loan.

The families not covered under SHG programme were proposed to be covered by Scheduled Castes Finance Corporation, Backward Classes Finance Corporation, Minorities Finance Corporation, Self Employment Schemes, and District Industries Centre etc. The conditions of lending vary as follows (Table 19).

Table 19: Conditions for loans

	Agency	Maximum Cost (Rs)	Govt. Subsidy	Margin Money (for loan)	Bank Loan	Beneficiary Contribution
1	SC Corp	50000	50%	20%	Balance	Nil
2	BC Corp	100000	50% (Max. Rs 25,000/-)	Nil	Balance	

3	Self Employment (for petty business)	50000	50%	Nil	Balance	10%
4	Self Employment (for 10th class pass/fail)	100000	50% (Max. Rs 25,000/-)	Nil	Balance	Nil
5	Group Loans (at least one member to be 10th class	125000	50% or Rs 1.25 lakhs @Rs 25,000/- per member whichever is less	Nil	Balance	10%

This in effect means that the loan component varies from Rs 25000- to 62500/-. However, it seems that the bankers were not keen to extend loans citing the factor of viability. Based on a proposal by the Krishna District Collector the government decided [GO Ms No 400 PR&RD (RD VI) Dept dated 23-08-2007] to permit releasing Rs 15000/- as direct subsidy without linking to loan or beneficiary contribution.

7.5.2 Details of the scheme implementation

The overall status of the Alternative Livelihood Programme (ALP) scheme implementation is as given below (Table 20).

Table 20: ALP scheme implementation (Rs in Crores)

District	Units sanctioned						Grounded Units	
	Units	**Subsidy**	**M M**	**Be Co**	**BL**	**Total**	**Units (No)**	**Subsidy**
West Godavari	21015	45.81	0.05	6.14	25.01	77.04	13613*	27.39
							6283**	15.70
		Sub-Total					19896	43.09
Krishna	2271	3.07	0.00	0.62	3.19	6.89	2271*	3.07
							6645**	9.97
		Sub-Total					8916	13.04
	Bamboo	-	-	-	-	-	10668	2.56
		Sub-Total Krishna					**19584**	**15.60**
Grand Total	***23286***	***48.88***	***0.05***	***6.76***	***28.20***	***83.93***	***39480***	***58.69***

Note: MM = Margin money, Be Co =Beneficiary contribution, BL = Bank loan,
*With Bank loan, ** Direct subsidy

7.5.2.1 Viability of schemes implemented

The schemes implemented are of routine DRDA type self employment schemes expected to generate income sufficient for their needs and repaying loans wherever the bank loan was linked. The average amount sanctioned was Rs 20120/- in West Godavari district and Rs 13518/- in Krishna district. As expected, all these schemes

are business oriented while the local public lack such business aptitude. Although some schemes such as trade in fishing the locals are familiar with, no surplus fish said to be available in the area after the fish tanks were demolished. Schemes to help ventures such as grocery and cloth shops also seems to have not picked up due to dwindling purchase power of the villagers and emigration of the people looking for better pastures. Shops for sale of fertilizers were sanctioned while the sanctuary rules do not permit using them. Animal husbandry schemes also seem to have failed due to fodder shortage.

Many beneficiaries during the personal discussions in the field informed that they have used this money either to repay loans or for personal consumption due to their decreased incomes. Most of the Rs 28/- crores thus released as direct subsidy to about 23 thousand beneficiaries in Krishna and west Godavari districts was spent in two or three months, did not help in developing a livelihood for the people and practically were wasted. Similarly an amount of Rs 2.56/- Crores, at the rate of Rs 2400/- per family, released for purchase of bamboo was also consumed in no time as income from basket making was not attractive. To sum up the Alternative Livelihood Programmes sanctioned were irrelevant in the local context and funds available were insufficient. The total amount of Rs 58.69/- crores disbursed as subsidy on the whole did not result in rehabilitation of the affected population. The other alternative, not attempted here, to develop an alternative livelihood was providing land for land outside the sanctuary area or provide wage employment through NREGP while people continue traditional agriculture or traditional fishing and working for the sanctuary.

7.6 Potential alternative sources of livelihood

The Lake Kolleru and its surroundings offer several sources of livelihood for the local people. The section below examines some of the potential sources.

7.6.1 Traditional fishing

The wage earners of aqua farms are BCs and SCs and most of them are originally from Orissa. To improve their livelihood the state government had assigned lakebed lands on patta. While the BCs, mostly Fishers converted their land to fish tanks, the SCs used their land for agriculture. In 1996 the Government constituted 88 Fishermen

Co-operative Societies and assigned about 2088 acres of land and allotted 50cents to each member of the societies for capture fisheries. Later on the Government encouraged them to go in for aqua farms and offered concessions and subsidies. The sudden riches reaped from aqua farms spurred the rich and influential to take the lake bed lands on lease to start commercial aquaculture activity on a large scale. Consequently the lessees started working as laborers in the fish tanks. In fact it is the rich aqua lobby and the powerful politicians of the two districts who deprived the genuine Fishers of their livelihood for selfish and personal gains. They also resorted to obstructionist tactics at the time of Operation Kolleru.

The notification issued in G.O Ms No 120 makes it clear that the rights to do fishing with traditional methods using navus, nets etc and the right to traditional agriculture without using pesticides and chemicals are protected. A P High Court of Judicature in its judgment WP No 33587 dated 30-7-2001 and 12498 of 2001 have held this notification valid. The Supreme Court in its judgment Nos 1486-87 in MP(c) No 202 of 1995 dated 10-4-2006 observed that the notification issued u/s 26-A needs to be enforced immediately and that in any event the rights of the Fishers surviving on a traditional method of fishing have not been taken away and that they have been duly protected. In fact, the Fishers were practicing traditional methods of fishing in the Kolleru prior to intensive commercialization of fisheries. The only argument that is consistently and persistently being advanced is that the formation of the sanctuary has affected the livelihood of the traditional Fishers. In the guise of livelihood needs of Fishers, the rich aqua and powerful lobby, personating as their benefactors, are raising the bogey of loss of livelihood. It seems that the rich, powerful and aqua-corporate nexus started batting for the so-called poor Fishers as a last resort.

The Central Empowered Committee in its Lr No 1-5/CEC/SC/ 05 Pt VI dated 16-2-2006 has observed that pisciculture activities are being carried out in the lake in violation of the Supreme Court's and High Court's orders. It has further observed that there is no dispute that these activities which are purely for commercial gains is concentrated in the hands of a few influential persons and that the activities are adversely affecting the livelihood of the traditional Fishers as well as the agriculturists.

On the advice of state Fisheries Department, culture of cat fish was taken up (15 species of cat fishes have been recorded in Kolleru, Appendix 7). Besides some aqua farmers had introduced the fish *Tilapia* which was responsible for decline of several native fish species. The cumulative effect of these is that the livelihood of traditional Fishers was adversely affected and they were almost forced to work as laborers in the aqua farms.

7.6.2 Duck farming

Duck farming was the second important livelihood for the villagers. The estimated duck population of 7.41 lakhs yielded about 710 lakh eggs in a year. About 37300 tons of duck droppings were also released in a year. The waters of the lake are thus highly enriched with nutrients of biological origin resulting in lake waters becoming highly productive. The duck population was reported to be helping in controlling diseases such as malaria and filariasis since they feed on the vector larvae. Large-scale excavation of tanks for fish and prawn farms in the lake bed has vitally affected this subsidiary livelihood of the Fishers families. It is possible to re-develop duckary in the area.

7.6.3 Livelihood of women

The local women largely are trained in farm work. After the entire farm fields have been turned into fish ponds they are rendered jobless. According to Priyadarsini Manila Mandali President Ms P Kanakaratnam, women used to contribute their mite to families by rearing ducks and working in the fields before the advent of pisciculture which brought about a drastic change in gender relations in the area. Appropriate means to engage the women by way of Alternate Livelihood schemes is essential here.

7.6.4 Harvesting weeds

Harvesting weeds was also a source of income and livelihood for the Fishers. The reeds, *Phragmites karka* (locally known as Kikkisa grass), are harvested and extensively used for reinforcement of mud walls. Dried *Phragmites* and *Typha* grass are also used as fuel. These weeds provide breeding ground for certain birds such as Baya and certain warblers. Indian Moorhen, Purple Moorhen, Teals etc also frequent those patches. *Cyperus* spp (locally called *jammu*), *Typha* and *Phragmites karaka* are widely used for thatching roofs and mat making by the womenfolk of fisher

community. They also use *Alternathera sessillis* (*Ponaganti kura*) as leafy vegetable and the rhizomes of Nymphaea species is used as supplementary vegetable by Fishers and other villagers. *Pistia* and *Salvinia molesta* is used as mulch in gardens. The aquatic weeds are used as livestock feed because of their high nutritional value as compared to paddy hay. Compost of water Hyacinth is used for fertilizing coconut plants. Each kilogram of dried water Hyacinth yields about 5 to 10 liters of biogas with an average methane content of 69%. It seems that there is lot of potential for value added products to be produced using these weeds. However, identifying such potential, finding appropriate technology and market linkages need extensive work and commitment.

7.6.5 Medicinal plants

According to the study conducted by the Regional Ayurvedic Research Centre, Vijayawada there are about 30 medicinal plant species in the lake area which can be another source of livelihood. A strategy for sustainable and ecologically benign harvesting, value addition and marketing has to be developed for these.

7.6.6 Ecotourism

The lake can be developed as a major tourist destination and that will create direct and indirect employment for the people of the area. The lake harboring rare and endangered species of migratory birds has high potential to develop into a major attraction for general tourists, students, researchers and other special interest groups. Ecotourism should be targeted at socio-economical development especially of the local communities and should be community based. These activities should be aimed at developing soft and hard infrastructure and all infrastructure development should be environmentally sensitive and culturally sound, keeping local landscape in mind and should at all times involve the local community. Benefits of ecotourism must go only to the local stakeholders with minimum investment from outside agencies. Appropriate means such as Eco-development committees (EDC) may be formed to implement such programs. A few actions that could be taken up for ecotourism development are:

- Providing traditional boats such as donies for tourists and training locals on their operation and on bird identification to act as birding guides for tourists.
- Encouraging traditional fishing for locals in which tourists may be encouraged to partake.

There are several locations for development of tourism such as Akiveedu, Kolletikota with its hamlets. Kolletikota has a temple known as Peddintalamma constructed around 600 AD. Komatilanka has a highly rich bird population. Upputeru is an ideal place for angling by tourists.

7.6.7 Socioeconomic development via community participation

Participation of the community is very essential in a successful conservation action. Community participation is further more essential in wetland conservation for various reasons related to the ecosystem. Without their participation and without taking them into confidence, an exclusive top-down conservation strategy would relegate the public to the position of a viewer and make them antagonistic or at best apathetic towards the cause. A typical example as of now is the case of Kolleru. This has to be rectified by various means, for the cause of the stakeholders, for the cause of the ecosystem services offered by the lake and for the numerous birds and other faunal and floral forms and for the cause of the sustainability of the lake at large. The wetland system with its intricate fabric of life is an invaluable infrastructural asset. Immediate means have to be taken up to bring the locals into the conservation action, the actions for wise use of the resources. A major drawback in the conservation actions so far undertaken in Kolleru is that no effective programs to make the locals aware of the ecological importance of the lake were attempted alongside.

Eco-Development committees (EDC) formed of the locals may help in managing the ecosystem, and its resources. Livelihood and life-skills training should be provided to the communities reliant on the lake for their subsistence to reduce their unsustainable exploitation of the resources. Women may be trained on the alternative income generation schemes such as tailoring, candle making and adoption of other cottage occupations. Natural resources based schemes such as harvesting aquatic weeds for conversion into value added organic products may be introduced for the benefit of the locals. Localized un-conventional energy generation schemes such as biogas plants may also be initiated and the inhabitants be encouraged to undertake duck rearing and animal husbandry. This will not only offer monitory benefits to the poor but will also improve their socio-economic conditions. Fish breeding and fishing activities may be allowed as a traditional occupation for fishing communities in the buffer zone. Training may be provided to fisher folk to enable them to operate traditional gadgets

and nets. Limits should be placed on the quantity of fish catch and strict regulations should be enforced on species to be fished, introduction of exotic species etc. The nation and people from the mainstream has to subsidize the locals for helping in maintaining the ecosystem with all its conservation and ecosystem service potentials; payment for ecological services (PES). The local public needs to be benefited, both tangible and intangible benefits, from the conservation of local resources. The nation and the people from the mainstream need to pay for the invisible / intangible benefits from the Kolleru, that essentially is invisible to the market forces.

8 FIELD CONSULTATIONS AND EXPLORING ISSUES

As discussed earlier, the field consultation formed the most important part of the committee's work strategy. A large number of bed and belt villages were visited by the committee, interacting with the villagers, with no restrictions, to have first hand information on their grievances. The committee also wanted to be exposed to the ecological characteristics, fish culture and various other ecological issues in the field. Local government administration organized the logistics for the field-visits, scheduled the route in the field, and arranged the public interactive meetings. In total the field trips were excellent. The public meetings were very interactive; however, the committee while sitting through the whole proceedings developed a gut feeling that almost all of them appeared as stage managed by the leaders advocating one particular view point; reduce the boundary of the sanctuary. It was felt that alternative view points were censored and not allowed to be brought up to the committee. During the last public meeting at Eluru, one of the speakers who dared raising a different point of view was shouted down. On the last day of the meeting, meant for NGO and others, there was also a demonstration in front of the hall ostensibly advocating reduction of the area, but covertly to avert alternate opinions from coming up. Therefore the committee gave audience to a group of about 20 people, who had inhibition to come to the public meeting for apprehensions about their security, in the government guest house where the committee was residing.

8.1 Representations - salient points

During the public consultations and during the travel through villages a large number of representations were received by the committee. The representations were from the common people, community leaders, political leaders, NGOs and elected representatives. In total, the committee received 2269 representations (Table 21) during the visit.

Table 21. Representation submitted to the committee during its field visits

	Location	Date	Representations
1	Gudivakalanka	21-09-2010	233
2	Pothunuru	21-09-2010	68

3	Agadalanka	21-09-2010	44
4	Pedanindrakolanu	22-09-2010	44
5	Thokalapalli	22-09-2010	235
6	Siddapuram	22-09-2010	1163
7	Gudipadu	23-09-2010	169
8	Sriparru	23-09-2010	139
9	Devichintapadu	23-09-2010	57
10	Bhujabalapatnum	24-09-2010	48
11	Kolletikota	24-09-2010	39
12	IADP Meeting hall	25-09-2010	30
	Total		***2269***

The important grievances voiced by the people, community leaders, political leaders and elected representatives as reflected in their representations to the committee were as follows:

8.1.1 Supporting reduction of the WLS area, bringing down its boundary

8.1.1.1 Pollution and other issues

- Those who supported reductions of the area stated that pollution caused by pisciculture in the lake is over emphasized. Pollution caused by industries and municipalities which are several times higher, harmful and even continuing was ignored, mainly because fisher folks are poor and industrialists rich. Pollution of lake by industries and municipalities continue to be unabated while the livelihoods of the local Fishers and farming communities were severely affected due to demolition of tanks up to the 5 feet contour.
- The submersion of lands in the upper reaches mostly attributed to construction of tanks in the lake area is over stressed in reports by officials and media while it is a perpetual problem over the decades caused due to the extremely low outflow capacity of the Upputeru, the only outlet in to the sea compared to the inflow from the large number of streams and drains (total inflow in peak rainy season is about 111000 cusecs where as the out flow at +7 level is only around 12,000 cusecs).
- The encroachments causing obstructions in Upputeru, problem of silting up of canals, lack of modernization of canals etc added to the problem and this is being conveniently overlooked. Demolitions are part of the conspiracy of the rich people who are envious of the well being of the fisher folks.

- The submersion is continuing even after four years of demolition of fish tanks. "*Disease is one and medicine prescribed is different*" said Sri K Bapi Raju, Honourable Member of Parliament from the area.
- There are several cases of omissions and commissions in determining the boundary of the sanctuary and there was no genuine consultation with people on their rights at any point of time. It appears that only formalities of notification have been attended to for the sake of official record.

8.1.1.2 R& R and livelihood issues

- Livelihood concerns of farmers of upstream areas (the real polluters) are being protected at the cost of poor Fishers living on Kolleru. With the increase in population, permission for second crop in Krishna district was given and consequently there was higher usage of fertilizers and pesticides.
- Among the 25000 acres of the destroyed fish tanks, in Krishna district only 17000 acres are within +5 contour. After deducting roads etc about 8000 acres are in excess and that should be distributed to the poor
- Fishing permits are not issued from 1st June to 30th September (spawning period) only as per rules. After October there will be little or no water and therefore, fish catch will be very less, a serious issue to the livelihood. Similarly places like Pedanindrakolanu the fishers are bound by '*kattubatu'* and they do '*doddikattu'* fishing.
- No serious and genuine consultations on the livelihood issues were made by the District Collectors with the people as per provisions of the Wild Life (Protection) Act, 1972.
- No compensation as per R&R Policy of the state was paid to the legal land holders and D form Patta holders even after eleven years of issuing the GO 120 and four years of demolition of tanks.
- Landless among the population who have been working as labourers in fish tanks and agriculture and lost their occupations were also not taken care of as per R&R program of the State.
- The Fishers are facing erosion of their economic base leading to migrations, problems in educating their children, performing marriages of their children etc.

- Alternative Livelihood Programmes for the project affected populations taken up were irrelevant to the area and people, and funds provided per family were totally inadequate; said Smt Jayamangala Mahalaxmi, Sarpanch, Pattikolla Lanka village at public hearing on 21-09-2010 at Gudivaka Lanka village. Representations from Devichintapadu were desperate with the livelihood packages promised by Mr Navin Mittal, then District Collector, Krishna, which has not come in to action so far.
- Appointment of this Committee should have happened before the demolitions to address issues in proper perspective which could have saved thousands of families from misery.

8.1.1.3 Discrepancy in notifications

- Larger area than notified was taken possession by sanctuary officials. While 77138 acres was notified in GO 120 the Forest department have taken possession of 84,000 acres. During the CM's review meeting on 30-03-2007, the officials were instructed to restrict the sanctuary to the notified extent only; however, action is being done to regularise this irregularity; said Sri Jayamangala Ramana, Honourable Member of the AP legislative Assembly.
- Serious concerns were expressed on the acts of omission and commission while declaring the sanctuary area and fixation of boundaries at 5^{th} Contour.
- All the participants of village level meetings requested downsizing of the lake from +5 to +3 feet contours. In the district level meetings at Eluru with Project Affected Population, NGOs and elected representatives, the same was the position. The argument in favour of reduction is that if the contour is reduced to +3 feet levels, 13946.99 hectares of land held by people will be out of sanctuary which includes 8413.65 hectares of government land, 5533.34 Hectares of private land. People and political parties argued that about 22000 Hectares of government land which would still be available can be distributed to the poor. They further argued that huge expenditure on R&R for PAFs can also be saved.

8.1.1.4 Co-operation to protect the sanctuary

- Some people also offered cooperation in protecting and developing the sanctuary at +3 feet contour by forming themselves into eco-development committees. They also wanted to form such committees to undertake eco-

tourism projects and make a livelihood. Most and immediate action required to be taken according to them is to bring back the glory of fresh water in the lake by totally eliminating the pollutants and weeds and removing the debris to make traditional fishing and agriculture reasonably profitable and slowly introduce eco friendly and sustainable agricultural and fisheries practices for better incomes. It was also stated that youth could be trained in eco-tourism project activities.

8.1.1.5 General

- For villages such as Bhujabalapatnum road accessibility are very less and poor, villagers are depending on boats.
- Representations from Bhujabalapatnum say no birds in the region.
- It was also suggested that the present committee may consider Mitra Committee's Report and Sivaramakrishnaih Report to manage Kolleru.
- The land taken from Scheduled Cast has to be cancelled and given back, since these (100 acres) lands were distributed by the government to pursue fish farming.

8.1.2 Against boundary change

- After reduction from +5 to +3 feet contour, encroachments may extend to the area below +3 feet contour as the demand and greed for land in these districts is very high and ultimately no Kolleru lake will be left. Further the reduction of the area will lead to serious fragmentation of the habitats.
- Prawn farms use various ecological resources in the area presumptuously. For example *Pila virens* which is the main food of the Open billed stork is being exploited with no hold. Consequently 90% of *Pila virens* have disappeared. Vaster such farms many similar species will get rooted out.
- Fish of Kolleru are different from others as they are darker; Kolleru being shallow, light plays a part on the skin of the fish. Of the 60 species native to the area many have disappeared as a result of polluted waters from the fish farms as fertilisers and pesticides are used in them.
- Representatives of environmental activists, Mala Mahanadu and such groups argue against the proposition of reducing the boundary.

- As such the vagu, vankas and river porambokes come under the definition of water bodies and that they attract the ban imposed by the Government. It is reported that Kolleru was included in the "*Prohibitory Order Book*" long back.
- The Revenue department of the government of AP and the Commissioner of Land Administration, Hyderabad, (Memo No 24140/Assn. 1(1) 2003-3/Rev dated 22-8-2003) have categorically stated that the tanks, kuntas, ponds, lakes and supply channels etc vested with the government are intended for providing irrigation facilities and drinking water to the people at large and to maintain and augment ground water potentialities. That apart, the water bodies are also helpful in the maintenance of ecological balance. On a reference made by the Collector, Krishna district for conversion of a Vagu poramboke to waste land, the government directed the Collector, Krishna to remove the encroachments and to protect water bodies on war footing under '*neeru meeru*' programme.
- The Chief Commissioner of Land Administration in a circular (Ref No B2/2225/2003 dated 20-9-2003) has directed the Collectors to take steps to identify and include all lands covered by water bodies in the "*Prohibitory order book*" and follow these instructions scrupulously (Appendix 15). Now the governmental agencies themselves are violating these instructions.

