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Regeneration and Rejuvenation of Water Bodies in the City of Bhawanipatna

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Abstract: *Water is one of the essential resources for human survival. It is also a precious national resource linked to every aspect of development. With less than 3% of the Earth's water being fresh, the need to conserve and manage it is crucial. Global warming, climate change causes inadequate rainfall which are the reason for the water stress condition of India. It affects the level of water in ponds and lakes and eventually dries them up. Water bodies like lakes and ponds are integral for drinking water, agriculture, and urban purposes. Assessing freshwater resources and implementing conservation measures are essential for sustainable development. Watershed development, rainwater harvesting, and water recycling are essential for sustainable water supply in the coming future.*

Regeneration and rejuvenation of water bodies are important for sustainable development of cities and towns as they help in water conservation, ground water recharge, improve climatic conditions, supports bio-diversity, etc. In which community plays an important role in the regeneration and rejuvenation process.

Bhawanipatna is the city and the district's headquarter of the Kalahandi district in the Indian state of Odisha. These water bodies both big and small have an inseparable impact on the aestheticity and operational functionality of the city. They are a vital part of the temperature regulatory mechanism and help the city in various other ways. Bhawanipatna, having highest population growth in the Kalahandi District, faces an imminent and acute water scarcity due to the lack of development as compared to other cities. Asha Sagar Pond which is located at the epicenter of Bhawanipatna has a significant amount of land cover that impacts the lifestyle and influences the microclimate of the study area.

Implementation of water management scheme with local community participation is essential for sustainable urban development of cities and towns. Restoration methods such as preventive and ameliorative method can help in overcoming water scarcity at a micro to city level.

There is a growing concern in many quarters that the world is running out of water. According to the United Nations Development Programme (UNDP) Human Development Report 2006, for over a billion people around the world, water access is unreliable, unsafe or beyond their purchasing power (UNDP, 2006). Urban areas in India are facing a water crisis due to loss of watershed, increasing levels of pollution, deteriorating water balance, lowering of water table and a dire lack of groundwater recharge (Singh, 2012). Regeneration and rejuvenation of water bodies are important for sustainable development of cities and towns as they help in water conservation, ground water recharge, improve climatic conditions, supports bio-diversity

Keywords: *Regeneration, Rejuvenation, Water bodies, Degradation, Ponds (tank/talab/bandh), Urbanization, Restoration methods, Water harvesting, Preventive method, Ameliorative method.*

I. INTRODUCTION

Water is a precious national resource & essential for human civilisation, living organisms, and natural habitat. Water is linked with every aspect of development. It drives economic growth, supports healthy ecosystems, and is essential and fundamental for life itself. Water is used for drinking, cleaning, agriculture, industrial purpose, recreation, animal husbandry, generation of electricity and lot of other purposes as well. Only less than 3 percent of the total water available on the earth is fresh water, of which about 75.2 percent lies frozen in polar regions and another 22.6 percent is present as ground water.

The rest is available in lakes, rivers atmosphere, moisture, soil and vegetation. In fact, a very small proportion of fresh water is effectively available for human use.

Water is a recyclable resource but the availability is limited and the gap between the supply and demand is widening over time. Climate change on global scale will be creating more water stress conditions in many regions of the world. Since there is a declining availability of freshwater and increasing demand, the need has arisen to conserve and effectively manage this precious life giving resource for sustainable development. There is need to encourage watershed development, rainwater harvesting, water recycling and reuse, and conjunctive use of water for sustaining water supplying in long run.

India had abundant supply of water resources. However from being a water abundant country India is gradually progressing towards water scarcity due to increasing population pressure and urbanization. At present, it is sustaining 18 percent of world population with only 4 percent of global water resources. Therefore management of water resources has assumed great importance. Today availability of water resources is a major issue and is a big challenge facing our country. Water bodies are an integral part of fresh water resources. The landscape of India is dotted with large number of water bodies such as lakes, tanks, and ponds, which have historically played a crucial role in supplying drinking water, supporting agriculture, and serving as a source of minor irrigation. These water bodies also play a significant role in urban areas, serving as sources of drinking water, floodwater absorption, and groundwater recharge. Therefore, assessing the existence and usage of freshwater resources and implementing measures for their conservation and restoration are essential for healthy and sustainable development.