8.1.3 Akiveedu railway station and Komatilanka

On 22-09-2010 the Committee members were taken to Akiveedu Railway station by Mr Kanumuri Bapiraju, Honorable MP from Narsapur, explaining that the railway station is falling within +5 feet contour line. However, the DFO (WL), Elluru informed the Committee members that the survey numbers covering the railway station are excluded from +5 contour and that the problem is nonexistent. The board at the railway station also indicates that it is above +5 feet contour (Figure 25). This indicates that there is gross misinformation among the public about the contours and the boundary line of the sanctuary and it need to be corrected. The district authorities have to spread the right information to all the stakeholders as well as opinion makers and elected representatives.

After meeting at Bujabalapatnam, the Committee members visited Atapaka and inspected the rough path that is said to be used to reach Komatilanka. Earlier the villagers of Komatilanka were using boats along the drain adjacent to the pathway for

transportation. According to the forest department, the fish tanks in this area were demolished and the earth from the blasting operation was deposited on the side which the villagers of Komatilanka leveled and made a path. During rainy season and at the time of our visit, this pathway was partially covered by flood waters. Mr Maganti Babu, former MLA of Kaikalur represented that the forest department is not permitting black topping this road.

The Standing Committee of the National Board for Wildlife met at Delhi on 13-10-2010 to consider 32 proposals placed before it for using National Parks and Wildlife sanctuaries or areas around them for other projects. This Committee cleared some road-related proposals on the pre-condition that no black topping of the roads would be allowed, re-alignment and expansion would not be permitted and that the Committee would make site visits to each of the project sites to make case specific decisions.

Figure 25: Akiveedu Railway Station, indicating the altitude (3.26 m) marked on the board

Enquiries reveal that there were illegal fish tanks in Komatilanka village which were demolished during Operation Kolleru. If the path is converted into a pucca road, it would be used by the residents for them a vital requirement; more than that it would

also definitely be used by heavy vehicles, earth moving machinery, tractors, tippers etc for making the fish tanks afresh. It seems that this would be a stronger motive behind the representation. Higher movement of vehicles on this road is bound to disturb the birds in Atapaka where we have seen notable number of Spot billed Pelicans, Herons, Storks, moorhens and other waterfowl.

8.2 Merits and demerits of the demand for resizing

The issue of re-sizing is widely discussed, among the local public, the political parties, community leaders, elected representatives, NGOs, environmentalists and conservationists. Various arguments for the reduction and against reduction are put forth. Some focus their arguments chiefly on livelihood issues and economic development of the area, while others focus on wider issues such as ecological services, habitats for a large number of endangered and threatened species, water storage, ground water recharge etc. The section below makes a brief visit to the arguments.

8.2.1 For re-sizing the sanctuary and possible benefits

As noted earlier the representations, almost all, were overwhelmingly and vociferously supporting bringing down the sanctuary boundary to +3 feet contour. The chief argument in favor of reduction is that the boundary shift to +3 feet contour will release a large chunk of land. Another, constantly and persistently advanced point is that formation of the sanctuary has deprived the livelihood of a large portion of the local public. There were also opinions, but subdued, less clamorous and public, against reduction. Arguably there are several potential benefits from resizing the lake. Several benefits, whether factual or speculated, have been highlighted. These benefits are supposedly the driving force behind the overwhelming representations, although seemingly organized, for reducing the boundary of the sanctuary. Some such arguments and benefits are briefed below.

- Reduction of the boundary to +3 feet level will take 13946.99 hectares of land held by people out of sanctuary. This includes 8413.65 hectares of government land and 5533.34 hectares of private land (Notes of CF, Elluru - page 22).
- It was also argued that about 22000 hectares of government land which would still be available can be distributed to the poor. They further argued that huge expenditure on R&R for project affected families can also be saved.

- Government land of about 8413.65 hectares lying between +5 feet and +3 feet contour could be made available for free use to public
- Aquaculture being one lucrative venture in the area, all these lands could be ultimately used for agriculture or could be converted into fishponds.
- Big investors and corporate agencies would pump in money to take these lands on lease for commercial culture fisheries.
- Kolleru people who would be assigned these lands could lease out this lands for Rs 15,000/- to Rs 25,000/- or higher per acre, while the richer investors / leaseholders could earn return in the range of a lakh or more rupees per acre.
- Land prices would go up considerably and infrastructure such as road and residences could come up.
- Local people who have resources could raise required investment and develop fish farms in their own land
- Ancillary industries / enterprises could come up in the area or its neighborhood
- More Fishers and others in all probability could get employed as laborers to work in the fish farms, ancillary trades and other infrastructure projects.

8.2.2 Against re-sizing the sanctuary

An argument that is persistently advanced against the sanctuary is that its formation has affected the livelihood of the employees of aqua farms and a large portion of the local public and overall economic development of the area. The workers, mostly BCs and SCs who were one-time immigrants from Orissa, were either assignees or pattadars with small land holdings. They had leased their parcels of lands to richer persons who have converted these lands into fish tanks. Thus the owners started working as laborers in these fish farms. It was raised by several persons in private that in the guise of arguing for the livelihood needs of the poor Fishers, the rich aqua and powerful lobby are working towards saving their own interests.

The Principal Secretary to Government, EFS&T Department, in the detailed replies dated 14-2-2006 to the points raised by the Central Empowered Committee (CEC) categorically stated that the rich and powerful persons had taken up the commercial activities in the name of livelihood needs of the poor and that they are the only persons who are getting benefit from the area. The CEC in its letter No 1-

5/CEC/SC/05/Pt.VI dated 16-2-2006 has observed that there is no dispute that these activities which are purely for commercial gains is concentrated in the hands of a few influential persons. It is further observed that these activities are adversely affecting the livelihood of traditional Fishers as well as that of the agriculturists.

Honorable Justice Kuldip Singh in MC Mehta vs Kamalnath 1997 (1 SCC 388) has observed thus: "*The notion that the public has a right to expect certain lands and natural areas to retain their natural characteristics is finding its way into the Law of the land. The ancient Roman empire developed a legal theory known as the "Public trust doctrine*". *The Public Trust Doctrine primarily rests on the principle that certain resources like air, sea, waters and forests have such a great importance to the people as a whole that it would be wholly unjustified to make them a subject of private ownership. This doctrine enjoins upon the Government to protect the resources for the enjoyment of general public rather than to permit their use of private ownership or commercial purposes.*"

In the GO Ms No 120 the existence, nature and extent of rights as determined by the District Collectors of the West Godavari and Krishna districts have clearly allowed i) right to do fishing with traditional methods using navus, and nets of size as specified by the Chief Wildlife Warden and ii) right to traditional agriculture without using pesticides and chemicals.

A P High Court of Judicature in its judgment WP No 33587 dated 30-7-2001 held that the notification GO Ms No 120 is valid and directed that only traditional methods of fishing should be permitted. The Supreme Court in its judgment [in LA Nos 1486-87 in WP (C) No 202 of 1995 dated 10-4-2006] observed that the notification issued u/s 26(A) needs to be enforced immediately. Sections 29 of the Wildlife (Protection) Act, 1972 specifically prohibits any destruction or damage or diverting the habitat by any act or divert, stop or enhance the flow of water into and outside the sanctuary. The Supreme Court in IA Nos 1486-87 in WP(C) No 202 of 1995 has observed that "*out of 901 sq kms of Kolleru lake, an area of 308 sq kms alone is notified as a sanctuary. This indicates that the Government had balanced the needs of sustainable development with the livelihood of persons surviving on the resources of the lake*."

It is obvious that proper consideration to avoid the livelihood of traditional Fishers, local farmers and land owners were not made while executing the GO. However, at Kolleru, in fact, in the guise of livelihood needs of the poor Fishers who are being used as a front, powerful aqua farms are reaping benefits by large-scale commercial fishing. Even after destruction of fish tanks native fish growing there are being exploited by powerful investors. It is said that the native fish that grow in the demolished tanks in Bhimadole, Korukallu, Agadalalanka, Chettunnapadu and Mallavaram were reportedly auctioned by them for about Rs 40/- lakhs. Powerful fish farm lobby earns to the tune of about Rs 5000/- crores a year, most of which seemingly is unaccounted. As the aqua lobby prospered, the environment in the area took a big blow as documented by many a studies.

It is a well known fact that area under each contour measures over thousands of acres. If the boundary at the +5 feet contour level is reduced to +3 feet, thousands of acres of valuable land will be released. However this freed area will be exploited certainly for intensive pisciculture that can progressively tamper with the lake's ecosystem. Further, releasing those areas is unlikely to relieve the pressure for land at Kolleru. The demand and greed for land in these districts is such that slowly but surely encroachments will spread into +3 feet and lower contour area in future. There is already 483.39 hectares of private land (Zirayathi land) within +3 feet Contour.

If fish tanks come up in the denotified area, large areas will be inundated, besides threatening the birds and wildlife. With the fish farms exotic species of fish which may gradually eliminate some endemic species would be introduced. According to Dr BV Seshagiri Rao who had studied into the fish fauna of the lake, the fish that were integral to the food web, but almost disappeared from natural waters, are *Chela labuca, Oxygaster* sp, *Danio devario*, *Esomus danricus*, *Rasbora danionicus*, *Puntius* species, *Chanda nama*, *Chanda ranga* and *Nandus maddus*.

Besides polluting the whole lake, the fish farms have spawned up a cottage industry; collecting Apple snail (*Pila virens*) to be used as feed. Women and children are engaged in this collection, especially during nights and there have been deaths while collecting snails. Moreover, snails are important food items for many birds. Large

scale collection of the species will seriously affect their food availability, and also affect other ecological role played by the species.

Kolleru people have been utilizing a variety of wetland resources for decades which they had lost as a result of commercial fishing. Unfortunately the resources of the lake have been commercialized as merchandise of the rich and powerful aqua lobby with the cooperation and connivance of the system.

The flow of fresh water will flush the lake while enabling the diversity in the lake to survive which in turn will provide livelihood to the Fishers. The flowing nature of water gives the lake its natural values while conversion to a stagnant, reduced and fragmented water body would cause the lake to lose invaluable natural properties, and affect the natural fabric of life there.

The fish tanks that come up after resizing the lake with high-rise bunds will prevent the natural flow of flood waters from areas in Khammam, Krishna and West Godavari districts. As a result, the flood waters will pond back resulting in flooding and submersion of around two lakh acres of food crops. Consequently an estimated three lakh tons of food grains will be affected every year. In due course, this will force the landowners to gradually convert their lands into fish tanks resulting in various repercussions on natural resources and socio-economic setup of the area, apart from causing colossal loss of food grain production in the state.

Higher production of commercial fisheries focusing chiefly on higher profits will lead to extensive use of fertilizers and chemicals, and artificial fish feed and medicines. While examining the effects of culture fisheries on the native species, certain studies have reported that the fishes of the area are affected by parasitic and bacterial infections (Kumaraiah et al., 2004; Sarangi et al., 2004). For treating the fish affected highly potent chemicals will be used. Boiled poultry, goat and cattle meat waste is fed to catfish all of which will pollute the lake waters. This will lead to ground water gradually becoming non-potable. It is said that today, the people of Kolleru are purchasing drinking water and they find difficulty to provide safe drinking water to cattle.

Further, the following points also need to be noted.

- When the District Collectors conducted enquiries under the Wildlife (Protection) Act 1972 namely proclamation u/s 21 and enquiry u/s 19, no objections were raised regarding the contour demarcation or regarding +5 contour.
- The lobby of fish farms and the powerful failed to appeal to the Central Empowered Committee (CEC) for reduction from +5 feet to +3 feet contour when it visited the lake area twice in 2006-2007.
- The activity advocated in the area below +5 feet contour is largely a commercial activity and not a livelihood activity.
- The management plan by the Wetland International commissioned by the forest department of AP does not propose reduction of the sanctuary area or another delimitation of the boundary. On the other hand, it suggested alternative livelihood practices to address the issues affecting the local people.
- Looking at the contour map of Kolleru, adopting +3 feet contour as boundary would result in serious fragmentation of the habitat and enormous increase in the shore line of the lake that would lead to exerting unsustainably high pressure on it. At +5 feet contour the lake would be more intact and ecologically better sustainable in the long run if management needs are well addressed.
- Since Kolleru lake is a sensitive ecosystem and notified as a sanctuary, an ecozone or buffer zone ought to have been formed at the time of its declaration as a sanctuary. It is a failure on the part of the state government not to earmark such a zone.
- If Kolleru is to survive as an ecosystem and continue providing its valuable ecological services, for drainage and irrigation, resizing of this lake should be given up.
- Birds of Kolleru have made the lake their habitat even before the villagers settled in the area.
- Public Trust Doctrine enjoins upon the government to protect the natural resources for the enjoyment of general public.
- Government of India is a signatory to a number of international conventions and Mr Jairam Ramesh, the Honorable Minister for Environment and Forests has told the Rajya Sabha that Government was keen on protecting wetlands.

The State Government is constitutionally obliged to adhere to the Union Government's international commitments.

- The entire drainage system of Godavari and Krishna deltas has evolved keeping in view the water retention capacity of this lake. Several streams drain into the lake and gradually flow into the sea through Upputeru. It is a natural mechanism which has been grossly interfered with by construction of high rise bunds around fish farms in the Lake Kolleru and unauthorized and illegal bunds across Upputeru. Roads & Buildings Department has laid roads to a total length of 180 kms in the lake bed with insufficient vents without considering water flow parameters resulting in increase in flood waters and disparities in the water level as hydraulic contact is lost among the artificially fragmented zones.
- The lake is about 901 sq km at +10 feet contour and 135 sq km within +3 feet contour. If the lake size is reduced to +3 contour the inflow reaching up to 1222 Mm^3 would spread far and wide into upstream areas; submerging more than 50 belt villages, the bed villages and may spread to the towns of Eluru, Gudiwada and Vijayawada. Water may enter back to the inflow-drains resulting in longer periods for recession of floods. This elevated water level will remain for a longer period as it is to be drained only by Upputeru. Considering the low capacity of Upputeru as a drain it will take longer period to deplete all the flood water.
- With increased tidal activity in Upputeru drains, the time taken for discharge of water per day is subject to tidal complexities with water changing the direction back and forth every 6 hours. There will be more than two pulses of flow front moving in the same direction on any day. At a hydraulic head of +7 feet with an approximate velocity of 0.5 m/sec, it takes 28 hours for the lake water to reach the sea.
- Reduction of wildlife sanctuary from +5 to +3 contour would worsen the water storage situation since most of the lake bed will be converted into fish tanks, being very lucrative. Fish tanks have a processed, modified and stabilized floor that in effect will fail to serve any ecological functions of a wetland bed including its recharge functions. In fact, there is a need to desilt the lake bed at several places to increase the storage capacity to save the bed and belt villages from inundation in future.

- The district administration never had any meaningful engagement with the ziroyithi landowners over the quantum of compensation.
- The failure of the government to explore and sensitize Kolleru inhabitants that conventional fishing, its various potentials for value additions and preservation of a wetland ecosystem can provide them attractive sources of sustainable livelihood has led people to believe that conservation of the lake is inimical to their livelihood and this has been fully exploited by the aqua and powerful lobby.
- For their failure to pay land compensation of Rs 625.48/- crores for acquiring 13899.47 acres, the state government seem to be willing to sacrifice a large chunk of government land by resizing the lake from +5 to +3 contour.
- Having declared a sanctuary after following the procedure laid down in the Wildlife (Protection) Act, 1972, the State Government cannot take the plea that it has no funds to meet the cost of land acquisition which is estimated to be Rs 625.48/- crores as furnished by the Collector, West Godavari, in the note submitted to the Committee. The State Government or the Central Government should foot the land acquisition cost singly or share the cost. In the case of Polavaram Project the State Government had deposited Rs 600/- crores with the Central Government for taking over 484 acres of forests in Papikonda WLS and also promised to develop forest in one lakh acres. Likewise the state Government could raise required funds for Kolleru.
- In none of the meetings held with the stakeholders in Kolleru villages by this Committee, was there any demand for payment of land compensation or any mention of it in any of the written representations submitted to the Committee. This is because of the impression created that the boundaries of the lake will be changed, and perhaps for the wide propaganda and hype created by the business and associated interests in the area along this line.
- It is not the formation of KWS that has curtailed the development of the area, but the lack of coordination among government departments at the district level, failure to identify a proper development strategy and its committed execution.
- Since the A P High Court and the Supreme Court has held GO Ms No 120 as valid, their permission is absolutely necessary for considering resizing of the

lake provided there are very valid grounds. The approval of the Central Wildlife Board is also necessary.

- Under the Wetlands (Conservation and Management) Rules, 2010, Kolleru lake, being a Ramsar site, is protected against activities such as i) reclamation, ii) setting up new industries and expansion of existing one, iii) manufacture and storage of hazardous substances, iv) Solid waste dumping, iv) Discharge of untreated wastes and effluents from industries, v) Any construction of permanent nature, and v) any other activities having adverse impact on the ecosystem. All the above activities are taking place in Kolleru with impunity and with the active support of the nexus between aqua lobby and the powerful, and connivance of the system.
- Any reduction in area of the lake will vitally affect the ecological restoration and the functional integrity of the lake. There are fish and prawn farms above +5 contour and in these farms chemically laced aqua feed are used especially for the fingerlings. The toxic residues from these aqua farms seeps into the lower contours. Cosmetic efforts are not going to retrieve and restore the lake to its former grandeur unless appropriate measures to protect ecological characteristics of the lake is taken up immediately and boundary appropriately redefined (but not reduced) considering hydro regimes and ecological characteristics.
- In fact, Sri E Ramakrishnan, Administrative Staff College of India, Hyderabad, in his report for the integrated development of the lake in 1980 had suggested that the area below +5 MSL should be declared as flood prone zone and should be reserved for fishing, birds etc and warned that extension of cultivation up to +3 MSL is fraught with many ecological problems. He also suggested maintenance of lake level up to +7 feet contour and that no agriculture should be allowed below this level. However, on the ground, as per some conservation conscious corners, actions were schematically destroying and obliterating the lake in the name of floods. Persistent efforts were made to build reservoirs across Tammileru, one of the main rivulets to reduce inflow into the lake. A reservoir was built at Nagireddygudem in Chintalapudi Mandal although a reservoir across Tammileru already existed at Bathupalli in Khammam district. The waters of Budameru were diverted into Krishna river.

Upputeru, the natural drain which empties into the sea at Perantalakanuma was widened; but not sufficient to quickly vacate the flood waters. Thus the lake appears to be going through a systematic strangulation to emasculate and to ensure that it fades out.

- If fish tanks spring up between +5 and +3 contour, birds and other fauna will be deprived of their traditional habitat. Further, polluted waters from the multiplied fish tanks will flow into the remnant sanctuary. In view of the pollution and habitat changes, the birds that still thrive in the area may be forced to reach to the neighboring cultivated fields for food that will lead to higher poaching.
- Resizing of the lake will have cascading effect on similar natural resources in the region and lands for various purposes such as house sites and tank-bed cultivation. It would also affect the water retention capacity of this ancient wetland and other ecological services.
- The alignment of Right Canal of Polavaram Project which is North of Kolleru is at a distance of 4.5 to 18 km from several Kolleru villages. Eluru town is only 7 km from the canal. The agricultural run-off from the area irrigated by this canal naturally flow into Kolleru lake in view of the gradient. In case this canal breaches, there is high threat of water flowing into the lake resulting in increased flooding.

8.2.3 Concluding remarks

Although human beings are highly dependent on ecosystem services, we do not have sufficient ecological understanding of the same (Kremen and Ostfeld 2005). Managing ecosystems embedded with human beings involves several tradeoffs that require detailed understanding of the biophysical magnitude of the changes in ecological services resulting from human actions and the impacts of these changes on human welfare (Farber et al., 2006).

It is felt that reducing the area under the sanctuary does not serve the intended objectives, although it may release a large chunk of lands for other uses. It will lead to destruction of a very valuable ecologically important area for short sighted benefits. Further, before considering any changes in the KWS or the lake area in all, it is prudent to understand the ecological characteristics and underpinnings of the area, and

to integrate the knowledge in the socio-economic context to develop better policies and management strategy that will help in balancing the aspirations of the local inhabitants and the conservation needs.

An ecosystem like Kolleru has to be considered as an infrastructural asset. It is wise to invest in preservation of this common wealth bestowed on us by nature. The ecosystem services as generally considered as granted free of cost and hence remains invisible to market forces as of now. A change is required in this outlook.

9 RECOMMENDATIONS

Looking at the issues confronting the Kolleru Wildlife Sanctuary (KWS), the local inhabitants and the lake ecosystem we conclude the following.