II. NEED OF THE STUDY

- 1) Most of the natural lake pollution problems are caused by nutrients, mixing of contaminants, and sediments carried into the lakes by the rivers and other free flowing water bodies.
- 2) These water bodies both big and small have an inseparable impact on the aestheticity and operational functionality of the city. They are a vital part of the temperature regulatory mechanism and help the city in various other ways.
- 3) Bhawanipatna, having highest population growth in the Kalahandi District, faces an imminent and acute water scarcity due to the lack of development as compared to other cities.
- 4) Asha Sagar Pond which is located at the epicenter of Bhawanipatna has a significant amount of land cover, that impacts the lifestyle and influences the microclimate of the study area.
- 5) There are also many mini ponds, tanks and other natural water bodies whose water quality are being deteriorated everyday due to anthropogenic activities and which are in need of immediate human intervention to restore them to their former glory.

III. STUDY AREA

- 1) Bhawanipatna is the city and the district headquarter of the Kalahandi district in the Indian state of Odisha.
- 2) Bhawanipatna is a city of numerous temples dedicated to different deities of Hindu pantheon. It is named after the presiding deity, Bhawani-Shankar.
- 3) Bhawanipatna municipality is the administrative head of the city, which is divided into twenty wards (20) with different sub-areas called para (pronounced "padaa").
- 4) Originally, these paras were inhabited by people of different communities, but over the last few decades, these Paras have become homogeneous. Bhawanipatna has more than forty-two paras. It is one of the peaceful and biggest urban areas of Western Odisha.

TABLE I
Demographic Data Of Bhawanipatna

DEMOGRAPHIC DATA		
Area		15.40 SQ.KM
Population	Male	35,506
	Female	33,539
Total		69,045
Number of households		15,599
Number of wards		20
Sex ratio	Female	945
	Child	911
Literacy rate	Male	90.95%
	Female	78.72%
Average		85.00%

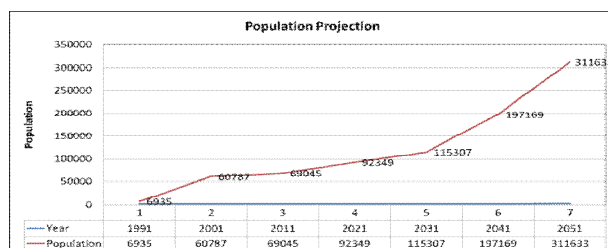


Fig. 1 Population Growth Graph Of Bhawanipatna

The population projection shows 2051 it will be 311633.

The population projection is the average of Arithmetical increase method , Geometrical increase method ,Incremental increase method. From 1991 to 2051.