9.1 Contours and boundaries

1) Reduction of wildlife sanctuary area would worsen the water storage situation as in due course of time most of the lakebed will be converted into fish tanks. In fact there is need to desilt the lake bed at certain locations and increase the storage facility considering the high flood level. However, dredging should be undertaken, after a detailed bathymetric survey, wherever necessary to enhance the water storage capacity, to facilitate water movements, to remove accumulated silt.
2) It is apparent that the original contours would have lost its anticipated sanctity because of anthropogenic interferences, excavations and siltation. The floods happening in the area are largely due to unscientific human interventions interfering with the hydrological regimes and flow pattern.
3) There is an urgent need for conducting re-survey of boundaries, as of now, using advance GPS technology handled by well trained staff so that there are no large variations in boundaries from the specified contour and loss of land to the people. As mentioned earlier nonconformity is seen among the maps used by various government departments. A competent survey can help is resolving this issue and standardize the maps. Erection of balance boundary pillars, about 2000 in numbers, may be taken up after the resurvey is completed.
4) Seasonality assessment of various ecological characteristics, fauna and flora is a must. Ecological principles should be the guiding precept and not just contours. This will help in establishing the rationale of contour as boundary.
5) The boundary of a wetland is essentially decided by the hydro period. Demarcation of the boundary based on contour, which is highly disturbed as of now appears unrealistic and hence, is not acceptable. The boundary has to be re-fixed after consideration of the scientific and ecological characteristics, and environmental flows to ensure the ecosystem sustainability of the area.

Issues need to be considered seriously while re-fixing the boundary are i) critical water level from hydrological point of view, ii) ecological requirement including habitat and breeding requirement for migratory and resident species both during monsoon and non monsoon seasons, iii) ensuring the minimum level of water required especially during the lean and winter months, iv) functioning of the water body as a flood barrier and v) traditional agricultural / fishery practices.

6) The area need to be mapped in full based on ecological and conservational aspects and the area that is relatively undisturbed and frequented by the birds need to be marked. That area will remain inviolate / untouchable to all human activities, called core area and should be declared as a "Critical Wildlife Habitat". Till such a survey is conducted the area at +3 feet contour will remain undisturbed and be considered as untouchable and inviolable. Beyond this area a stretch skirting this core area will be demarcated as buffer area or conservation area, where environmentally benign activities will be permitted and will be managed by a co-management group, as cited in the Wildlife Protection Act. Till the survey mentioned above is done, the area falling between +3 and +5 feet counter will be considered as buffer area, under the control of the forest department.
7) The process of survey need to be undertaken immediately and is to be completed within a period of 18 months so as to ensure the lake's conservation and to address peoples' concerns.

9.2 Ecological / biological

1) Steps may be initiated to protect Bantumilli brackish water lake, a satellite wetland habitat for birds, located downstream of the Kolleru towards the coastal side.
2) Regional landscape zonation for the whole Kolleru up to the highest flood level to be worked out and preparation of a master plan of actions to be undertaken.
3) Introduction of exotic fish species for farming may not be allowed in the area.
4) Detailed study need to be conducted to document the floral and faunal profile of this wetland. Regular collection of environmental baseline data may be

initiated. The ecological management plan may be implemented. Authorities may explore funding for the purpose from appropriate sources. Indo-Canadian Environment-Facility (ICEF) has funded Loktak Lake Development Authority for taking up works in Loktak lake.

5) Measures should be taken up for protection of waterfowl, to control poaching and restrict collection of aquatic life forms.
6) Manual or biological measures should be taken up for de-weeding the lake, especially species such as water hyacinth.
7) Tree cover is meager around the lake and on lake foreshores affecting the nesting habitats of several bird species. Attempts may be made for planting good nesting trees along the bunds and periphery and islands of the lake and its catchment.

9.3 Pollution management

1) Identify area of major pollution sources (e.g., Rechacode, Budameru side – 'A' in the Figure 9 and make appropriate means for treatment of the effluents, to regularly monitor, and to ensure that the water do not reach the lake Kolleru. Consider diverting polluting effluents away from the Kolleru lake. However, this should not absolve the polluters from the responsibility of treating the effluents. Moreover, this may be considered only after a detailed water budgeting is done for the lake.
2) Appropriate treatment plants need to be established to clean up water flowing to all streams carrying pollutants from various sources. In case found necessary, the stream Budameru may be diverted from the lake to empty into the sea directly through another drain or Krishna river.
3) The industrial waste waters entering Chandraiah drain joining Kolleru Lake should be diverted to the sea through Mullapudi drain.
4) The industries should be enforced to install Effluent Treatment Plants (ETP). It is also to be ensured that the ETPs are functioning. Stringent action should be taken including closure of the polluting industries and penalization, if cleaning their effluents are not effected.
5) There should be continuous monitoring of water quality of the lake, preferably with cooperation from the locals.

6) The municipalities also should be forced to manage their wastes, to build ETPs and to execute scientific means to dispose off their solid wastes. Appropriate measures should be taken to force the three municipalities to build and operate ETPs for treatment of sewerage entering the lake.
7) Local authorities of the towns and villages along the drains and channels should be compelled to provide collection and treatment systems for sewage by extending financial help.
8) Discharges from the fishponds above +5 contour should be stopped and the farms may be forced to build and operate ETPs for treating their water, at their own cost. In case of failure, action should be taken to demolish the fishponds.

9.4 Catchment area treatment

1) Catchment area treatment plan and Soil conservation schemes for reducing silt load reaching the lake from the catchment area should be taken up urgently. Ecozoning above +5 feet contour should be done to take up afforestation to increase tree cover for attracting the birds, conserving soil and reducing silt load being carried to the lake along with storm water.
2) Steps may be taken to promote use of organic manure in the catchment, bed and belt villages, to create awareness about the need to minimize / avoid chemical fertilizers and pesticides, and to encourage use of bio-fertilizers and bio-pesticides. Appropriate means of value addition and market linkages could be developed using this as their Unique Selling Proposition (USP).

9.5 Hydrological

1) Make straight cut on Upputeru functional to facilitate flow of water to the sea and build the regulator, proposed on the channel, to be located upstream of the confluence of Yenamaderu drain with Upputeru. The barrage / regulator, below the confluence of Upputeru and Juvvikanuma, to retain water at about +3 feet contour level in the lake Kolleru for the ecological requirements and for required environmental flow. The lake should not be allowed to dry in summer and the regulator should be provided with a fish ladder to sustain faunal migration.

2) The House Committee on the lake Kolleru presenting its report on 17-7-1996 had recommended construction of a regulator at 6/1+33' across Upputeru. Estimates were prepared for the same at a cost of Rs 15/- crores. Under Phase I, the discharge capacity of Upputeru at M 6/6 of road bridge at +7 feet contour has been enhanced to 15000 cusecs as per Mitra Committee's (1966) recommendations. To dredge left over portions between 6/6 and 23/4 revised estimate for Rs 25/- crores was submitted to the government. Although the government has given administrative sanction, it is yet to accord technical sanction. Proposal for clearance of mounds in Upputeru at an estimated cost of Rs 2.3/- crores was also submitted to government and administrative sanction for the same is awaited. Action is yet to be taken to enhance the discharge capacity of Upputeru to 20,000 cusecs by improving the under section of the road bridge at M 6/6 and also by taking up clearance of the vent ways underneath the railway bridge at M 6/3.
3) In view of the topographic gradient due to land subsidence in the delta, and decrease in the velocity of out flowing water, a balancing reservoir is required to store the inflows to minimize the flooding, to regulate outflow and to prevent salt water influx.
4) As noted elsewhere some of the roads are interfering with the water flow regime. As advised in the management plan by the Wetland International (2008) these 7 roads about 32.55 km long may be demolished, and provision be made to build 339 vents / culverts on 28 roads to enhance water circulation and flushing. Unauthorized roads should be demolished and the pump sets erected near the fish tanks be removed.
5) Construction of roads across the lake bed to link villages should be stopped forthwith.
6) The drainage system in the two deltas should be improved to reduce the miseries of flood and improve conditions of people.
7) Chintakoduru drain which is within +5 feet contour starts from the agricultural fields of Pothunur village. Tender for widening this drain was approved for Rs 15/- lakhs. It is reported that so far works worth only Rs 5/- lakhs is done. The fish tanks adjacent to this drain with 3 to 4 meters high bunds obstruct this drain. The width of the drain is reduced near the fish tanks. Even after the supposed widening work, it appears that water does not flow down the drain

smoothly; on the other hand Kolleru lake waters spread upstream. For the free flow of Chintakodura drain, all the five culverts across this drain and obstructions from fish tanks need to be removed.

9.6 Administrative

1) 2010 satellite imagery shows that fish tanks re-formed after "Operation Kolleru" are thriving in Bhimadole, Nidamarru, Eluru Rural, Kaikalur and other mandals. These tanks whether in ziroyithi or government lands should be demolished forthwith to save the lake.
2) Existing check posts should be strengthened and new check-posts should be established to prevent transport of fish feed, fish seed, diesel etc.
3) There is need to educate both the people and officials manning the check posts to avoid conflicts and animosity.
4) Promote establishment of bio-gas plants in bed and belt villages.
5) Check dams and settling basins should be constructed across the streams and drains to arrest the flow of silt and industrial pollutants into the lake.
6) It is recommended that those areas which are fully developed falling in +5 feet contour must be identified (such as railway stations, fully developed villages with basic amenities and commercial centers and public facilities) and excluded from the sanctuary area subject to the Honorable Supreme Court's approval.

9.7 Legal

1) After detailed ecological survey is completed, in case there is scientifically reasonable changes in the area equivalent and appropriate areas may be brought under the protected area. This is necessary as the boundary and ecology need to be matching reasonably.
2) It is recommended that certain areas be declared as Critical Wildlife Habitat (CWH) under the Forest Rights Act (FRA) so that no diversion of such critical lands is possible in future and the lake is saved for posterity.
3) The buffer areas may also be declared as Community Forest Resource under the FRA or as conservation reserve under the Wildlife Protection Act. In fact, private land owners may also be provided incentives to declare certain critical

areas of Kolleru as community reserve under the WLPA, if they could be persuaded to do so. Otherwise lands may be acquired between the +3 and +5 feet contours. Above the +5 feet contours the choice may be left to the landowners.

4) It was informed that certain fish farms under ziroyithi or private lands, with which loans were secured, have been destroyed. Any demolition of private land is illegal. Legal recourse is available to each ziroyithi land owner - either as a civil suit for compensation or even for criminal trespass. Further a compensation measure with a fare assessment need to be worked out.
5) Another crucial point is Section 20 violations i.e. Bar on accrual of new rights after notification under Section 18 is issued. (Any such accrual can also be established through satellite imagery as well. For this 3 reference maps would be useful. a) Map of date of Intention notification i.e. 25/09/1995, b) Map of date of final notification i.e. 04/10/1999, c) Map of date of Kolleru committee visit i.e. September 20, 2010. This will establish the Section 20 violations.
6) Detailed and transparent consultation process should be conducted again followed by suo motto enquiries in unrepresented areas to determine the rights of people in the sanctuary area.
7) As decided in the review meeting held by the then Honorable Chief Minister with officials on 30-03-2007, it is necessary to restrict sanctuary area to 77,138 acres only as prescribed in the GO 120. Cultivation in an area of 2576.79 hectares falling within +5 feet contour which was not included in the schedule of GO 120 may be permitted till the amendment as proposed by forest department is issued.

9.8 R&R actions

1) Execute appropriate R& R policy for all affected people within the contour +3 feet to +5 feet; People below 3 feet contour, holding zirayithi pattas, may be relocated paying appropriate compensation, as is legally mandatory, for the land holding coupled with a package for livelihood losses.
2) The D-form patta holders also need to be offered a package for livelihood and involve them in the management of the lake to obviate the possible conflicts.

Compensation may be considered as in certain precedent situations done by the irrigation department in Andhra Pradesh.

3) Ryotwari (Zirayathi Lands) below +5 contour is 14861.33 acres. As per the note furnished by the District Collector to the Committee, an extent of 3487.39 acres of government land is available in the district for assignment but these lands are already under occupation by poor for quite some time and displacing one poor to rehabilitate another poor is not in the spirit of R&R Policy. Therefore, 14,861.33 acres have to be found elsewhere to provide as land for land. In case necessary the provisions of LA Act can be used to acquire land for the purpose.
4) Zeroyathi lands within +3 contour: There are 483.39 Hectares or 1208.47 Acres of Zeroyathi lands in +3 contour. Steps may be taken to provide alternative lands elsewhere and take over these lands for conservation.
5) D Form Patta Lands: Government of Andhra Pradesh in their GO Ms 1307 dated 23-12-1993 Revenue Assignment (1) Department ordered payment of lump sum exgratia equalling market value to the assignees whose lands are acquired for the projects and other public purposes. However, this dispensation given in 1993 for Irrigation and Power projects was not extended to assignees of land in the sanctuary while issuing the sanctuary notification six years later in 1999. On the other hand the GO 120 cancelled all the D Form Pattas without compensation. It is advisable to compensate the D Form Patta holders by extending the policy followed in case of Irrigation and power projects by the AP government, by providing land for land.
6) New area of Kaikaluru Mandal: An area of 2576.79 hectares in Kaikaluru Mandal which was not mentioned in GO 120 but lying with in Contour 5 may be acquired as proposed by forest department after providing alternative lands.
7) Alternative Livelihood Programs may be identified and implemented to the PAFs after giving them sufficient training so that they will be successful over a period of time.
8) With appropriate acquisition and compensatory programs the sanctuary will have no private land within its boundary, a commendable situation.

9.8.1.1 Methods that can be adopted

1) Cash compensation: The District administration following the standard procedures for fixing land value under Land Acquisition arrived at a rate of a rate of Rs. 4.5/- lakhs per acre (estimated in 2006). But discussions with people during tour of the Committee showed that the prevailing land value is much higher. A reasonable assessment may be made as per established procedures to avoid further litigations.
2) Land Purchase Scheme: The government can also follow the guidelines of Land Purchase Scheme already under implementation for Scheduled Castes and Scheduled Tribes in the state to purchase land by government and provide land to all Kolleru PAFs.
3) Compulsory Land Acquisition: As a last alternative, provisions of compulsory acquisition in the Land Acquisition Act may be used for acquiring lands from rich farmers in the districts by declaring "Project for Rehabilitation of the Kolleru PAFs" as a Public Purpose and provide them to the Kolleru PAFs.
4) The PAFs may be resettled as communities to preserve social fabric.
5) Compensation to land less poor: One time compensation of 625 days of wage may be paid and 250 days of wage labour may be provided as per the R&R Policy. The amount required for wages may be calculated basing on the wages being paid under MNREGP.
6) Compensation for loss of income: The rehabilitation programs should be applicable from 11-11-1999, the date of publication of the Government Order (GO Ms 120) in the Government Gazette declaring the sanctuary or at least from the date of Supreme Court order on demolition of tanks in the Sanctuary.
7) As the PAFs are not compensated, they are continuing in the same villages and living on agriculture and fishing or emigrating to other districts and other states for livelihood. They have gone through severe loss of income. This loss of income has to be compensated from date of issue of final notification or date of Supreme Court order till rehabilitation is completed. This may be calculated by deducting the present estimated income from the income they would have got, had they been rehabilitated as per R&R Policy or had they continued commercial fisheries and advanced agriculture in the absence of Sanctuary.

8) Admitting Children in Residential Schools: As children are reportedly losing education due to loss of income and also due to emigrations of parents, all children may be admitted in the government Residential Schools in West Godavari and Krishna districts to reduce the burden on the parents. This will also meet the requirements of Right to Education. All of them may be educated up to Class 10 (beyond RTE level also) at government cost.

9.9 General

1) Most immediate action required is total elimination of pollutants and invasive weeds such as water hyacinth, removal of the leftover debris from demolition and other actions to reinstate the natural flow regimes, actions to make traditional fishing and agriculture reasonably profitable, immediate and consistent introduction of eco-friendly and sustainable agricultural and fisheries practices, and effective and realistic alternate livelihood programs including eco tourism with local inhabitants as partners for providing better incomes without affecting the environment.
2) The State governments in future should carefully follow all the provisions of the respective Acts while declaring Wild life Sanctuaries, especially those dealing with determining the rights of people so that this kind of problems will not arise for the people.
3) Appointment of a multi disciplinary Committee should have been made before declaration of the sanctuary so that holistic and social impact assessment could have been undertaken to address related issues in proper perspective.

9.10 Concluding remarks

Under the Wild Life (Protection) Act, 1972, the state government can declare an area as Wild life Sanctuary. However, upon issuing the final notification, all authority vests with Union Government who has to seek approval of Wildlife Advisory Board and its standing committee to make any changes in the notification. In the instant case where Supreme Court has already passed final orders, the revised orders of Supreme Court have to be obtained. Hence the State governments should be careful in future in following the provisions of the Act meticulously while declaring sanctuaries, especially those dealing with determining the rights of people. If the genuine rights

are denied, that nullifies the purpose of declaring an area as protected, because of several socio-economic, cultural and legal complications, and its repercussions. The conflicts in Kolleru has turned out to be this grave largely due to the failure on the part of the concerned authorities in addressing relevant socio-economic and legal issues arising from the declaration of the sanctuary in time.

The reduction of the present sanctuary area is not a viable solution for various socio-economic and ecological issues confronting the Lake Kolleru, although it may release a large chunk of lands for other uses. It will lead to destruction of a very valuable ecologically important area for short sighted benefits. A detailed survey of the lake Kolleru to be conducted to delineate boundary based on ecological characteristics immediately. As of now pending the detailed survey, it is suggested that the area falling under +3 feet contour may be declared as "critical wildlife habitat" and the +3 to +5 area as a buffer or conservation area.

Appropriate R& R policy needs to be implemented immediately for the land acquired for the sanctuary as per the provision of Wild Life Protection Act. For those holding D-form pattas appropriate one time ex-gratia payment may be given following the precedence made in the state while acquiring lands by the Irrigation department of Andhra Pradesh.

Before making any further changes in the KWS or the lake area in total, it is prudent to understand the ecological characteristics and underpinnings of the area, and to integrate the knowledge in the socio-economic context to develop appropriate policies and management strategy that will help balancing the aspirations of the local inhabitants and the conservation needs. The lake Kolleru serves several ecological services and that needs to be preserved for posterity. Striking a balance between environmental concerns and livelihood issues is a challenge that the managers and policy makers essentially are required to address. As noted earlier Kolleru is a valuable infrastructure asset bestowed on us. The State needs to take active measures to conserve the same; it is always wise to invest public money on conserving a public resource, providing for appropriate means to ensure confidence of the public and their participation.

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11 REFERENCES / BIBLIOGRAPHY*

Amaraneni SR (2004) Poly cyclic hydrocarbons in sediments of Kolleru wetland in India. Bulletin of Environmental Contamination and Toxicology 70:964–971; DOI: 10.1007/s00128-003-0076-3

Amaraneni SR, S Singh and PK Joshi (2004) Mapping the spatial distribution of air and water pollutants in Kolleru Lake, India using geographical information system (GIS). Management of Environmental quality 15(6):584-607; DOI 10.1106/ 14777830410560683

Anjaneyulu Y (undated). Head. Centre for Environment. JNTU, Hyderabad, Assessment of environmental quality of Kolleru lake and strategic management Plans: Lake Kolleru: Environmental Status, pp 3-15.

Ashok Kumar (2007) Kolleru lake, can it be redeemed. Proceedings of National Seminar on Conservation of Eastern Ghats, 2007, Pp 348-355, EPTRI, Hyderabad

Ashok Kumar S (1979) Bird watching in Kolleru lake. Newsletter for Birdwatchers XIX (3), March, 1979; pp 4-6.

Azeez PA and Prusty BAK (2008) Transition metals in decomposing macrophytes in a wetland system. Asian Journal of Water, Environment and Pollution 5: 27-36 38)

Azeez PA, Nadarajan NR and & Prusty BAK (2007). Macrophyte decomposition and its impact on the water quality. In: Environmental Degradation and Protection. KK Singh, AK Singh, A Tomar and V Singh (Eds.). Volume - II, MD Publications, New Delhi, pp. 115-156.

Babu PVLP (1978) Geomorphology of the Krishna Godavari delta region interpreted from Landsat imagery. The National Geographical Journal of India 24: 55-61

Bhavaraju Venkata Krishna Rao (1942). A history of early dynasties of Andhra Desa C.200 – 625 AD), Andhra Historical Research Society, Rajamundry. Published by V Ramaswamy Sastrulu & Sons, Esplananede, Madras

Biswas SK (1993) Major neotectonic events during the quaternary in Krishna-Godavari basin. Current Science 64 (11-12): 779-803

Chacko PI, JG Abraham and R Andal (1952). Survey of the flora, fauna and fisheries of the Collair Lake. Indian Commerce Journal 272¬280.

Dutt S (1983) Fishes of Lake Kolleru. In: Ecodevelopment of Kolleru lake. Status and approach document of INCOR, Visakhapatnam**.

Dutt S and PB Reddy (1979). On the snake-head fishes of Andhra Pradesh. Memoirs of the Society of Zoology, Guntur 1: 103-108**.

Dutt S and SV Sharma (1979). Provisional key to common cat fishes of central coastal, Andhra Pradesh. Memoirs of the Society of Zoology, Guntur 1: 109-119**.

Dutt S and VR Murthy (1971) On the fishes of the genus Cirrhinus Cuvier, 1817 (Family: Cyprinidae) from Lake Kolleru, Andhra Pradesh. Bulletin of the Department of Marine and Oceangraphy University, Cochin 5: 39-48**.

Dutt S and VR Murthy (1976a). On the fishes and fisheries of lake Kolleru, Andhra Pradesh. Memoirs of the Society of Zoology, Guntur 1: 17-27**.

Dutt S and VR Murthy (1976b). Remarks on some diagnostic characters used in taxonomic studies on cyprinid fishes with special reference to those of lake

Kolleru, Andhra Pradesh. Memoirs of the Society of Zoology, Guntur 1: 70-75**.

Farber S, R Costanza R, DL Childers, J Erickson, K Gross, M Grove, CS Hopkinson, J Kahn, S Pincetl, A Troy, P Warren, M Wilson (2006) Linking Ecology and Economics for Ecosystem Management, BioScience, 56(2): 121-133

Gee EP (1960) The breeding of the grey or spotted billed Pelican Pelecanus philippensis philippensis Gmelin. Journal of Bombay Natural History Society 57(2): 245-251.

Gopalakrishnayya CH(1999) Kolleru lake and its ecological importance. Central Inland Capture Fisheries Research Centre. Eluru

Guttikar SN (1978) Lost Pelicanry. Journal of Bombay Natural History Society 75(2): 482-485

Irrinki S R and NL Irrinki (2006-7) Implementing Sustainable Development in the Lake Kolleru, India, Department of Environmental, Social and Spatial Change (ENSPAC), Roskilde University, Denmark, Pp 98

Islam MZ and Rahmani AR (2004) Important Bird Areas in India: Priority sites for conservation. Indian Bird Conservation Network, Bombay Natural History Society and & BirdLife International (UK). Pp xviii + 1133

Jayanthi M, P N Rekha, N Kavitha and P Ravichandran (2006) Assessment of impact of aquaculture on Kolleru Lake (India) using remote sensing and Geographical Information System. Blackwell publishing Ltd

Jhunjhunwala S, Rahmani AR, Ishtiaq F and Islam Z (2001) The important bird areas programme in India. Buceros 6(2), Pp 49

Kannan V and Ranjit Manakadan (2005) The status and distribution of Spot-billed Pelican Pelecanus philippensis in southern India. Forktail 21: 9–14

Katiha PK, Jena JK, Pillai NGK, Chakraborty C and Dey MM (2005) Inland aquaculture in India: past trend, present status and future prospects. Aquaculture Economics and Management 9(11): 237-264; DOI: 10.1080/1365730 0590961573

Kremen C and RS Ostfeld (2005) A call to ecologists: measuring, analyzing, and managing ecosystem services. Frontiers in Ecology and the Environment 3(10): 540-548

Krishnan M (1981) Birds of Southern India. Illustrated Weekly of India C II 23: 26-31**

Kulshreshtha M and B Gopal (1982a) Decomposition of freshwater wetland vegetation. I Submerged and free floating macrophytes. In: Gopal B, RG Turner, RG Wetzel and DF Wigham (Eds) Wetlands – Ecology and Management, National Institute of Ecology and International Scientific publication. Pp 259-278

Kulshreshtha M and B Gopal (1982b) Decomposition of freshwater wetland vegetation. II above ground organs of emergent macrophytes. In: Gopal B, RG Turner, RG Wetzel and DF Wigham (Eds) Wetlands – Ecology and Management, National Institute of Ecology and International Scientific publication. Pp 279-292

Kumaraiah, P, PV Rangacharylu and B Seshagiri (2004) Status of fresh water aquaculture in Andhra Pradesh - A Report. Pp16

Kumaran M, P Ravichandran, BP Gupta and A Nagavel (2003) Shrimp farming practices and its socio-economic consequences in East-Godavari district, Andhra Pradesh, India – A case study. Ornamental Fish 48**

Lamba, BS (1963) Nidification of some common Indian birds. No.7. The Spottedbilled or Grey Pelican. Pavo 1: 110–119.

Magendra Reddy K and BM Shah (1991) Evolution of Krishna delta, Andhra Pradesh. Memoirs of Geological Society of India 22: 57-64-285

Malik A (2006) Environmental challenge vis a vis opportunity: The case of water hyacinth. Environment International 33(1):122-138: doi:10.1016/j.envint. 2006.08.004

Mistnet (2003) The mighty pelican needs protection, Mistenet 4(2) Apr-Jun 2003

Mitra A.C. (1966). Report of The Expert Committee on Flood for Deltaic Areas of Krishna, Godavari and Guntur Districts of Andhra Pradesh. Ministry of Irrigation and Power, Vol.: 1

Mittal R (1993) Management plan for Kolleru bird sanctuary. Forest department, Government of Andhra Pradesh. Pp 318

MoEF (2010) The Wetlands (Conservation and Management) Rules, 2010, Ministry of Environment and Forests, Government of India

Murthy VS (1977). Taxonomic studies on the fishes of the family Cyprinidae from lake Kolleru, Andhra Pradesh. Proceedings of the Indian Academy of Science 85B(3): 107-146.

Nagabhatla N, C Pattnaik, S S Sellamutthu, S N Prasad, R. Wickramasuriya and M Finlayson (2009) Investigation of aquaculture dynamics at a Ramsar site, using earth observation systems in conjunction with a socio-economic assessment. Lakes & Reservoirs: Research and Management 2009 14: 325–336

Nagabhatla N, Sellamutthu SS (2008) Political Ecology of Wetland Management: the post aquaculture demolition case of Lake Kolleru in India. Rev. Geogr. Acadêmica 2(1):10-19

Nageswara Rao K, G Murali Krishna and B Hema Malini (2004) Kolleru Lake is vanishing - a revelation through digital processing of IRS-1 D LISS-III sensor data. Current Science 86(9): 1312-1316

Nageswara Rao K, K Ch V Naga Kumar, P Subraelu, G Demudu, B Visweswara Reddy and B Hema Malini (2010) Kolleru lake revisited: the post 'Operation Kolleru' scenario. Current Science 98(10): 1281-1291

Narayan Jayaprakash (2006) Wildlife reserve vs. livelihoods success story in Andhra Pradesh, June 5, 2006. http://us.oneworld.net/article/wildlife-reserve-vs-livelihoods-success-story-andhra-pradesh

National Environment Policy (NEP) 2006

Neelakantan K K (1949) A South Indian Pelicanry, Journal of Bombay Natural History Society 48(4): 656-666

Nerender K (1993) The broken mirror. Down to Earth Volume 2 December 1993. www.downtoearth.org.in/node/31851

PA Update Vol XIV No 5, October 2008.

Pandurangan TC (1976) Report of integrated development of Kolleru lake area

Pattanaik C, SN Prasad, N Nagabhatla and CM Finlayson (2008), Kolleru regains its grandeur. Current Science 94(1): 9-10

Pattanaik C, SN Prasad, N Nagabhatla and SS Sellamuthu (2010), A case study of Kolleru Wetland (Ramsar site), India using remote sensing and GIS. The IUP Journal of Earth Sciences 4(2): 70-77

Prusty BAK, Azeez PA and Jagadeesh EP (2009) Alkali and alkaline earth metals in decomposing macrophytes in a wetland system. Acta Ecologica Sinica doi:10.1016/j.chnaes. 2009.04.003.

Pushpa Kumar (1980) Survey of the birds of Andhra Pradesh, Mayura, Newsletter of Birdwatchers Club of Andhra Pradesh 1(2), July, 1980: 14-17.

Radhakrishna Y (1989) .Research on Kolleru lake: Status Report Proceedings of Indo-US workshop on wetlands, Mangroves and Biosphere Reserves, New Delhi, 1989, pp 52-59.

Raju DCV, Rajesh RS and Mishra DC (2003) Bouguer anomaly of the Godavari basin, India and magnetic characteristics of rocks along its coastal margin and continental shelf. Journal of Asian Earth Science 21: 535-541

Rama Raju TS (1990) The largescale destruction of molluscan population of Kolleru lake and its likely impacts on the lake ecology. Kolleru lake fisheries institute, Research Centre for Inland Fisheries, Eluru

Rama Rao J, Jasveen Jairath and P Umesh (2006) Pollution through aquaculture - Kolleru Wildlife Sanctuary, Economic and Political Weekly February 2006, 41 (7): 585-587

Rama Rao RV (1981) Techno economic evaluation studies of aquaculture at Kolleru Lake. Department of Geoengineering and resource development, Andhra University, Visakhapatnam

Ramakrishna E (1980) Integrated Development of Kolleru Lake Area - A Report. Administrative Staff College of India, Hyderabad**

Ramakrishna R (2007) Kolleru carp culture in India: An aquaplosion and an explosion. Aquaculture Asia Magazine October-December 2007, pp 12-18

Ramana Murty MV and K Mruthyunjaya Reddy (2010) Flood hazard zonation around the Kolleru lake, Andhra Pradesh, India – A remote sensing and GIS based approach. In *Proceedings of the 3rd International Conference on Hydrology and watershed management with a focal theme on climate changes – water, food and environmental security*, 3-6 February 2010, Centre for Water resources, Jawaharlal Technological University, Hyderabad. Pp1010-1021

Ramana Murty MV, VVRM Narayana Rao and K Mruthyunjaya Reddy (2010) Status of aquaculture in Kolleru Lake, Andhra Pradesh using geoinformatics. In *Proceedings of the National Conference on sustaining technology for advancements in civil engineering*, 24-26 November 2005, Department of Civil Engineering, SRKR Engineering College, Bhimavaram, Andhra Pradesh. Pp 9-1-8 to 9-1-13

Rao AS and Pillala RR (2001) The concentration of pesticides in sediments from Kolleru Lake in India. Pest Management Science 57:620-624.

Rao D P, V Raghavswamy, NC Gautam, G Ravi Shankar, LS Suresh and SM Mujtaba (1991) Land use patterns in deltas of east coast with special reference to Godavari and Krishna river deltas. Memoirs of Geological Society of India 22: 277-285

Rao DP, V Bhanumurthy, GS Rao and P Manjusri (1998) Remote sensing and GIS in flood management in India. Memoirs Geological Society of India 41: 195-218

Rao GR and Rao JVR (1987) Kolleru Lake - Its Diversity and Avifauna. Cheetal 27(1&2): 47 – 48**.

Rao GV, SK Beebi and P Malleswara Rao (2006) Water quality studies of Kolleru Lake, Upputeru river and Enamaduru Drain. Indian Journal of Environmental Protection 26(6): 537-545

Rao KJ, Rao KV, Rama Raju TS and Rao KS (1987) Studies on the position and prospectus of fisheries of Kolleru lake with special reference to the management of resources. Journal Indian Society Coastal Agricultural Research 5(1): 215-221**.

Rao KN (1985) Evolution of land forms in the area between the Krishna and Godavari delta. Indian Geographical Journal 60:30-34.

Rao MV, KH Rao, I V Ramana, SK Sasmal, SB Chuodhary and SK Bhan (2000) Change detection studies in and around Kolleru lake using high resolution data. PORSEC proceeding, Goa, India, Vol II: 690-694

Rao NCV (1988) Report on geomorphological and quaternary geological mapping in the Kolleru lake area, parts of Krishna and Godavari district, A.P, Geological Survey of India Operation A.P. Southern Region, Progress Report for the field season, 1985-86.

Rao PP, Joshi PK, Shravan Kumar and Kavery Ganguly (2008) Agricultural Diversification in Andhra Pradesh, India: Patterns, Determinants and Implications. Published jointly with the International Food Policy Research Institute, IFPRI). Research Report no. 2. International Crops Research Institute for the Semi-Arid Tropics. 100 pp.

Rao Sreenivasa A and Rao Ramamohan P (2000). Pesticides in the air of the Kolleru Lake. Environmental Health 42(2): 70-74

Rose PM and Scott DA (1994) Waterfowl population Estimates, 1 WRB Publication, 29, 1994, Pp 19

Sadakata N and Rao KN (1997) Radiocarbon ages of the subsurface sediments in the Krishna delta and their geomorphological implications. Quarterly Journal of Geography 49: 163-170.

Sarangi N, Kumaraiah P, Rangarcharyulu PV and Giri BS (2004) Status of freshwater aquaculture in Krishna-Godavari delta: a profile. Regional Research Centre, Central Institute of Freshwater Aquaculture, Vijayawada, Andhra Pradesh**

Sarangi, N, P Kumariah, PV .Rangacharylu and Bandla S Giri (2004).Status of fresh water aquaculture in Krishna-Godavari Delta: A Profile. Central Institute of Fresh water aquaculture, Kausalyaganga Bhubaneswar, Pp 29**

Sekhar KC, Chary NS, Kamala CT, Raj DSS and Rao AS (2004) Fractionation studies and bioaccumulation of sediment-bound heavy metals in Kolleru lake by edible fish. Environment International 29:1001-1008.

Seshagiri Rao BV (1991) The impact of fisheries in Kolleru lake, a wetland Ecosystem: Paper presented at the National workshop on Kolleru Environmental Information System. Centre for Environment. School of Environment, Water Resources & Remote Sensing, Jawaharlal Nehru Technical University

Seshagiri Rao BV (1997) Birds and aqua culture with special reference to coastal Andhra Pradesh. Paper presented at the Second National Symposium on Applied Ornithology, University of Baroda, pp 19-20.

Seshagiri Rao BV (undated) Kolleru Lake in India - an important wetland ecosystem of international importance.

Seshagiri Rao BV and Varhala Raju K (1996) The impact of coastal aquaculture on the population of Openbill storks *Anastomus oscitans* in Kolleru lake, Mayura, Journal of Bird-watchers Society of A.P, pp 2-5

Seshagiri Rao BV(1988) Kolleru lake in India under threat of ecological degradation, Asian Wetland News 1(2): 13-16.

Seshavataram V and P Venu (1981) Ecology of Kolleru lake. International Journal of Ecology and Environmental Sciences 7: 35-44.

Seshavataram V and P Venu (1982) Some observations on the ecology of Kolleru lake. In Gopal B, Turner RE, Wetzel RG and Wigham DF (ed) Wetlands; ecology and management. International Scientific Publications and National Institute of Ecology, Jaipur, Pp 35-44.

Seshavataram V, Dutt BSM and Venu P (1982) An ecological study of the vegetation of the Kolleru. Bulletin of Botanical Survey of India 24(1-4): 70-75.

Seshavatharam V and Murthy BS (1982) An ecological study of the vegetation of Kolleru lake

Smith VH, Tilman GD and Nekola JC (1999). Eutrophication: impacts of excess nutrient inputs on freshwater, marine, and terrestrial ecosystems. Environmental Pollution 100 (1-3):179-96.

SreeKrishna V (undated) Andhra Pradesh, Indian East Coast. ftp://ftp.fao.org/docrep/fao/007/ad894e/AD894E09.pdf

Sreenivasa Rao A and Rama Rao P (2000) Pesticides in the ambient air of Kolleru lake. Indian Journal of Environmental Health, 42(April, 2000): 70-74.

Sreeramakrishnaiah R (1987) Comprehensive report on drainage problems of Kolleru and Upputeru. Government of Andhra Pradesh

Sriramachandra Murty V (1977) Taxonomic studies on the fishes of the family Cyprinidae from Lake Kolleru, Andhra Pradesh. Proceedings of Indian Academy of Sciences 85 (3): 107-146

Sriramakrishnaiah K (1980) A case study of Kolleru Lake and Upputeru river

Syvitski JPM, A J Kettner, I Overeem, EWH Hutton, MT Hannon, GR Brackenridge, J Day, C Vorosmarty, Y Saito, L Giosan and RJ Nicholls (2009), Sinking deltas due to human activities. Nature Geoscience; p1-6, DOI:10.1038/NGEO629

Taher, H and Mani, U (2008). Sighting of the Great White Pelican Pelecanus onocrotalus at Kolleru Wildlife Sanctuary Andhra Pradesh, India. Indian Birds 4 (1): 14.

Thornton C, Shanahan M and J Williams (2003) From wetlands to wasteland; Impact of shrimp farming. SWS Bulletin March 2003: 48-53

Toxics Link, India (2006) Country Situation on Persistent Organic Pollutants (POPs) in India, March 2006 International POPs Elimination Project

Venkata Rao G and P. Malleswara Rao (2009) Estimation of dispersion coefficient by using mathematical model of Upputeru river at estuary. International Journal of Dynamics of Fluids 5(2): 173–178

Venkateswara Rao (Personal communication), Deputy Executive Engineer, Irrigation. Eluru.

Venkateswaralu V, Kolleru lake Ecosystem: A comprehensive study; Lake Kolleru, Environmental Status, pp 159-167, Retd Professor, Department of Botany, Osmania University, Hyderabad

Wetland International (2008) Integrated management plan for Kolleru Wildlife Sanctuary, Final Report prepared for the Forest Department. Government of Andhra Pradesh

Wildlife Management Division, Eluru (undated) Brief note on Koleru Wildlife Sanctuary, p22

WW India (2002–2003) Kolleru lake - Andhra Pradesh,. http://www.wwfindia.org/programs/freshwet/koleru.jsp?prm=100.

WWF India (1987) Wetlands, status and management in India; an overview. Environmental Service Group, Delhi

(Note: **Includes paper / documents that were not directly referred in the report, but are related to Kolleru as a source of additional information, ** Original not seen*)

11.1 Court documents, letters etc

- Court documents: IA No 381 Complaint against ecological degradation and violation of laws in Kolleru Wildlife Sanctuary filed by the applicant Sri Pranay Waghrey and (2) other filed before the Central Empowered Committee (CEC) constituted by Supreme Court of India in WP No 202/95 and 171/96
- Court documents: SC judgment in LA No 1486-87 in WP(C) No 202 of 1995 dated 10-4-2006.
- Court documents: Chief Secretary, AP Government, Counter affidavit dated 15-4-1988 filed in WP No 14/80 of 1997.
- Court documents: APHC judgment in WP No 33587 dated 30-7-2001
- Letter: from DFO (Wildlife Management Division, Eluru) Ref No 374/2002/WLM dated 28/04/2002).
- Letter: Replies submitted by the Principal Secretary to Government, EF&ST Department Government of AP to the CEC dated 14-2-2006
- Court Documents: Petition filed before the Central Empowered Committee by Nallamalai Foundation.
- Letter: from Central Empowered Committee (CEC) F No 1-5/CEC/SC/05/Pt VI dated 1/02/2006
- Letter: from Central Empowered Committee (CEC) F No 1-5/CEC/SC/05/Pt VI dated 16/02/2006
- Letter: from Principal Secretary, EFS&T, AP Government, dated 14/02/2006 to the Central Empowered Committee (CEC)
- Letter: No l-5/CEC/SC/05/Pt.VI dated 16-2-2006 of the CEC addressed to the Chief Secretary A P
- Letter: No l-5/CEC/SC/05/Pt.VI dated 28-2-2006 of the Central Empowered Committee addressed to the Chief Secretary to Government of AP, Hyderabad.
- Letter: From Dr Patanjali Sastry dated 21-9-2007 addressed to Sri YS Murthy, Advocate, Member AP High Court's Committee on Kolleru
- Letter: To the District Collector Ref. No. E2/697/2006 dated 11/October 2009)
- Letter: CEC Lr No F.l-5/CEC/SC/05/Pt VI dated 1-2-2006
- Letter: CEC Lr. No l-5/CEC/SC/05/Pt.VI dated 16.2.2006

11.2 Minutes of meetings

- Minutes: Record of discussions of the group of minister on the restoration of Kolleru lake dated 10/01/2006 at the chamber of Agriculture
- Minutes: The meeting with honorable Chief Minister convened on 17/01/2006 along with Group of Ministers on Kolleru lake

11.3 News papers / TV

- News Paper / TV: ETV 7.00 pm, News bulletin 20-8-2010
- News Paper / TV: ETV 6.00 pm, News bulletin 4-11-2010
- News Paper / TV: Sakshi, 24/7 West Godavari Editions, Telugu daily dated 6-3-2010, 7-3-2010, 12-3-2010 and 13-3-2010
- Newspaper: The Hindu daily, Fish seeds released into Kolleru, dated 19-11-2007

- Newspaper: The Hindu daily dated 03-08-2007
- Newspaper: The Hindu daily dated 09-09-2008
- Newspaper: The Hindu daily dated 10-09-2008.
- Newspaper: The Hindu daily dated 3-8-2007
- Newspaper: The Hindu daily dated 31-08-2008
- Newspaper: The Hindu dated 9-9-2008
- Newspaper: The Hindu dated 31-8-2010
- Newspaper: The Times of India daily dated 13-12-2007
- Newspaper: The Times of India daily dated 4-7-2008
- Newspaper: Times of India daily dated 14-10-2010, Hyderabad Edition.
- Newspaper: Times of India daily dated 13-09-2007

11.4 Representations with specific information*

- Federation of Retired Irrigation Engineers (2010) entitled "Save Kolleru Lake"
- Forum for Sustainable Development
- Gracious P, Assistant Conservator of Forests (Retd)
- Dr Sheshagiri Rao BV, Formerly Head of the Department of Zoology, DNR College, Bhimavaram
- Dr Patanjali Sastry T, President, Environment Centre, Rajahmundry dated 21-9-07; p 3
- Mr Vasantha Rao M, Chairman, CCKLS dated 25-9-2010
- Prof Krishna Rao G, Retired Professor of Geology, Andhra University, dated 25-9-2010
- Sri Padmanabham M, ex-MP & Chairman, Kolleru Lake Development Society, Bhimavaram dated 25-9-2010
- V Mallikarjunudu, District Working Committee Member, Communist Party of India, West Godavari District Unit dated 25-9-2010 submitted to the Committee on 25-9-2010
- Sri Nakksante Subba Rao Secretary, Communist Party of India, West Godavari District Unit dated 19-6-2010
- Sri EAS Sarma IAS (Retd), Convener, Forum for Better Visakaha (FBV) addressed to Sri Jairam Ramesh, Honorable Minister for Environment and Forests, GoI
- Sri Kavuri Sambasiva Rao MP, Eluru Constituency dated 25-09-10
- Sri Jayamangal Venkata Ramana, MLA, Kaikalur Constituency dated 25-9-10
- Sri V V Pardhasaradhi, Ex-MLC, West Godavari District dated 24-9-2010
- Sri Nerneni Nagendranath, President, Rhythanga Samakhya dated 25-9-10
- Sri Eada Vykunta Rathnam, Advocate, ZPTC, Bhimadole, West Godavari district dated 25-9-10
- Sri Mrutyunjaya Rao, President, Wild Kakinada
- WWF - India, Andhra Pradesh state office, dated 30-11-2011
- Information Sheet on Kolleru lake sent to Ramsar Convention

(Note: **Salient points from other 2269 representations are summarized in the report*)

12 APPENDICES

Appendix 1: MoEF notification forming the committee

F. No. 6-18/2006 WL-I
Government of India
Ministry of Environment & Forests
Wildlife Division

Paryavaran Bhawan,
CGO Complex, Lodhi Road,
New Delhi – 110003.