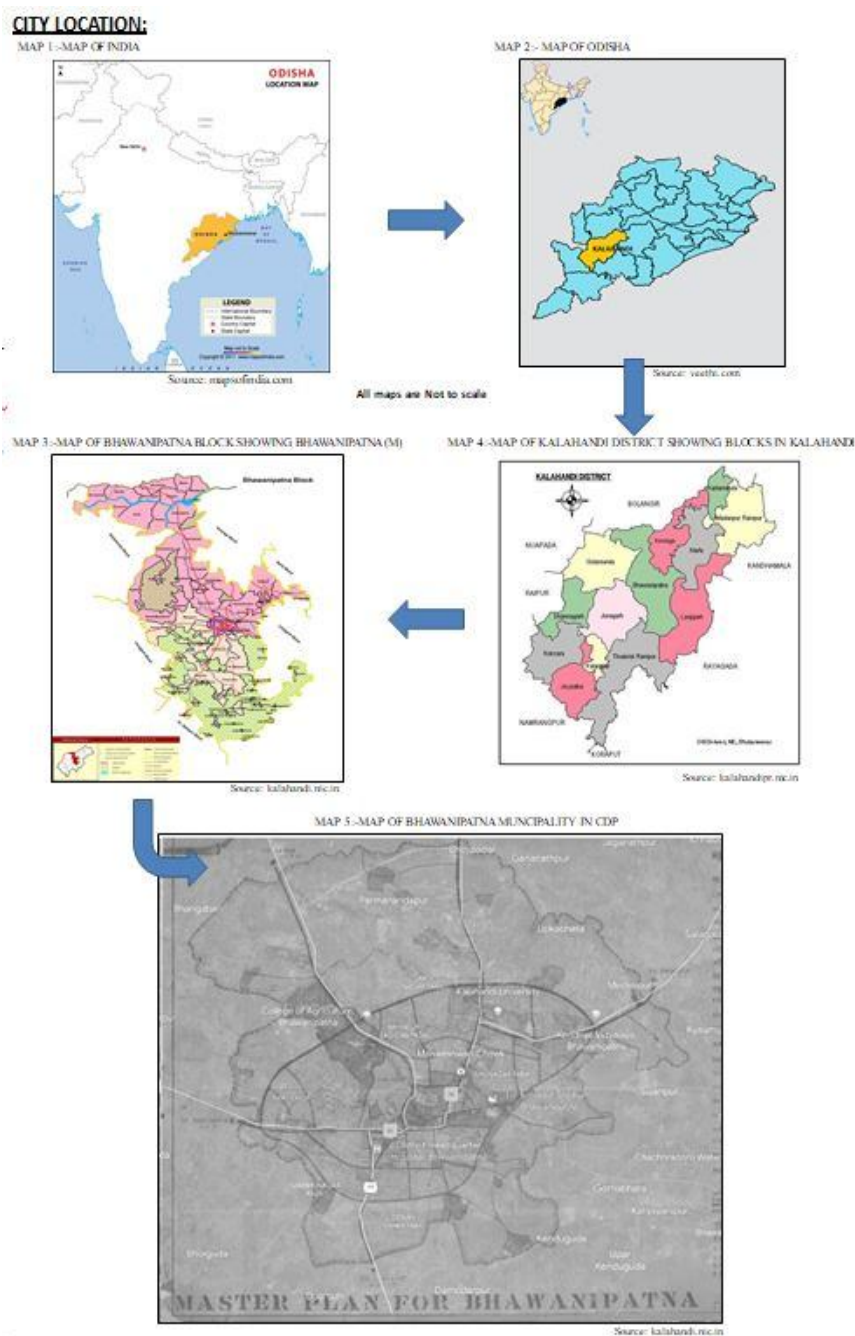


Fig 2: regional connectivity map of Bhawanipatna city.

A. Location and Connectivity

Bhawanipatna is located at 19.9°N 83.17°E. It has an average elevation of 248 m (814 ft).

Nearest railway station- Bhawanipatna railway station

Nearest bus stand- Bhawanipatna Bus Stand.

Nearest airport- Utkela airstrip, Swami Vivekanand Airport, Raipur.

Nearest health care- Bhawanipatna govt. Hospital

B. Climate and Rainfall

Tropical wet and dry climate

Climate Temperature

In summers – the temperature can also go up to 50 °C (122 °F).

In winters - lows can fall to 5 °C (41 °F).

The city receives about 1283 millimetres (51 in) of rain.

IV. DATA COLLECTION AND ANALYSIS

TABLE II

Water bodies (Tanks, Ponds, Lakes) details and their uses inside Bhawanipatna

Sl. no	Name of the water bodies	Area in acres	Depth	Ownership	Utilities
1	Asha sagar	74.00	3m-4m	Public	Irrigation and daily use
2	Purnapada bada bandh	4.87	3m-3.5	Public	Recreational and temple use
3	Purnapada san bandh	1.00	2m	Public	Recreational and temple use
4	Nua bandh/Makadi bandh	3.00	3m-4m	Public	Recreational and daily use
5	Purusottam sagar bandh	9.00	3m-4m	Private	Temple tank and recreational
6	Darpan sagar	5.00	2m	Private	Recreational and daily use
7	Ram sagar bandh	3.00	4m-5m	Public	Recreational
8	Pond near vimala convent	1.33	3.5- 4m	Public	Recreational
9	Pond near fishery office	1.97	3.5- 4m	Public	Recreational
10	Naktiguda bandh	0.93	2m	Public	Recreational and daily use