Dated: 29th April, 2010.

Office Memorandum

Sub: Constitution of Committee for conservation of Kolleru Lake Sanctuary.

During the 18th meeting of Standing Committee of NBWL held on 12th April, 2010 the issue regarding reduction of boundaries of Kolleru Lake Sanctuary from +5 to +3 contours was considered. It was decided to constitute an Expert Committee to study the issue in greater detail and to recommend to the Government the merits and demerits of the proposal of Andhra Pradesh assembly for reduction of the Sanctuary. Accordingly, the following Expert Committee is constituted with the Terms of Reference as given below:

1.	Dr. Anees, Director, SACON, Coimbatore	Chairman
2.	Prof. K. Kameshwar Rao, Dept of Environmental Studies, Andhra University	Member
3.	Mr. Ashok Kumar, IAS (Retd.), working in Environmental Management issues	Member
4.	Dr. B.C. Choudhary, Professor, Dept. of Wetlands, WII, dehradun	Member
5.	Mr. Sanjay Upadhyay, Managing Partner, Enviro Legal Defence Firm	Member
6.	Dr VNVK Sastry, Ex-Director, TCIS&TT, Hyderabad	Member
7.	Shri K Muruvanjaya Reddy, DG, APSRSAC, Hyderabad	Member

Terms of Reference:

(1) To study the issue in greater detail both from the perspective of the protection of the livelihoods of the local fisherman and farming communities and the conservation and protection of the wetlands of kolleru and recommend to the government on the merits and demerits of the proposal of the Andhra Pradesh Assembly for reduction of the Wildlife Sanctuary from the contour 5 to contour 3.

(2) The committee would tour extensively in the area and interact with all the stakeholders including the public representatives of the area. They would study the issue from a holistic view keeping the interests of both the local people and the environment.

(3) The committee would also look into the matter of paying compensation to the private landowners who are losing their lands in the Wildlife Sanctuary.

(4) The committee would be given three months time to give their final recommendations and based on the recommendations of the committee, the government will take the final decision.

(5) Get a quick scientific survey of the entire area done through satellite mapping to get an actual picture of the status of the lake and the alignment of the contour lines.

The other conditions with respect to the Committee would be as under:

1. The term of the Committee will be for a period of three months from the date of notification.
2. The members of the Committee will be entitled to traveling and all other allowances as applicable to the non official members and as per Rule SR 190.

Dr. Anand Kumar
Deputy Inspector General (WL)
Telefax 24366842

Distribution:

1. PS to Hon'ble MOS (I/C) E & F.
2. PPS to Secretary, E&F.
3. PPS to DGF & SS.
4. PPS to Addl. DGF (WL).
5. PS to IGF (WL)
6. All Members of Expert Committee on Kolleru Lake Sanctuary.
7. All Members, Standing Committee of NBWL.

Appendix 2: The schedule of the committee's field visits

Day	Meeting place & Venue	Sl. No of villages day wise	Villages covered	Mandal
20-09-2010	Collectorate Conference hall	Meeting with the officers of line departments (Revenue, Forest, Irrigation, Fisheries & Tourism of both the Districts)		
21-09-2010	Gudiwakalanka Community hall	1	Gudiwakalanka	Eluru
		2	Chataparru	Eluru
		3	Prathikollanka	Eluru
		4	Kokkirayalanka	Eluru
		5	Pydichintapadu	Eluru
	Kolletikota Temple ground	6	Kolletikota	Kaikaluru
		7	Gokarnapuram	Kaikaluru
		8	Pandiripalligudem	Kaikaluru
		9	Lakshmipuram	Kaikaluru
		10	Gummallapadu	Kaikaluru
		11	Srungavarappadu	Kaikaluru
		12	Jangampadu	Kaikaluru
	Agadalalanka Panchayat office	13	Agadalalanka	Bhimadole
		14	Chettunnapadu	Bhimadole
		15	Mallavaram	Bhimadole
	Pothunuru Panchayat office	16	Pothunuru	Denduluru
		17	Dosapadu	Denduluru
		18	Kovvali	Denduluru
22-09-2010	Tokalapalli Panchayat Office	1	MM Puram (Pulla)	Bhimadole
		2	Amberpet	Bhimadole
		3	Bhimadolu	Bhimadole
		4	Tokalapalli	Nidamarru
		5	Kaikaram	Unguturu
	Pedanindrakolanu Gandhi Bhavan	6	Pedanindrakolanu	Nidamarru
		7	Bynepalli	Nidamarru
		8	D. Gopavaram	Nidamarru
		9	Nidamarru	Nidamarru
		10	Venkatapuram	Nidamarru
		11	Bavaipalem	Nidamarru
		12	Timmaraogudem	Nidamarru
		13	Chanamilli	Nidamarru
	Siddapuram open area	14	Peda Kapavaram	Akiveedu
		15	China Kapavaram	Akiveedu
		16	Siddapuram	Akiveedu
		17	Adavikolanu	Nidamarru
		18	Dharmapuram	Akiveedu
		19	Dumpagadapa	Akiveedu
		20	Krovvidi	Nidamarru
		21	Akiveedu	Akiveedu
		22	Madivada	Akiveedu
		23	Kolleru	Akiveedu

		24	Gummuluru	Akiveedu
		25	Kollaparru	Akiveedu
23-09-2010	Gudipadu	1	Satyavolu	Pedapadu
		2	Koniki	Pedapadu
		3	Mupparru	Pedapadu
	Sriparru community hall	4	Sriparru	Eluru
		5	Jalipudi	Eluru
		6	Manuru	Eluru
		7	Kalakurru	Eluru
		8	Ponangi	Eluru
	Devichintapadu community hall	9	Manuguluru	Mandavalli
		10	Kovvadalanka	Mandavalli
		11	Nuchumilli	Mandavalli
		12	Penumakalanka	Mandavalli
		13	Ingilipakalanka	Mandavalli
		14	Chintapadu	Mandavalli
		15	Nandigamalanka	Mandavalli
		16	Deyyampadu	Mandavalli
24-09-2010	Bhujabalapatnam	1	Kaikaluru	Kaikaluru
		2	Atapaka	Kaikaluru
		3	Bhujabalapatnam	Kaikaluru
		4	Gonepadu	Kaikaluru
		5	Pallewada	Kaikaluru
		6	Alapadu	Kaikaluru
		7	Chatakai	Kaikaluru
		8	China Kottada	Kaikaluru
		9	Peda Kottada	Kaikaluru
		10	Penchikalamarru	Kaikaluru
		11	Vadakutithippa	Kaikaluru
		12	Komatilanka	Eluru
		13	Someswaram	Kaikaluru
		14	Singapuram	Kaikaluru
25-09-2010	Eluru at IDBA hall / Indoor Stadium	Forenoon	Meeting with all Public representatives (MPs, MLAs, MLCs, and, ZPTCs, MPTCs, etc,)	
		Afternoon	Meeting with Environmentalists, NGOs and other Officers	

Appendix 3: Bed and belt villages of the Kolleru Lake

	Name of the habitation	Status
Krishna District: Kaikalur mandal		
1	Kaikaluru	Belt
2	Danagurtei	Belt
3	Atapaka	Belt
4	Johnpet	Belt
5	Gonepadu	Belt
6	Singapuram	Belt
7	Bhujabalapatnam	Bed
8	Nattagullapadu	Bed
9	Chatakai	Bed
10	Laximinarayanapuram	Bed
11	Pallevada	Belt
12	Narasayapalem	Belt
13	Kottadalapatnam	Bed
14	Jangampadu	Bed
15	Chinakottada	Bed
16	Rajulakottada	Bed
17	Gandghinagaram	Bed
18	Penchikalaurru	Bed
19	Vadlakulitippa	Bed
20	Kollptikota	Bed
21	Laxmipuram	Bed
22	Gummalapadu	Bed
23	Gokarnapuram	Bed
24	Pandiripalligudem	Bed
25	Srungavarappadu	Bed
26	Alapadu	Belt
27	Someswaram	Belt
Krishna-Mandavalli mandal		
28	Chinatapadu	Belt
29	Maugunuru	Belt
30	Kovvadalanka	Bed
31	Dayyaspddu	Bed
32	Pulaparru	Bed
33	Pillipadu	Belt
34	Nutchumilli	Bed
35	Penumakalanka	Bed
36	Nandigamalanka	Bed
37	Ingilipakrlanka	Bed
38	Sreeramanagaraa	Belt
39	Takkellapadu	Belt
40	’’	Belt
41	Laamanivargudem	Belt

42	Laxminarayanapura	Belt
43	MaidenVenkarapuira	Bed
West Godavari District: Pedapadu mandal		
44	Satyavolu	Belt
45	Gudipadu	Belt
46	Kalingipet	Belt
47	Koniki	Belt
48	Rallapallivarigudem	Belt
49	Vaddogie,	Belt
50	Punukollu Partlli (deserted)	
51	Mupparru	Belt
52	Jayapuram	Belt
53	Pathamupparru	Belt
54	Baginaidupakalu	Belt
55	Baginaidupakalu	Belt
56	PedapaduPartll	Belt
57	Veerammakunta	Belt
58	Naidugudem	Belt
59	Karrovanoa;u	Belt
60	Kazigudem	Belt
West Godavari District: Eluru mandal		
61	Ponangi	Belt
62	Manuru	Bed
63	Haripura	Bed
64	Anantaraa	Bed
65	Narayanapuraa	Bed
66	Kalakurru	Bed
67	Maheshwarapuraa	Bed
68	Madepalli	Belt
69	Lingaranguden	Belt
70	Siriparru	Belt
71	Kooatilanka	Bed
72	Katlanpudi	Belt
73	Gudivakalanka	Bed
74	Pdayagananilli	Bed
75	Mondikodu	Bed
76	Motevailanka	Bed
77	Venkannapuraa	Bed
78	Minapalanka	Bed
79	Kokkirayilanka	Bed
80	Prathikolanka	Bed
81	Paidichintapadu	Bed
82	Chataparru	Bed
83	Timmaraoguden	Belt
84	Gollaguden	Belt
85	Chatapartigudea	Belt

86	Koteswaradurgapuraa	Belt
87	Jalipudi	Belt
88	Bapirajuden	Belt
West Godavari District: Denduluru mandal		
89	Pothumarru	Belt
90	Kedaram	Belt
91	Rajulapakalu	Belt
92	Laxmipuram	Belt
93	Kovvill	Belt
94	Dosapadu	Belt
West Godavari District: Bhimaddlu mandal		
95	Bhimadolu	Belt
96	Dingampadu	Belt
97	Amberpeta	Belt
98	Kurullagudam	Belt
99	Pulla	Belt
100	Malkimbhamadpuram Pallapurl	Belt
101	Sayampalem	Belt
102	Gundugolanu	Belt
103	Bhogapuram	Belt
104	Agadallanka	Bed
105	Laxmipuram	Bed
106	Korukollu	Bed
107	Ratnapuram	Bed
108	Babilanka	Bed
109	Chettunnapadu	Bed
110	Mallavaram	Bed
West Godavari District: Unguturu mandal		
111	Kaikaram	Belt
112	Brahaanandapuram	Belt
113	Ramannagudem	Belt
114	Venkatakrishnapuram	Belt
West Godavari District: Nidamarru mandal		
115	Nidamarru	Belt
116	Venkatapuram(Depopulated)	Belt
117	Adavikolanu	Belt
118	Amudalapalli	Belt
119	Chanamilli	Belt
120	Thokalapalli	Belt
121	Bynapalli	Belt
122	Devaragopavaram	Belt
123	Pedanindrakolanu	Belt
124	Krovvidi	Belt
125	Bhavayapalea	Belt
126	Timmaraogudem	Belt
West Godavari District: Akiveedu mandal		

I27	Akiveedu	Belt
l28	Dharmapuram	Belt
129	Siddapuram	Belt
130	Kalingigudem/Kottapeta	Belt
13I	Chinamillipadu	Belt
132	Nandamillipadu	Belt
l33	Kurupaka	Belt
l34	Kollaparru	Belt
l35	Kothacheruvu	Belt
136	KoIleru(Depopulated)	Belt
137	Gummuluru	Belt
138	Apparaopeta	Belt
139	Chinakapavaram	Belt
140	Mahalaxmipuram	Belt
141	Ramayyagudem	Belt
142	Janakirama-Rajupuram	Belt
143	Pedakapavaram	Belt
144	Kshtriyapuram	Belt
145	Gantalarayudupeta	Belt
146	Adi-Andhrapalli-I	Belt
147	Adi-Andhrapalli-II	Belt
148	Gollagudem	Belt

Source: Mittal 1993

Appendix 4: Drains in West Godavari district

No	Name	Length (km)	Discharge in		Remarks
			MFD	OFD	
1	Ramileru drain	11.00	4028	2014	The drain cross Krishna- Eluru canal at U.T. at M.29/6-7nr. Vasanthavada
2	Pedapadu Drain	11.40	3050	1655	Eluru canal through U.T. at M.33/4-5 near Pedapadu village
3	Vathuru Drain	12.60	1839	920	Eluru canal through U.T. at m.36/3 Near Kotturu (V)
4	No.8 U.T. Drain	0.40	1206	634	Eluru canal through U.T.at M.37/1-584 near Surepagudem (V)
5	Mondikodu Drain	10.70	12676	6338	Starts from"No.4 outlet at M.45/7 of Godavari - Elluru canal in the village limits of Malikapurarn lnfalls: No: 10U.T. drain infalls into the drain at KM.2.75. 2) East Tammileru joins into Mondikodu drain at KM 10.33 Upland discharges considered 1) No.4 Escape: 83.26 cumecs. 2) East Thamileru 123.91 Cumecs 3) No. 10 UT drain : 27.33 Cumecs Total: 233.50 Cumecs
6	Rachacodu Drain	4.80	378	189	-do- Veerammakunta (V)
7	Jallpudl Drain	11.20	724	362	-do- Eluru canal of Eluru Town
8	KoWall Drain (9U.T)	8.70	2845	1422	-do- Eluru canal at M.42-0-610.
9	Pothunuru Drain	5.40	183	91	The drain starts from Pothunuru
10	Kedavaram Drain	3.20	158	79	-do- Kedavaram
11	No.3 Escape drain	6.00'	167	83	Eluru canal at M.33-12 1/4 chains
12	Polimerapuntacodu Drain	5.00	167	83	Eluru canal in Kurellagudem
13	Vadalicodu Drain	6.00	185	100	The drain starts from Pulla (V)
14	Nutalacodu Drain	280	111	55	The drain starts from Rachuru (V)
15	Loyeru Drain	8.20	574	287	The drain starts from Satyavolu
16	Mondicodu Drain	2.70	129	64	The drain starts from Pala Mupparu

17	Appnnacodu Drain	7.50	283	141	The drain starts from Pala Mupparu
18	Reddivanicodu Drain	1.10	28	14	The drain starts from Ponang (V)
19	Tamaracodu Drain	0.60	18	9	The drain starts from Ponangi (V)
20	Madigavanicodu Drain	3.40	78	39	The drain starts from Ponangi(V)
21	Pathacodu Drain	2.70	72	36	The drain starts from Ponangi (V)
22	Pedayedlagadi Drain	1.60	81	41	-do- Maheswarapuram (V)
23	Ananthayyacodu Drain	1.10	81	48	-do- Maheswarapuram (V)
24	Polimeracodu Drain	1.60	40	19	-do- Koteswaradurgapuram (V)
25	Appalaswami Eanda Drain	4.70	63	32	-do- Koteswaradurgapuram (V)
26	K. Duragapuram Drain	5.23	103	51	The drain starts from Koteswaradurgapuram (V)
27	Pedacodu Drain	8.05.	65	33	The drain starts from Bavayyapalem
28	Educodu Drain	9.00	75	38	The drain starts from Bavayvapalem
29	Addacodu Drain	3.90	355	177	The drain starts from Chataparru
30	Rayaleti calva drain	1.60	64	32	The drain starts from Chataparru
31	Vissacodu Drain	9.00	75	38	The drain starts from Kroviddi
32	Pedacoda Drain	1.6	147	74	The drain starts from Chataparru
33	Tavvacodu Drain	2.6	85	43	The Drain starts from Chattaparu
34	Chinakapavaram Drain	11.2	1635	818	The drain starts from Chinalapavaram
35	Nagulacodu Drain	4.4	138	69	The drain starts from Gondugolanu
36	Bhadricodu Drain	4.2	188	115	Do- Elluru canal at KM 39.1.330
37	Puppalavanicodu Drain	4.80	158	87	The drain starts from Pulla (V)
38	Gummulurucodu Drain	9.00	233	117	The drain starts from Apparao peta
39	Alacodu Drain	7.60	187	94	The drain starts from P. kavavaram
40	Siddapuram Drain	3.50	167	83	The drain stars from Siddapuram
41	Pandikodu Drain	12.00	2352	1176	The drain starts from Gunaparu (v)
42	Thaokalappalli Maj. Drain	24.20	4000	2000	The drain starts from Uppakapadu
43	Gedalakodu Drain	2.80	96	48	The drain starts from Pedamidracolanu
44	Kolletiputhakodu Drain	3.00	36	18	Do- Nindracolanu
45	Nidamaru Drain	2.80	36	18	The drain starts from Nidamaru
46	Venkatapuram Drain	2.90	36	18	The drain starts from Venkatapuram

47	Roadkolumula-kodu	4.70	120	60	The drain starts from Adavikolanu
48	Mokalikodu Drain	8.40	193	96	The drain starts from Adavikolanu
49	Timmaraogudem Drain	8.20	141	70	The drain starts from Adavikolanu
50	Kothakodu Drain	2.90	85	43	The drain starts from Adavikolanu
51	Ganapayyacodu Drain	2.90	108	54	The drain starts from Bynepalli
52	Gangadevicodu	3.40	124	62	The drain starts from Thokalapalli
53	Polaraju Drain	31.90	2499	1249	The drain starts from Thokalapalli
54	L.S Drain of Moturu	20.47	3593	1796	The drain starts from Thokalapalli
55	Chendrayya Drain	38.50	3893	1947	The drain starts from Thokalapalli
56	L.S Drain of Nehrall	11.00	1035	518	The drain starts from Thokalapalli
57	Eranamcodu Drain	4.80	51	25	The drain starts from Thokalapalli
58	Hariincodu Drain	3.00	81	40	The drain starts from Thokalapalli
59	Gongaralacodu Drain	4.00	58	29	The drain starts from Pedanindrakolanu
60	Naiducodu Drain	5.00	122	61	The drain starts from Pedanindrakolanu
61	Kothacodu Drain	5.00	122	61	The drain starts from Chanamili
62	Valucodu Drain	8.00	72	36	The drain starts from Chanamili
63	Tummacodu Drain	3.40	113	57	The drain starts from Pulla (V)
64	Chandrayyacodu Drain	2.20	46	23	The drain starts from Pathamupparu
65	Kolletti kaluva	2.00	64	32	The drain starts from Ponangi (v)
66	Sathyanarayanacodu	2.60	63	32	The drain starts from Jalipudi
67	Kondepuntha Drain	4.00	109	55	The drain starts from Jalipudi

Source: Collector, West Godavari District

Appendix 5: Maximum discharge through Upputeru to the sea

Year	Flow (Cusecs)	Year	Flow (Cusecs)
1980	5672	1991	13825
1981	5170	1992	8210
1982	5109	1993	3250
1983	14544	1994	5672
1984	6479	1995	13900
1985	6985	1996	4520
1986	14400	1997	3238
1987	3941	1998	13360
1988	11756	1999	-
1989	21291	2000	13400
1990	12738	2001	4328

Source: Engineer In Chief, Government of Andhra Pradesh

Appendix 6: Birds recorded in the area

	Common name	Scientific name	Type	Abundance	Status
1	Alpine Swift	*Tachymarptis melba*	WA		LM
2	Ashy Prinia	*Prinia socialis*	WA	C	R
3	Ashy Woodswallow	*Artamus fuscus*	WA	C	LM
4	Ashy-crowned Sparrow Lark	*Eremopterix grisea*	WA	C	R
5	Asian Koel	*Eudynamys scolopacea*	WA	C	M
6	Asian Openbill	*Anastomus oscitans*	W	A	LM
7	Asian Palm Swift	*Cypsiurus balasiensis*	WA	R	R
8	Asian Paradise-flycatcher	*Terpsiphone paradisi*	WA	R	LM
9	Asian Pied Starling	*Sturnus contra*	WA	A	R
10	Bar-headed Goose	*Anser indicus*	W	?	W?
11	Barn Owl	*Tyto alba*	WA	C	M
12	Barn Swallow*	*Hirundo rustica*	WA	C	
13	Baya Weaver	*Ploceus philippinus*	WA	C	R
14	Bay-backed Shrike	*Lanius vittatus*	WA	R	LM
15	Black Bittern	*Ixobrychus flavicollis*	W	C	M
16	Black Drongo	*Dicrurus macrocercus*	WA	C	R
17	Black Kite	*Milvus migrans*	WA	C	R
18	Black Stork	*Ciconia nigra*	W	?	
19	Black-bellied Tern	*Sterna acuticauda*	W	?	R
20	Black-crowned Night-heron	*Nycticorax nycticorax*	W	R	LM
21	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	WA	C	LM
22	Black-headed Gull	*Larus ridibundus*	W	R	L
23	Black-headed Ibis	*Threskiornis melanocephalus*	W	R	LM
24	Black-headed Munia	*Lonchura malacca*	WA	C	R
25	Black-headed Munia	*Lonchura malacca*	WA		R
26	Black-rumped Flameback	*Dinopium benghalense*	WA	C	R
27	Black-shouldered Kite	*Elanus caeruleus*	WA	C	R
28	Black-tailed Godwit	*Limosa limosa*	W	C	M

29	Black-throated Munia	*Lonchura kelaarti*	WA	C	R
30	Black-winged Stilt	*Himantopus himantopus*	W	A	R
31	Blue Rock Thrush	*Monticola solitarius*	WA	R	LM
32	Blue-tailed Bee-eater	*Merops philippinus*	WA	C	R
33	Bluethroat	*Luscinia svecica*	WA	R	M
34	Blyth's Reed Warbler	*Acrocephalus dumetorum*	WA	R	R
35	Brahminy Kite	*Haliastur indus*	WA	C	R
36	Bronze-winged Jacana	*Metopidius indicus*	W	A	R
37	Brown Crake	*Amaurornis akool*	W	R	R
38	Brown Shrike	*Lanius cristatus*	WA	C	LM
39	Brown-headed Barbet	*Megalaima zeylanica*	WA	R	R
40	Brown-headed Gull	*Larus brunnicephalus*	W	C	LM
41	Caspian Plover	*Charadrius asiaticus*	W	C?	M
42	Caspian Tern	*Sterna caspia*	W	U	
43	Cattle Egret	*Bubulcus ibis*	W	A	R
44	Chestnut-headed Bee-eater	*Merops leschenaulti*	WA	C	R
45	Chestnut-tailed Starling	*Sturnus malabaricus*	WA	C	M
46	Cinnamon Bittern	*Ixobrychus cinnamomeus*	W	C	LM
47	Citrine Wagtail*	*Motacilla citreola*	WA	C	
48	Clamorous Reed-warbler	*Acrocephalus stentoreus*	WA	R	R
49	Collared Pratincole	*Glareola pratincola*	W	C	LM
50	Comb Duck	*Sarkidiornis melanotos*	W	R	M
51	Common Chiffchaff	*Phylloscopus collybita*	WA	C	R
52	Common Coot	*Fulica atra*	W	A	R
53	Common Greenshank	*Tringa nebularia*	W	C	M
54	Common Hoopoe	*Upupa epops*	WA	C	R
55	Common Iora	*Aegithina tiphia*	WA	C	R
56	Common Kingfisher	*Alcedo atthis*	WA	C	R
57	Common Moorhen	*Gallinula chloropus*	W	C	R
58	Common Myna	*Acridotheres tristis*	WA	A	R
59	Common Pochard	*Aythya ferina*	W	R	M
60	Common Redshank	*Tringa totanus*	W	C	M
61	Common Ringed Plover	*Charadrius hiaticula*	W	C?	M
62	Common Sandpiper	*Actitis hypoleucos*	W	A	M
63	Common Snipe	*Gallinago gallinago*	W	R	M
64	Common Stonechat	*Saxicola torquata*	WA	C	R
65	Common Tailorbird	*Orthotomus sutorius*	WA	C	R
66	Common Teal	*Anas crecca*	W	A	M
67	Common Tern	*Sterna hirundo*	W	R	LM
68	Common Woodshrike	*Tephrodornis pondicerianus*	WA	C	R
69	Cotton Pygmy-goose	*Nettapus coromandelianus*	W	A	R
70	Crested Lark	*Galerida cristata*	WA	C	R
71	Crimson-breasted Barbet	*Megalaima haemacephala*	WA	R	M
72	Curlew Sandpiper	*Calidris ferruginea*	W	?	
73	Darter	*Anhinga melanogaster*	W	?	
74	Drongo Cuckoo	*Surniculus lugubris*	WA	R	M
75	Dusky Crag-martin	*Hirundo concolor*	WA	R	R
76	Egyptian Vulture	*Neophron percnopterus*	WA	C	R
77	Eurasian Collared Dove	*Streptopelia decaocto*	WA	C	R
78	Eurasian Curlew	*Numenius arquata*	W	C	M
79	Eurasian Golden Plover	*Pluvialis apricaria*	W		R
80	Eurasian Golden-oriole	*Oriolus oriolus*	WA	C	R
81	Eurasian Marsh Harrier	*Circus aeruginosus*	WA	C	M
82	Eurasian Oystercatcher	*Haematopus ostralegus*	W	?	

83	Eurasian Sparrowhawk	*Accipiter nisus*	WA	R	M
84	Eurasian Spoonbill	*Platalea leucorodia*	W	?	
85	Eurasian Wigeon	*Anas penelope*	W	R	M
86	Ferruginous Pochard	*Aythya nyroca*	W	R	M
87	Forest Wagtail	*Dendronanthus indicus*	WA	C	M
88	Fork-tailed Drongo	*Dicrurus adsimilis*	WA	C	R
89	Fulvous Whistling-duck	*Dendrocygna bicolor*	W	C	R
90	Gadwall	*Anas strepera*	W	VR	M
91	Garganey	*Anas querquedula*	W	A	M
92	Glossy Ibis	*Plegadis falcinellus*	W	C	M
93	Great Cormorant	*Phalacrocorax carbo*	W	?	LM?
94	Great Crested Grebe	*Podiceps cristatus*	W	V,R	M
95	Great Egret	*Casmerodius albus*	W	C	LM
96	Great Knot	*Calidris tenuirostris*	W	R	M
97	Great Thick-knee	*Esacus recurvirostris*	W	?	
98	Greater Adjutant	*Leptoptilos dubius*	W	R	LM
99	Greater Coucal	*Centropus sinensis*	WA	C	M
100	Greater Flamingo	*Phoenicopterus ruber*	W	VR	LM
101	Greater Painted-snipe	*Rostratula benghalensis*	W	R	M
102	Greater Sand Plover	*Charadrius leschenaultii*	W	C	M
103	Greater Scaup	*Aythya marila*	W	C	M
104	Greater Spotted Eagle	*Aquila clanga*	WA	R	M
105	Green Bee-eater	*Merops orientalis*	WA	C	R
106	Green Sandpiper	*Tringa ochropus*	W	C	M
107	Grey Heron	*Ardea cinerea*	W	R	LM
108	Grey Wagtail	*Motacilla cinerea*	WA	C	M
109	Gull-billed Tern	*Gelochelidon nilotica*	W	U	
110	Hen Harrier	*Circus cyaneus*	WA	C	R
111	Herring Gull	*Larus argentatus*	W		
112	House Crow	*Corvus splendens*	WA	A	R
113	House Sparrow	*Passer domesticus*	WA	C	R
114	House Swift	*Apus affinis*	WA	C	R
115	Indian Bush Lark	*Mirafra erythroptera*	WA	C	R
116	Indian Cormorant	*Phalacrocorax fuscicollis*	W	A	R
117	Indian Cuckoo	*Cuculus micropterus*	WA	C	R
118	Indian Pond-heron	*Ardeola grayii*	W	A	R
119	Indian Robin	*Saxicoloides fulicata*	WA	C	R
120	Indian Roller	*Coracias benghalensis*	WA	C	R
121	Indian Silverbill	*Lonchura malabarica*	WA		R
122	Intermediate Egret	*Mesophoyx intermedia*	W	A	R
123	Jack Snipe	*Lymnocryptes minimus*	W	?	
124	Kentish Plover	*Charadrius alexandrinus*	W	C	M
125	Large Grey Babbler	*Turdoides malcolmi*	WA	R	LM
126	Large-billed Crow	*Corvus macrorhynchos*	WA	C	R
127	Laughing Dove	*Streptopelia senegalensis*	WA	C	R
128	Lesser Adjutant	*Leptoptilos javanicus*	W	VR	M
129	Lesser Kestrel	*Falco naumanni*	WA	VR	M
130	Lesser Spotted Eagle	*Aquila pomarina*	WA	R	R
131	Lesser Whistling-duck	*Dendrocygna javanica*	W	A	R
132	Little Bittern	*Ixobrychus minutus*	W	C?	LM
133	Little Cormorant	*Phalacrocorax niger*	W	A	R
134	Little Crake	*Porzana parva*	W	C	R
135	Little Egret	*Egretta garzetta*	W	A	R
136	Little Grebe	*Tachybaptus ruficollis*	W	A	R

137	Little Ringed Plover	*Charadrius dubius*	W	C	M
138	Little Stint	*Calidris minuta*	W	A	M
139	Little Tern	*Sterna albifrons*	W	R	LM
140	Long-billed Vulture	*Gyps indicus*	WA	A	R
141	Long-tailed Shrike	*Lanius schach*	WA	R	LM
142	Mallard	*Anas platyrhynchos*	W	?	
143	Marsh Sandpiper	*Tringa stagnatilis*	W	C	M
144	Northern Pintail	*Anas acuta*	W	A	M
145	Northern Shoveler	*Anas clypeata*	W	A	M
146	Oriental Magpie Robin	*Copsychus saularis*	WA	R	LM
147	Oriental Skylark	*Alauda gulgula*	WA		R
148	Oriental White-eye	*Zosterops palpebrosus*	WA	R	R
149	Pacific Golden Plover	*Pluvialis fulva*	W	R	M
150	Pacific Swallow	*Hirundo tahitica*	WA	C	R
151	Paddyfield Warbler	*Acrocephalus agricola*	WA	C	R
152	Painted Stork	*Mycteria leucocephala*	W	R	LM
153	Pale-bille Flowerpecker	*Dicaeum erythrorhynchos*	WA	C	R
154	Pallid Harrier	*Circus macrourus*	WA	C	R
155	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	W	A	R
156	Pied Avocet	*Recurvirostra avosetta*	W	R	M
157	Pied Bushchat	*Saxicola caprata*	WA	C	R
158	Pied Cuckoo	*Clamator jacobinus*	WA	C	M
159	Pied Harrier	*Circus melanoleucos*	WA	VR	M
160	Pied Kingfisher	*Ceryle rudis*	WA	C	R
161	Pintail Snipe	*Gallinago stenura*	W	R	M
162	Purple Heron	*Ardea purpurea*	W	C	R
163	Purple Sunbird	*Nectarinia asiatica*	WA	C	R
164	Purple Swamphen	*Porphyrio porphyrio*	W	A	R
165	Purple-rumped Sunbird	*Nectarinia zeylonica*	WA	R	R
166	Red Collared Dove	*Streptopelia tranquebarica*	WA	C	R
167	Red-capped Lark	*Calandrella cinerea*	WA	C	R
168	Red-crested Pochard	*Netta rufina*	W	A	M
169	Red-naped Ibis	*Pseudibis papillosa*	W		
170	Red-necked Falcon	*Falco chicquera*	WA	VR	M
171	Red-necked Phalarope	*Phalaropus lobatus*	W	VR	M
172	Red-rumped Swallow	*Hirundo daurica*	WA	C	
173	Red-vented Bulbul	*Pycnonotus cafer*	WA	C	R
174	Red-wattled Lapwing	*Vanellus indicus*	W	C	R
175	River Tern	*Sterna aurantia*	W	R	LM
176	Rock Pigeon	*Columba livia*	WA	C	R
177	Rose-ringed Parakeet	*Psittacula krameri*	WA	C	R
178	Rosy Starling	*Sturnus roseus*	WA	C	M
179	Ruddy Shelduck	*Tadorna ferruginea*	W	R	LM
180	Ruddy-breasted Crake	*Porzana fusca*	W	?	R
181	Ruff	*Philomachus pugnax*	W	VR	M
182	Rufous Treepie	*Dendrocitta vagabunda*	WA	C	R
183	Rufous-fronted Prinia	*Prinia buchanani*	WA	R	LM
184	Rufous-tailed Lark	*Ammomanes phoenicurus*	WA	C	R
185	Sarus Crane	*Grus antigone*	W		LM~
186	Scaly-breasted Munia	*Lonchura punctulata*	WA	C	R
187	Shikra	*Accipiter badius*	WA	C	R
188	Short-toed Snake Eagle	*Circaetus gallicus*	WA	R	R
189	Slaty-breasted Rail	*Gallirallus striatus*	W	R	LM
190	Slaty-legged Crake	*Rallina eurizonoides*	W	R	LM

191	Small Pratincole	*Glareola lactea*	W	R	LM
192	Spot-billed Duck	*Anas poecilorhyncha*	W	C	R/LM
193	Spot-billed Pelican	*Pelecanus philippensis*	W	C	LM
194	Spotted Crake	*Porzana porzana*	W	?	
195	Spotted Dove	*Streptopelia chinensis*	WA	C	R
196	Spotted Owlet	*Athene brama*	WA	C	M
197	Spotted Redshank	*Tringa erythropus*	W	C	WM/PM
198	Streaked Weaver	*Ploceus manyar*	WA	C	R
199	Streak-throated Swallow	*Hirundo fluvicola*	WA	R	R
200	Tawny Eagle	*Aquila rapax*	WA		R
201	Tawny-bellied Babbler	*Dumetia hyperythra*	WA	R	LM
202	Terek Sandpiper	*Xenus cinereus*	W	?	
203	Tickell's Blue Flycatcher	*Cyornis tickelliae*	WA		R
204	Tufted Duck	*Aythya fuligula*	W	R	M
205	Water Rail	*Rallus aquaticus*	W	R	LM
206	Watercock	*Gallicrex cinerea*	W	C	R
207	Western Reef-egret	*Egretta gularis*	W	R	LM
208	Whimbrel	*Numenius phaeopus*	W	C	M
209	Whiskered Tern	*Chlidonias hybridus*	W	C	LM
210	White Wagtail	*Motacilla alba*	WA	C	M
211	White-bellied Drongo	*Dicrurus caerulescens*	WA	R	R
212	White-breasted Waterhen	*Amaurornis phoenicurus*	W	C	R
213	White-browed Wagtail	*Motacilla madaraspatensis*	WA	C	LM
214	White-eyed Buzzard	*Butastur teesa*	WA	R	R
215	White-rumped Munia	*Lonchura striata*	WA	C	R
216	White-rumped Vulture	*Gyps bengalensis*	WA	A	R
217	White-throated Kingfisher	*Halcyon smyrnensis*	WA	C	R
218	White-winged Tern	*Chlidonias leucopterus*	W	R	LM
219	Wire-tailed Swallow	*Hirundo smithii*	WA	R	LM
220	Wood Sandpiper	*Tringa glareola*	W	C	M
221	Wood Snipe	*Gallinago nemoricola*	W	C?	M
222	Woolly-necked Stork	*Ciconia episcopus*	W	?	
223	Yellow Bittern	*Ixobrychus sinensis*	W	C	LM
224	Yellow Wagtail	*Motacilla flava*	WA	C	M

Common and Scientific names following Grimmett et al (2007), A-Abundant, C-Common, UC-uncommon, R- Rare, VR- very rare, ?- unknown, R- Resident, LM - Local migrant , PM - passage migrant, WM - winter migrant, M - International migrant, V - vagrant, ? - unknown
Source: Ashok Kumar, (pers. communication) and Wetland International (2008)
Note: Compiled by Dr Nikhil Raj and J Ranjini

Appendix 7: Fish and other taxa reported from Kolleru

Fish

1	*Elops saurus*	Elopidae
2	*Megalops cyprinoldes*	Megalopidae
3	*Anguilla bicolor*	Anguillidae
4	*A. bengalensis*	Anguillidae
5	*Moringua raitaborua*	Moringuldae
6	*Congresox talabon*	Muraenosocidae
7	*Pisodonophls boro*	Ophichthidae
8	*Dayella malabarica*	Clupeidae
9	*Hilsa ilisha*	Clupeidae
10	*H. kelee*	Clupeidae
11	*Nematalosa nasus*	Clupeidae
12	*Anodontostoma chacunda*	Clupeidae
13	*Pellona dltchella*	Clupeidae
14	*Thryssa purava*	Engrauildae
15	*T. mystax*	Engrauildae
16	*Coilia dussuralerri*	Engrauildae
17	*Notopterus notopterus*	Notopteridae
18	*Chanos chanos*	Chanidae
19	*Salmostoma phulo*	Cyprinidae
20	*S. clupeoldes*	Cyprinidae
21	*Chela atpar*	Cyprinidae
22	*C. labuca*	Cyprinidae
23	*Esomas danricus*	Cyprinidae
24	*Amblypharyngodon mola*	Cyprinidae
25	*Rasbora danlconius*	Cyprinidae
26	*Barllius barna*	Cyprinidae
27	*Hypophthalmichthys molitrix*	Cyprinidae
28	*Puntius sarana sarana*	Cyprinidae
29	*P. sophore*	Cyprinidae
30	*P.ticto*	Cyprinidae
31	*P.yelius*	Cyprinidae
32	*P.dorsalis*	Cyprinidae
33	*P.ambassis*	Cyprinidae
34	*Labco rohita*	Cyprinidae
35	*L.calbasu*	Cyprinidae
36	*L.flmbriatus*	Cyprinidae
37	*L.potail*	Cyprinidae
38	*L.bata*	Cyprinidae
39	*L.boga*	Cyprinidae
40	*L.pangusia*	Cyprinidae
41	*Catla cafcla*	Cyprinidae
42	*Cirrhinus mrigala*	Cyprinidae
43	*C.reba*	Cyprinidae
44	*Ctenopharyngodon idalla*	Cyprinidae
45	*Cyprlnus earpio carpio*	Cyprinidae
46	*Lepidocephalichthys thermalis*	Cobitidae
47	*L.guntio*	Cobitidae

48	*Mystus gulio*	Bagridae
49	*M. vittatus*	Bagridae
50	*M. cavasius*	Bagridae
51	*M. bleekeri*	Bagridae
52	*Ompok biraaculatus*	Siluridae
53	*O. pabda*	Siluridae
54	*Wallago attu*	Siluridae
55	*Pseudeutropius atherinoides*	Schilbeidae
56	*Proeutropilchthys takrae*	Schilbeidae
57	*Clupisoraa garua*	Schilbeidae
58	*Pangasius pangasius*	Pangasiidae
59	*Clarias batrachus*	Cardiidae
60	*Heteropneustes fossilis*	Heteropneustidae
61	*Arias arius*	Ariidae
62	*A.caelatus*	Ariidae
63	*Tachysurus dussumieri*	Ariidae
64	*T. caelatus*	Ariidae
65	*Plotossus canius*	Plotosidae
66	*Zenarchopterua dispar*	Hemiramphidae
67	*Xenentodon cancila*	Beionidae
68	*Aplocheiltt« panchax*	Cyprinodontidae
69	*Ichthyocampus carce*	Syngnathidae
70	*Microphis bleaker*	Syngnathidae
71	*Channa striatus*	Channidae
72	*Channa punctatus*	Channidae
73	*C. orientalis*	Channidae
74	*Platycephalus indicus*	Platycephalidae
75	*Lates calcarifer*	Centropooldae
76	*Epinephelous diacanthus*	Serranidae
77	*Ambassis coanersonil*	Chandidae
78	*A. gymnocephalus*	Chandidae
79	*Chanda name*	Chandidae
80	*C. ranga*	Chandidae
81	*Sillago sihama*	Sillaginidae
82	*Leiognathus equulus*	Leiognathidae
83	*Gerres setifer*	Gerridae
84	*G filamentosus*	Gerridae
85	*Pomadasys hasta*	Pomaadasyidae
86	*Drepance punctata*	Urepaenidae
87	*Johnius colter*	Sciaenidae
88	*Otolithes maculatus*	Sciaenidae
89	*O ruber*	Sciaenidae
90	*Otolithoides biauritus*	Sciaenidae
91	*Davsciaena albida*	Sciaenidae
92	*Dendrophysa russell*	Sciaenidae
93	*Scatophagies argus*	Sciaenidae
94	*Nandus nandus*	Nandidae
95	*Etropins maculatus*	Cichlidae
96	*E auratensis*	Cichlidae
97	*Oreochromis mossambica*	Cichlidae

98	*Mugil cephalus*	Mugilidae
99	*M. parsla*	Mugilidae
100	*Siganus javus*	Siganidae
101	*E leutheronema tetradactylum*	Polynemidae
102	*Lutjanus johni*	Lutjanidae
103	*Caranx* sp.	Carangidae
104	*Glossogobius giuris*	Gobiidae
105	*Chiramenu fluviatilis*	Gobiidae
106	*Pseudapocryptes niger*	Gobiidae
107	*Boleophthalmus boddarti*	Gobiidae
108	*Parastromateus niger*	Stromateidae
109	*Pampas argenteas*	Stromateidae
110	*Anabas testudineus*	Anabantidae
111	*A. oligolepis*	Anabantidae
112	*Colisa fasciata*	Belontiidae
113	*Cynoglossus elongatus*	Cynoglosidae
114	*Pseudorhomphus arsus*	Bothidae
115	*Mastaeambelus armatus*	Mastacembelidae
116	*M. pancalus*	Mastacembelidae
117	*Macrognathus aculeatus*	Mastacembelidae

Prawns

1	*Penaeus monodon*	Penaeidae
2	*P. indicus.*	Penaeidae
3	*Metapenaeus monoceros*	Penaeidae
4	*M. dobsoni*	Penaeidae
5	*M. affinis*	Penaeidae
6	*Macrobrachium rosenbergii*	Palaemonidae
7	*M. malcolmsonii*	Palaemonidae
8	*M. rude*	Palaemonidae
9	*M. scanbriaulus*	Palaemonidae
10	*M. lar*	Palaemonidae
11	*M. equldens*	Palaemonidae
12	*M. villosimanus*	Palaemonidae

Courtsey: S Ashok Kumar and Kolleru Fisheries Research Centre of Central inland Capture Fisheries Research Institute, Eluru, AP

Appendix 8: Fish species depleted or disappeared from Kolleru

	Species	Family
1	*Chela labuca*	Cyprinidae
2	*Oxygaster clupeoides*	
3	*Danio devario*	
4	*Esomus danricus*	
5	*Rasbora danionicus*	
6	*Puntius sarana*	
7	*P. sophore*	
8	*P.chola*	
9	*P.ticto*	
10	*Aplocheilus panchax*	Cyprinodontidae
11	*Chanda nama*	Centropomidae
12	*Chanda ranga*	
13	*Chanda commersoni*	
14	*Mugil cephalus*	Mugilidae
15	*Rhinomugil corsula*	

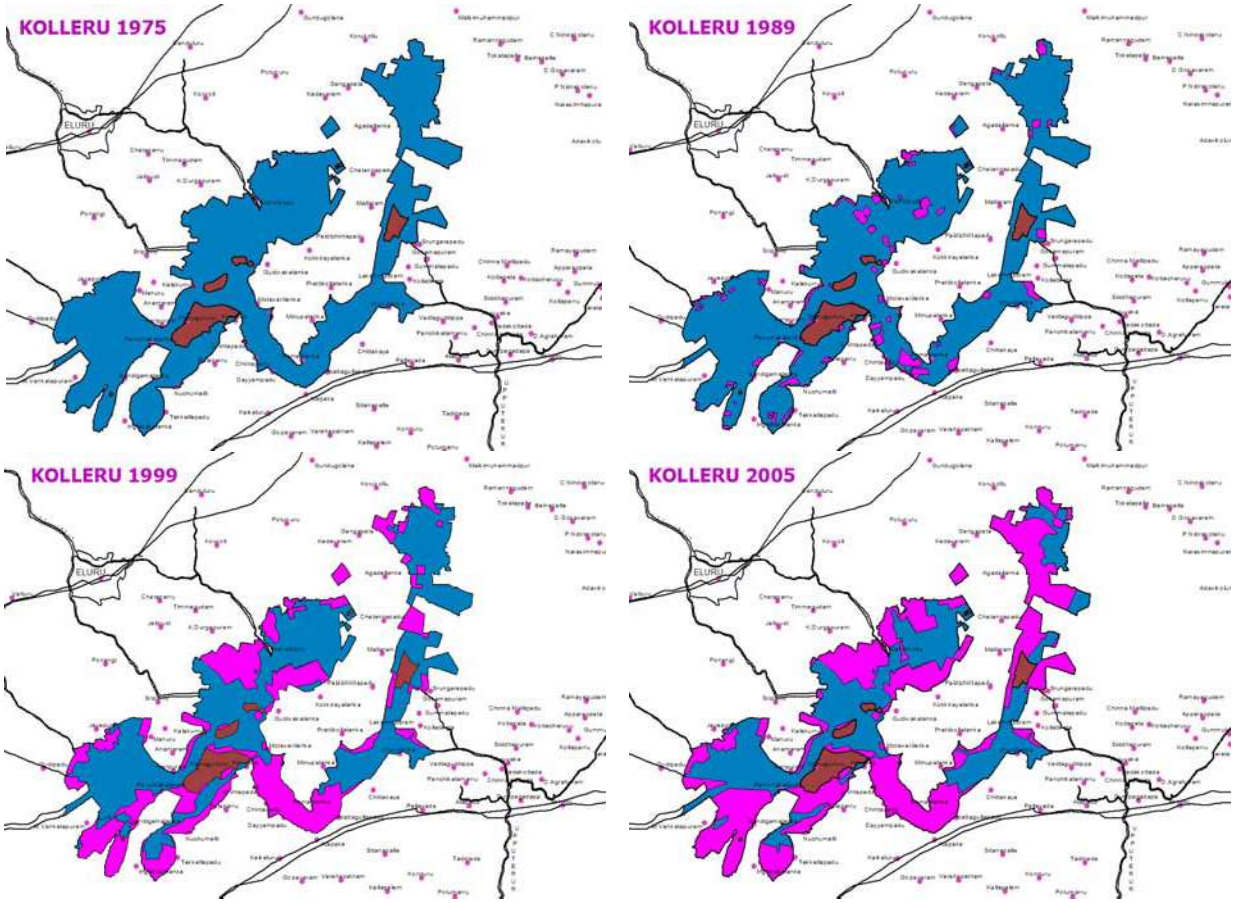
Source: Dr BV Sheshagiri Rao (Undated)

Appendix 9: Macrophytes reported from Kolleru

	Species	Habitat	Habit
1	*Acorus calamus*	Aquatic	Herb
2	*Alternanthera sessilis*	Semi-aquatic	Herb
3	*Aponogeton crispum*	Aquatic	Herb
4	*Azolla pinnata*	Aquatic	Herb/Fern
5	*Blyxa octandra*	Aquatic	Herb
6	*Ceratophyllum demersum*	Aquatic	Herb
7	*Chara* spp.	Aquatic	Herb/Algae
8	*Eichhornia crassipes*	Aquatic	Herb
9	*Eleocharis plantaginea*	Aquatic	Herb
10	*Hydrilla verticillata*	Aquatic	Herb
11	*Ipomoea aquatica*	Semi-aquatic	Herbaceous vine
12	*Lemna minor*	Aquatic	Herb
13	*Limnophila indica*	Aquatic	Herb
14	*Najas graminea*	Aquatic	Herb
15	*Nechamandra alternifolia*	Aquatic	Herb
16	*Nelumbo nucifera*	Aquatic	Herb
17	*Nymphaea alba*	Aquatic	Herb
18	*Nymphaea nouchali*	Aquatic	Herb
19	*Nymphaea stellata*	Aquatic	Herb
20	*Nymphoides indicum*	Aquatic	Herb
21	*Ottelia alismoides*	Aquatic	Herb
22	*Paspalidium geminatum*	Semi-aquatic	Herb/Grass

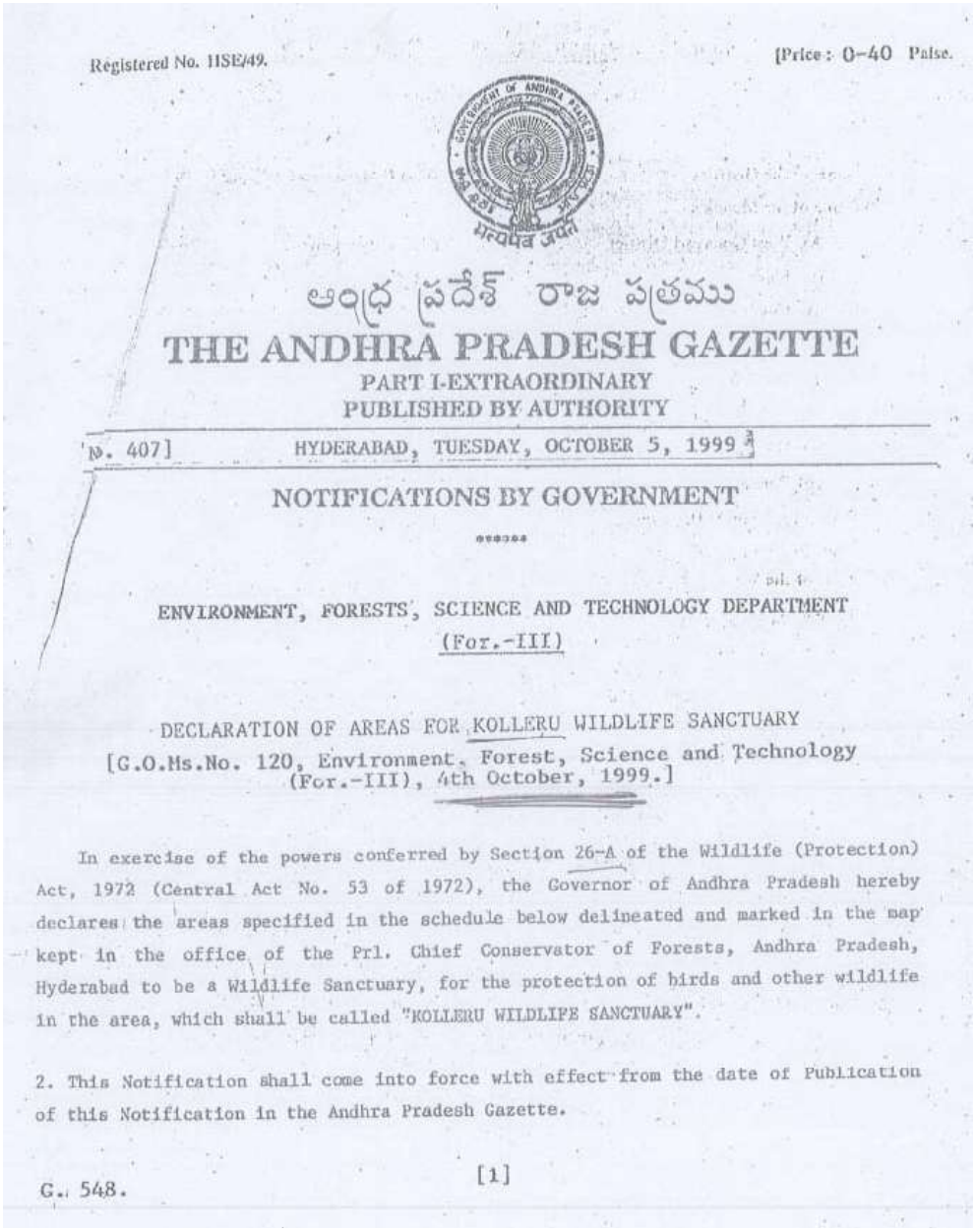
23	*Phragmites communis*	Aquatic	Shrub/Grass
24	*Phragmites karka*	Aquatic	Shrub/Grass
25	*Pistia stratiotes*	Aquatic	Herb
26	*Potamogeton crispus*	Aquatic	Herb
27	*Potamogeton natans*	Aquatic	Herb
28	*Salvinia auriculata*	Aquatic	Herb/Fern
29	*Scirpus articulatus*	Aquatic	Herb
30	*Spirodela polyrhiza*	Aquatic	Herb
31	*Typha angustata*	Aquatic	Shrub/Grass
32	*Utricularia flexuosa*	Aquatic	Herb
33	*Utricularia stellaris*	Aquatic	Herb
34	*Vallisneria spiralis*	Aquatic	Herb

Courtsey: Dr M Murugesan



Appendix 10: Growth of aquaculture in Kolleru
Source: APSARC

Appendix 11: Notification on formation of the Sanctuary



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THE ANDHRA PRADESH GAZETTE

PART I-EXTRAORDINARY

PUBLISHED BY AUTHORITY

No. 407] HYDERABAD, TUESDAY, OCTOBER 5, 1999

NOTIFICATIONS BY GOVERNMENT

ENVIRONMENT, FORESTS, SCIENCE AND TECHNOLOGY DEPARTMENT

(For.-III)

DECLARATION OF AREAS FOR KOLLERU WILDLIFE SANCTUARY

[G.O.Ms.No. 120, Environment, Forest, Science and Technology (For.-III), 4th October, 1999.]

In exercise of the powers conferred by Section 26-A of the Wildlife (Protection) Act, 1972 (Central Act No. 53 of 1972), the Governor of Andhra Pradesh hereby declares the areas specified in the schedule below delineated and marked in the map kept in the office of the Prl. Chief Conservator of Forests, Andhra Pradesh, Hyderabad to be a Wildlife Sanctuary, for the protection of birds and other wildlife in the area, which shall be called "KOLLERU WILDLIFE SANCTUARY".

2. This Notification shall come into force with effect from the date of Publication of this Notification in the Andhra Pradesh Gazette.

G.. 548. [1]

THE SCHEDULE

(1) Name of the Districts : West Godavari and Krishna

(2) Name of the Mandals

A) West Godavari District

i) Eluru
ii) Unguturu
iii) Pedapadu
iv) Denduluru
v) Akiveedu
vi) Nidamarru
vii) Bhimadole

B) Krishna District

i) Kaikaluru
ii) Mandavalli

(3) Name of the Forest Divisions : 1. Eluru, 2. Krishna

(4) Name of the Forest Ranges : 1. Eluru, 2. Vijayawada

(5) Name of the Wildlife Division : Wildlife Management Division, El

(6) Name of the Sanctuary : Kolleru Wildlife Sanctuary

(7) Area of the Sanctuary : 308.55 Sq. Kms. or 30,855.20 Ha

Sno.	Mandal	District	Area in Ha.
1	Eluru	West Godavari	9560.00
2	Unguturu	--do--	53.71
3	Pedapadu	--do--	315.72
4	Denduluru	--do--	234.23
5	Akiveedu	--do--	2765.62
6	Nidamarru	--do--	2735.30
7	Bhimadolu	--do--	8129.00
8	Kaikaluru	Krishna	4117.81
9	Mandavalli	--do--	2943.81
	Total		30855.20

BOUNDARY DESCRIPTION: The Boundary runs along the contour at +5' MSL as marke kept in the O/o. Principal Chief Conservator of Forests, Andhra Pradesh, Hyderabad. The details of area included in the Sanctuary including details of Survey Numbers is kept in Principal Chief Conservator of Forests, Andhra Pradesh, Hyderabad.

1) EAST : 'A' TO 'B': The Sanctuary starts at Station 'A' which is a trijunction of R.S.Nos.1050, 1061 and 1069 of Vaddegudem village H/o. Kaikaram Revenue village of Unguturu Mandal (West Godavari District) as shown on the map at +5' Contour. Then the line traverses generally in Southernly direction along +5' Contour till it reaches point 'B', a point on common village boundary in R.S.Nos. 207 of Mandavalli and 134 of Akiveedu village 500mts north of Kaikaluru- Bhimavaram Railway line as shown in the map. While the line traverses along the +5' contour of the lake it touches the villages Voddegudem H/o, Kaikaram, Tokalapalli, Binepally, D. Gopavaram, Pedanindrakolanu, Nidamarru, Venkatapuram, Timmaraogudem, Adavikolanu, Chanamilli, Bavayyapalem, Krovvidi (Nidamarru Mandal), Pedakapavaram, Chinakapavaram, Gummuluru, Kollaparru, Siddapuram (Akiveedu Mandal), Kottada (Kaikaluru Mandal) Dharamapuram, Akiveedu and Madivada (Akiveedu Mandal). This line cuts across Tokalapalli drain, Siddapuram drain and Chinakapavaram drain.

2) SOUTH 'B' TO 'C': Thence the line from point 'B' traverses generally in Westerly direction along the Southern boundary of the lake along +5' Contour till point 'C' which is south western corner of R.S.No.241 and South East corner of Rs.Nos.152 of Ingilipakalanka village of Mandavalli Mandal in Krishna District located at South West corner of the lake, as shown in the map. The line runs parallel to the road from Akiveedu to Kaikaluru touching the villages of Akiveedu ,Dumpagadapa (Akiveedu Mandal), Someswaram, Alapadu, Pallewada, Penchikalamarru (Intrusion as English alphabet Z shape) then to Pallewada, Bhujabalapatnam, Gonepadu, Atapaka, Kaikaluru (Kaikaluru Mandal), Dayyampadu, Chintapadu, Kovvadalanka, Chintapadu, Pulaparru, Pillipadu, Nutchimilli, Takkellapadu, Ingilipakalanka (Mandavalli Mandal). This line cuts across Upputeru river, Polaraju drain, Eluru-Kaikaluru road and Moturu Channel.

3) WEST 'C' TO 'D': Thence the line from point 'C' traverses generally in North, Northerly and South Westerly directions along +5' Contour of the lake and reaches the point 'D', trijunction of R.S.Nos. 391, 392 and 402 of Satyavolu village of Pedapadu Mandal in West Godavari District where Ramuleru River crosses +5' contour of the lake which is the Eastern limit of Satyavolu village. While the line traverses from point 'C' to 'D', it touches the villages of Ingilipakalanka, Nandigamalanka, Penumakalanka, Manugunuru, Penumakalanka, Nandigamalanka (Mandavalli Mandal), Koniki, Satyavolu (Pedapadu Mandal). This line crosses Gudivada channel, Chandraiah drain, N.S. drain of Nellimali, Dosapadu channel, Budameru river right and left branches.

4) NORTH 'D' TO 'A': Then the boundary line runs generally in North-easterly direction upto Sriparru village thence in Southernly direction through Manuru Village limits till it crosses Eluru to Kaikaluru road thence it travels in Northernly direction upto a point where it crosses Thammileru western branch. Thence it runs in North-easterly direction till it touches Gundugolanu-Agadalalanka road and then it runs generally in Southernly direction upto Komatilanka village. Thence it runs in Northernly

direction upto a point where it crosses Escape drain at the junction point of Bhimadolu and Ambarpeta villages. Thence it runs in Easterly direction to reach the starting point at 'A'. The Northern boundary line passes through the villages Satyavolu, Mupparru (Pedapadu Mandal), Manuru, Sriparru, Ponnangi, Kalakurru, Jalipudi, Chtaparru (Eluru Mandal), Kovvali, Dosapadu, Pothanuru (Denduluru Mandal), Agadalalanka, Chettunnapadu, Mallavaram (Bhimadolu Mandal), Kokkirayi lanka, Gudivaka lanka, Komatilanka, Prattikollalanka, Paidichintapadu (Eluru Mandal) and again Mallavaram, Chettunnapadu, Agadalalanka, Amberpeta and Poolla (Bhimadolu Mandal), Kaikaram village (Unguturu Mandal). This line crosses the Pedapadu drain, Vatluru drain, Tammileru western branch, Jalipudi drain, Tammileru eastern branch, Kovvali drain, Agadalalanka channel and No.3 Escape drain.

NAMES OF THE VILLAGES:

Krishna District

Kaikaluru Mandal :

1) Chinnakottada	2) Penchikalamarru	3) Vadlakutithippa	4) Kolletikota
5) Laxmipuram	6) Gummalladapadu	7) Gokarnapuram	8) Srungavarappadu
9) Pandiripallegudem	10) Jangampadu	11) Allapadu	12) Pallevada
13) Someswaram	14) Bhujabalapatnam	15) Chatakai	16) Singapuram
17) Atapaka	18) Gonepadu	19) Kaikaluru	20) Pedakottada
21) Pandiripalli gudem			

Mandavalli Mandal:

1) Penumakalanka	2) Manugunuru	3) Kovvadalanka	4) Chintapadu
5) Deyyampadu	6) Nutchumilli	7) Nandigamalanka	8) Ingilipakalanka

West Godavari District

Eluru Mandal:

1) Paidichintapadu	2) Manuru	3) Kalakurru	4) Gudivakalanka
5) Komatilanka	6) Kokkirailanka	7) Prattikollalanka	8) Chataparru
9) Jalipudi	10) Sriparru	11) Ponangi	

Nidamarru Mandal:

1) Nidamarru	2) Adivikolanu	3) Venkatapuram	4) Tokalapalli
5) Pedanindrakolanu	6) Chanamilli	7) Bavaipalem	8) Binepalli
9) Krovvidi	10) D.Gopavaram	11) Timmaraogudem	

Akiveedu Mandal:

1) Akiveedu	2) Madivada	3) Dharmapuram	4) Dumpagadapa
5) Siddapuram	6) Kolleru	7) Gummuluru	8) Chinakapavaram
9) Pedakapavaram	10) Kollaparru		

Denduluru Mandal:

1) Pothunuru 2) Kovvali 3) Dosapadu

Pedapadu Mandal:

1) Mupparru 2) Satyavolu 3) Koniki

Bhimadole Mandal:

1) Bhimadole 2) Amberpeta 3) Pulla 4) Mallavaram

5) Chettunnapadu 6) Agadalalanka

Unguturu Mandal:

1) Kaikaram

The existence, nature and extent of rights as determined by the District Collector, Krishna vide Proceedings No.E6/1236/97, Dated: 01-09-1998 and by the District Collector, West Godavari, Eluru in Rc.No.D6/11717/96, Dated:08-08-1999 are as follows:

1. Right to do fishing with traditional methods using mavus, nets of size (which does not cause damage to seed but catches only fish of harvestable size) which will be specified separately by the Chief Wildlife Warden of Andhra Pradesh.
2. No person shall form any tank for Aquaculture or for any other purposes.
3. Wherever Pisciculture was existing in private lands, as on the date of notification, fishing in traditional methods shall be permitted, without causing environmental hazard, till the Government acquires such private lands.
4. Right to do traditional Agriculture without using pesticides and chemicals.
5. Right to use the ordinary boats without motor for the movement of the people.
6. Right of way with existing Roads connecting main habitations and their maintenance by providing sufficient number of vents for the roads existing at the time of Notification of Kolleru Wildlife Sanctuary U/s. 18 of Wildlife (Protection) Act, 1972 without permitting new roads and culverts.
7. Right to maintain existing water courses and drains necessary to avert submersion of agricultural lands surrounding Kolleru Lake.
8. Other rights and conditions as specified U/s. 27 to 34 and other provisions of the Wildlife (Protection) Act, 1972.
9. Electricity connection shall be given for domestic use only and not for Aquaculture or any activity connected therewith.
10. The 'D' form pattas granted or lease of land allowed in the area in favour of any assignee or lessee as the case may be including three societies viz., Gangaraju Fishermen Cooperative Society, Srungavarappadu; Sringavarappadu Fishermen Cooperative Society; Sanjay Gandhi Fishermen Cooperative Society, Srungavarappadu of Krishna District will be cancelled. The claimants are not entitled to any compensation under Wildlife (Protection) Act, 1972 as they were assigned the lands by the Government on free of land value.

11. D-Farm pattas to the extent of Ac.2882.00cts issued to the individuals as per G.O.Ms. No. 118 Revenue (Q) Dept., Dated:24-01-1976 in West Godavari District wherein they were permitted to construct fish tanks on the said lands are liable to be cancelled and these lands will be resumed under the provisions of Wildlife (Protection) Act, 1972. These D-Farm patta holders are not entitled for any compensation except exgratia as provided by the Government.
12. The annual Licences which are being issued by the Fisheries Department for fishery purpose indicating the areas allotted are to be discontinued.
13. Encroachments in conditional patta lands of Siddapuram village of Akiveedu Mandal are to be evicted.
14. The village site Poramboke of Siddapuram village of Akiveedu Mandal measuring Ac.16.67cts is hereby excluded from the jurisdiction of the Sanctuary.
15. Any other encroachments/activities which are not permitted specifically are liable to be removed/ stopped forthwith.

V. P. JAUHARI
PRINCIPAL SECRETARY TO GOVERNMENT

GOVERNMENT OF ANDHRA PRADESH

సత్యమేవ జయతే

కృష్ణా జిల్లా రాజపత్రము

సాధారణము

అధికారమువలన ప్రచురించబడినది

No. 1] సుచిలీవట్టు ం, 1995వ సంవత్సరము, జనవరి 26వ, తేది, మంగళవారము

విషయసూచిక

ప్రభుత్వము వారి ప్రకటనలు

NOTIFICATION

G.O. Ms. No. 76, Environment, Forest, Science and Technology (Forest-III) Department dated 25th September, 1995.

In exercise of the powers conferred by Section 18 of the Wild Life (Protection) Act, 1972 (Central Act No 53 of 1972), the Government of Andhra Pradesh hereby declares the ar s specified in the Schedule below as a Wild Life Sanctuary, which may be called "The Kolleru Wild Life Sanctuary"

SCHEDULE

1.	Name of Districts	:	West Godavari and Krishna
2.	Name of the Mandals	:	1. Eluru of West Godavari District 2. Unguturu of West Godavari District 3. Pedapadu of West Godavari District 4. Dendulurru of West Godavari District 5. Akiveedu of West Godavari District 6. Nidamarru of West Godavari District 7. Bhimadole of West Godavari District 8. Kaikaluru of Krishna District 9. Mandavalli of Krishna District 10. Nandivada of Krishna District
3.	Name of the Forest Division	:	1. Eluru 2. Vijayawada
4.	Name of the Forest Ranges	:	1. Eluru 2. Vijayawada
5.	Name of the Wild life Division	:	Wild life Management Division, Eluru.
6.	Name of the proposed Sanctuary	:	Kolleru Wild Life Sanctuary
7.	Approximate area of the proposed sanctuary	:	300.4 sq. kms. or 30,040 Hc.

Boundary Description :— The boundary runs all along the contour at+5'MSL.

East 'A' To 'B' :— The sanctuary starts at station 'A' Located at the North-Eastern corner located near Thokalapalli shivar as shown on the map at+5 countour of the lake. Then the line traverses generally in southernly direction along+ 5 countour of the lake till it reaches point 'B' located near Akiveedu village shivar as shown in the map While the line traverses along the + 5 countour of the lake it touches the villages of Tokalapalli, Bynepalli, D. Gopavaram, Pedu-nindrakolanu, Thimmaraogudem Adavikolanu, Chanamilli, Bavaipalem, Krovvidi, Pedakapavaram, Chinnakapavaram, Siddapuram Kolaparru, Dharmapuram, Maddivada and

Dumpagadurru Cutting across Kaikaram drain, Kaikaram No Channel pandicodu drain old Veyyeru canal, Chinnakapavaram drain.

2. South 'B' To 'C' :— Thence the line from point 'B' traverses generally in westernly direction all along the southern boundary of the lake along +5 countour till point 'C' which is located at South Western corner of the lake, as shown in the map, parallel to the road from Akiveedu to Kaikaluru touching the villages of Someswaram, Kottada, Penchikalamarru, Atapadu, Pallewada, Bhujabalapatnam, Gonepadu, Singapurram, Atapaka, Kaikaluru, Komatilanka, Deyyampadu, Chintapadu, Kovvadalanka, Pulaparru, Manugunuru, Nutchmilli, Penumakalanka, Nandigamalanka and cuts across Upputeru river, Polaraju drain, Eluru-Kaikalur road, Mouru canal Gudivada channel, Chandraiah drain and crosses the district Boundary at Kovvadalanka.

3. West 'C' To 'D' :— Thence the line from point 'C' traverses generally in a North and Northeasterly direction along +5 countour of the lake which lines east of Gundugolanu village. While the line traverses from point 'C' to point 'D' it touches the villages of Kalakurru, Manuru, Sriparru, Penangi, Lalipudi, Chatparru, Kovvali, Dosapadu, Pothunuru, Agadallanka Chettunapadu, Mallavaram, Pratikollanka, Paidichintapadu, Kokkirayalanka, Guddivakalanka to point 'A'. This line cuts across Dosapadu, Chanel, Bichinneru river, Ramileru river, Rachacodu drain, Tammileru West drain, Tammileru East drain, Mandigadu drain, Rallakoti channel, Kovvali drain Pothunuru drain, Pothanur channel and Eluru, Kaikaluru road and Eluru to Gudivakalanka road.

4. North 'D' To 'A' :- Thence the boundary line traverses in Easterndy direction till it reaches point 'A' at the North-Eastern corner of the lake along the +5 countour line, while the line traverses from point 'D' to point 'A' it touches the villages of Agadallalanka, Amberpeta, Pulla and Kaikaram cutting across No. 3 escape channel, Pulla No. 2 channel and Pulla No. 1 channel (Pothunuru channels).

Villages :

I Bed villages (Inside) :

1 Kaikaluru Mandal :

1. Chinnakaottada
2. Penchikalamarru
3. Vadlakuttilippa
4. Kollenkota
5. Laxmipuram
6. Gumallapadu
7. Gokarnapuram
8. Srungavarappadu
9. Kandirlapalligudem
10. Tangampadu

2 Mandavalli Mandal :

1. Manugunuru
2. Kovvadalanka
3. Penumakalanka
4. Nandigamalanka

3 Eluru Mandal :

1. Gudivakalanka
2. Kokkirayalanka
3. Prathikollanka
4. Paidichintapadu
5. Lalipudi
6. Komatilanka

4 Bhimadole Mandal :

1. Chettunnapadu
2. Mallavaram

II Belt Villages : (In the periphery and above +5)

5 Kaikaluru Mandal :

1. Atapaka
2. Kaikaluru
3. Chatakai

6 Mandavalli Mandal :

1. Chintapadu
2. Deyyampadu
3. Nuchumilli
4. Inglipakalanka

7 Eluru Mandal :

1. Chataparru
2. Sreeparru
3. Kolukurru
4. Manuru

8 Nidamarru Mandal :

1. Pedamindrakolanu
2. Thokalapalli
3. Krovvidi

9 Bhimadole Mandal :

1. Agadallanka
2. Amberpeta

C. S. RANGACHARI,
Principal Secretary to Government

రెవిన్యూ డివిజనల్ అధికారివారి పర్యవేక్షణలు

WITHDRAWAL NOTIFICATION

In exercise of the powers Conferred by Sub-Section (2) of Section 62 of the A.P. Gram Panchayat Act, 1964 read with G. O. Ms. No. 63, Panchayat Raj Department dated 28-5-1974 the Revenue Divisional Officer, Bandar hereby excluded the land specified in the Scheduled below vesting with Gram Panchayat of Bhavadevarapalli village of Nagayalanka Mandal in Krishna District from the date of publication of the Notification in the District Gazette.

SCHEDULE

District : Krishna
Mandal : Nagayalanka
Village : Bhavadevarapalli

R.S. No.	Scheduled Extent Ac.	Boundaries
(1)	(2)	(3)
1102/2	0.27	North : 1102/1 East : 1100/3 South : 1102/3 West : 1103/4

Attested

Divisional Forest Officer
Wild Life Management
E.L.U.R.U.

Appendix 12: Roads in the Kolleru Wildlife Sanctuary

S No	Mandal	Road from	Road to	Length (Km)
District - West Godavari				
1	Eluru	Pydichintapadu (WG)	Gokarnapuram (Krishna)	2.200
2	Eluru	Kaiakaluru R&B Road	Komatilanka	2.000
3	Eluru	Devichintapu	Pedayaga namilli	2.600
4	Eluru	Eluru - Kaikaluru R&B Road	Kalakurru Road	1.600
5	Nidamarru	Adavikolanu	Kolleru Fields	6.100
6	Nidamarru	Nidamarru	Kolleru Fields	8.100
7	Nidamarru	Chanamilli	Kolleru Fields	6.500
8	Nidamarru	Pedanendrakolanu	Kolleru Fields	4.600
9	Nidamarru	Chinanindrakolanu	Thokalapalli / Kolleru Fields	1.100
10	Nidamarru	Pulla	MM Puram Sayannapalem Road	0.150
11	Akivedu	Dumpagadapa	Basabanagi colony	1.000
12	Akivedu	Samatanagar Railway gate	Kollaparru SC colony	4.000
13	Akivedu	Samathanagar	Veerampalli Ramakrishna Road	0.300
14	Akivedu	Kolleru Upputeru R&B road	Dharmapuram Agraharam Road	0.300
15	Akivedu	Dharmapuram Agraharam Road	Kothpata via Nandimillipadu	0.370
16	Akivedu	Siddapuram R&B road	Kuruvaka	1.000
17	Akivedu	Kuruvaka	Veterinary hospital ring road	3.200
18	Dendu leru	Pothunuru	Chintakodu	0.400
19	Nidam arru	Korvvidipunta Road	Kolleru Fields	1.100
20	Nidam arru	Bavaipalem	Kolleru Fields	4.900
21	Eluru	Koteswaradurgapuram to Gudiwakalanka cross road	Mondikodu	4.000
22	Eluru	Koteswaradurgapuram	Gudiwakalanka	6.000
23	Akivedu	Kolleru	Upputeru Road	5.200
24	Akivedu	Kolleru	Bhimavaram Road	0.420
25	Eluru	Gudiwakalanka	Pathikodulanka	7.400
26	Eluru	Pathikodulanka	Pydichinthapadu	5.000
27	Eluru	Pydichinthapadu	Mallavaram junction	0.600
28	Eluru	Gudiwakalanka to Pathikodulanka Junction	Kokkirayalanka	6.600
29	Bhima varam	Mallavaram junction	Gundugolanu	0.600
30	Eluru	Eluru	Kaikaluru Road	3.000
31	Akivedu	Pedakapavaram	Kolleru Fields	1.250
District –Krishna				

32	Mandavalli	Devichintapadu	Pedayaganamilli	1.500
33	Kaikaluru	Penchikalamarru	Pedakottada	3.400
34	Kaikaluru	Pedakottada	Jangampadu	1.800
35	Kaikaluru	BG Road	Penchikalamarru (via) Varimallipalli	4.000
36	Kaikalluru	Alapadu	Someswaram	1.200
37	Kaikalluru	BG Road	Chatakai	2.600
38	Kaikalluru	Srungavarapadu	Pandiripalligudam	3.924
39	Mandavalli	Kaikaluru R&B Road	Kovvadalanka	1.000
40	Mandavalli	Pellewada	Penchikalamarru	4.000
41	Kaikaluru	Juvva Kanuma bridge	Jangampadu	4.000
42	Mandavalli	Kaikaluru R&B Road	Chintapadu	1.200
43	Mandavalli	Nandigamalanka limits	Penumakalanka to Pedayedlagadi	7.500
44	Mandavalli	Eluru	Kaiakaluru Road	1.300
45	Kaikaluru	Allapdu	Gokarnapuram	10.300
		Total		139.314

Source: DFO, Wildlife Management Division, Eluru

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Appendix 13: Major industries releasing effluents to the Kolleru

No	Industry	Effluent released (KLD)	Location	Origin of the canal to which effluent joins	Main Pollutant Load (Kg/day)	Nature of ETP	BOD after treatment	Remarks
1	M/S KCP ltd. Vuyyuru, Krishna	480	Vuyyuru,	Chandrayya drain	BOD =16800	Anaerobic digesters, anaerobic contact filter aerators and clarifier	2592 kg/day	Sugar & distillery unit
2	M/S Guardian papers ltd.Bommuluru	50000	Bommuluru	Ramilaru	Chlorides (800 mg/l) =14763	Anaerobic lagoon, 2 settling tanks aerators, neutralization lagoon clarifier	815 kg/day	Sick for the last 12 years
3	M/S Hanumathkali Varaprasad Babu Chemicals, Kodurupadu, Krishna	200	Kodurupedu	Budameru	BOD = 6000	Anaerobic lagoon, 2settling tank	840 kg/day	Sick for the last 12 years
4	M/S Milk products factor, Chittinagar, Vijayawada	700	Budameru drain	Budameru	BOD =4200 pH =4.1 Oil & Greece = 300	Greece trap, equalization tank primary clarifier, secondary inter stage clarifier sledged drying beds, aerators	4200 kg/day pH =4.1 Oil & Greece = 300 kg/day	Milk and Powder
5	M/S Rajarajeswari paper mills ltd. Bapulupadu, Krishna	2250	Bapulupadu (near Hanuman jn.)	Ramileru	BOD= 450 Chloride = 380	Screening primary clarifier, sledged drying beds, aerators	BOD = 70 kg/day	Craft paper Disposing to fields
6	M/S Rajarajeswari paper mills, Serinarasannapalam	31.5	Serinarasannapalam	Budameru	BOD = 41.5	Utilizing for eucalyptus trees	BOD = 41.5 kg/day	Only a straw board unit, sick unit
7	M/S Mohiddin	4.5	RR pet	Tammileru	BOD= 32	Setting tanks	BOD = 40.5	No

	Thambi, RR pet, Eluru				Chloride = 40.5		kg/day Chloride 32 kg/day	initiatives regarding the system. tannery
8	M/S AgrifuraL Chemical ltd. Serinarasannapalam	24	Veeravalli	Budameru	BOD = 21	Neutralization with lime	BOD =21 kg/day	Furfulraldi hyde sick unit
9	M/S Hanuman co-operative sugars-Hanuman jn. Serinarasannapalam	4.5	Veeravalli	Budameru	BOD =1.12	lagoon	BOD = 0.9 kg/day	Sugar Unit
10	M/S west Godavari co-operative Sugars, Bhimedelu	200	Bhimadelu	Elusuvagu drain	BOD = 1.12	lagoon	BOD =0.9 kg/day	Sugar unit

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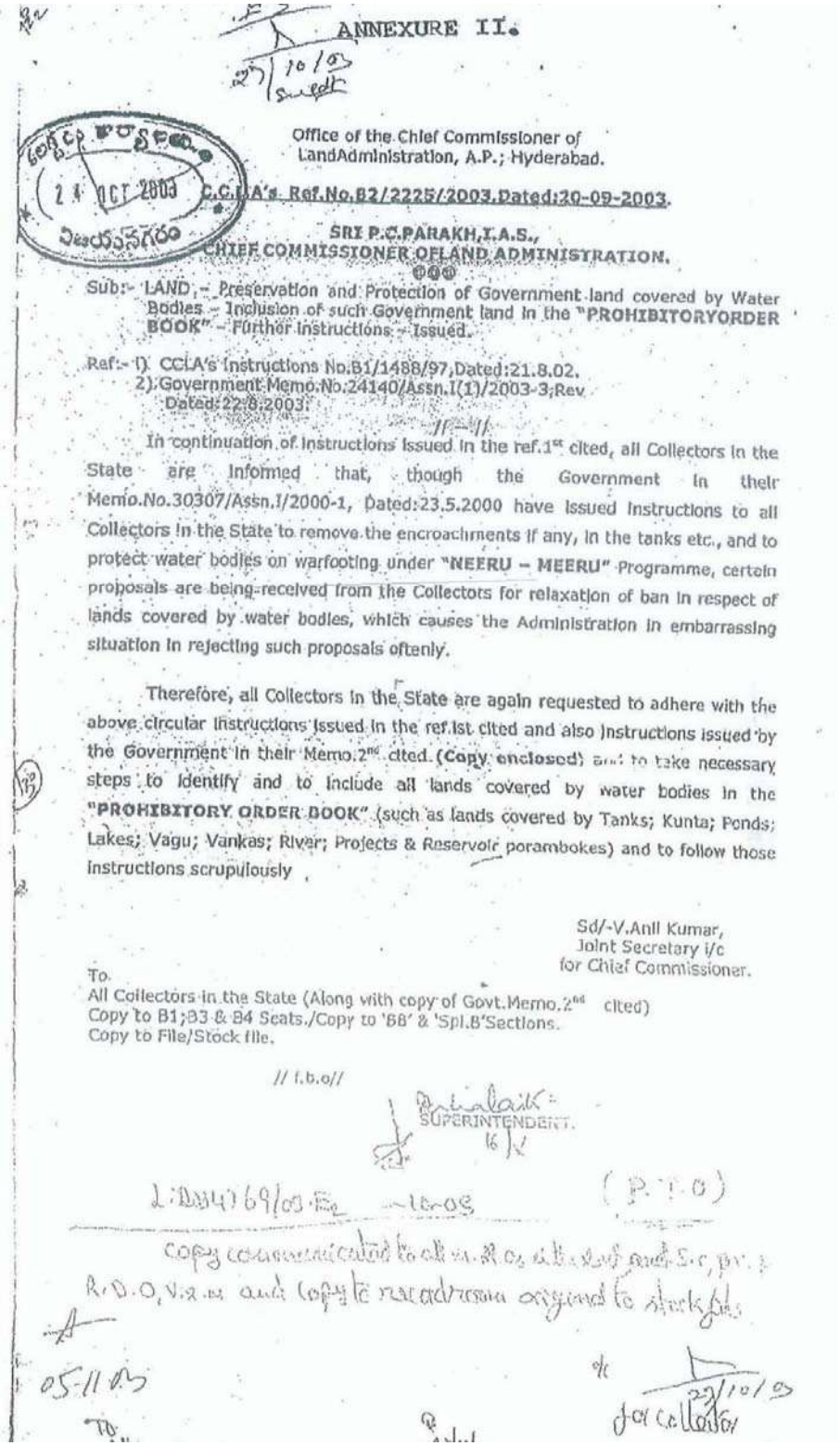
Appendix 14: Map of Kolleru Wildlife Sanctuary



ANNEXURE II.

Office of the Chief Commissioner of
LandAdministration, A.P.; Hyderabad.

C.C.L.A's. Ref.No.B2/2225/2003,Dated:20-09-2003.

SRI P.C.PARAKH,I.A.S.,
CHIEF COMMISSIONER OFLAND ADMINISTRATION.

Sub:- LAND - Preservation and Protection of Government land covered by Water Bodies - Inclusion of such Government land in the "PROHIBITORYORDER BOOK" - Further Instructions - Issued.

Ref:- 1) CCLA's Instructions No.B1/1488/97,Dated:21.8.02.
2) Government Memo.No.24140/Assn.I(1)/2003-3,Rev Dated:22.8.2003.

In continuation of instructions issued in the ref.1st cited, all Collectors in the State are informed that, though the Government in their Memo.No.30307/Assn.I/2000-1, Dated:23.5.2000 have issued instructions to all Collectors in the State to remove the encroachments if any, in the tanks etc., and to protect water bodies on warfooting under "NEERU - MEERU" Programme, certain proposals are being received from the Collectors for relaxation of ban in respect of lands covered by water bodies, which causes the Administration in embarrassing situation in rejecting such proposals oftenly.

Therefore, all Collectors in the State are again requested to adhere with the above circular instructions issued in the ref.Ist cited and also instructions issued by the Government in their Memo.2nd cited (Copy enclosed) and to take necessary steps to identify and to include all lands covered by water bodies in the "PROHIBITORY ORDER BOOK" (such as lands covered by Tanks; Kunta; Ponds; Lakes; Vagu; Vankas; River; Projects & Reservoir porambokes) and to follow those instructions scrupulously.

Sd/-V.Anil Kumar,
Joint Secretary i/c
for Chief Commissioner.

To
All Collectors in the State (Along with copy of Govt.Memo.2nd cited)
Copy to B1;B3 & B4 Seats./Copy to 'B8' & 'Spl.B'Sections.
Copy to File/Stock file.

// f.b.o//

SUPERINTENDENT.

Appendix 15: Order to adhere to "Prohibitory order Book"