TABLE III

Water bodies (Tanks, Ponds, Lakes) details and their depletion of area

Sl.no	Name of the water bodies	Location (Dms)	Area in acres	Area in acres (present)	Depth
1	Asha sagar	19°54'44"N 83°9'41"E	74.00	4.00	3m-4m
2	Purnapada bada bandh	19°54'7.9"N 83°9'31.1"E	4.87	4.00	3m-3.5
3	Purnapada san bandh	19°54'4.7"N 83°9'29.5"E	1.00	0.50	2m
4	Nua bandh/Makadi bandh	19°54'36.55"N 83°9'59.22"E	3.00	2.75	3m-4m
5	Purusottam sagar bandh	19°54'16.2"N 83°10'8.2"E	9.00	8.00	3m-4m
6	Darpan sagar	19°54'15.3"N 83°10'48.2"E	5.00	4.00	1m
7	Ram sagar bandh	19°54'59.1"N 83°10'20"E	3.00	3.00	4m-5m
8	Pond near vimala convent	19°54'56"N 83°10'24.3"E	1.33	1.00	3.5- 4m
9	Pond near fishery office	19°54'55.3"N 83°10'19.3"E	1.97	1.50	3.5- 4m
10	Naktiguda bandh	19°54'42.6"N 83°8'31.3"E	0.93	0.80	2m

- 1) There are 10 water bodies identified in this study.
- 2) In this study I have found that all of the water bodies are man made water bodies.
- 3) From the above table we can see that the most of the water bodies are public owned and other are privately owned water bodies.
- 4) Water bodies like Asha Sagar, Purusottm Sagar are made on the Ghodagath Nala which is the source of water for these water bodies.
- 5) Other water bodies are confined water bodies the water come from the surrounding area and pond itself.
- 6) Most of the ponds and lakes are polluted due to solid waste dumping in these water bodies.

Reasons for degradation of water bodies are :-

- a) Encroachment around the water bodies .
- b) Slum around the water bodies .
- c) Waste water/sewage water discharge.

- d) Improper maintenance and periodic cleaning of ponds and street near it.
- e) Water recirculation.
- f) Lack of territorial encampment.
- g) Open defecation.
- h) Shortage of drains and deteriorated condition of drains.
- i) Vegetation growth around and inside water bodies.
- j) Weed covering in the water bodies.
- k) Encroachment of dykes
- l) Solid waste dumping.

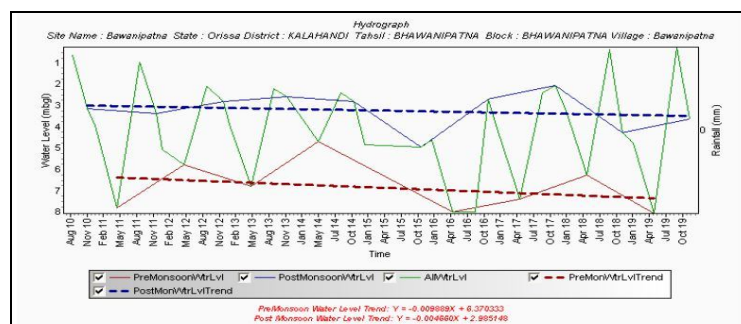


Fig 3 -Hydrograph (2010-19), Bhawanipatna, Bhawanipatna Block.

- An annual rising limb in hydrographs, indicate the natural recharge of groundwater regime due to monsoon rainfall, as the monsoon rainfall is the only source of water.
- However, the groundwater draft continuously increases as indicated by the recessionary limb.
- The groundwater resources where not replenished / recharged fully, the groundwater levels come under continuous stress and deplete.
- It has also been observed that there were few years when the recharge exceeded draft for a particular period or year but in the next successive year, the draft again exceeded recharge.

Issues:- Even if people are getting water supply they are using ground water which is used in any unprecedented manner.

- Due to lack of proper check and mis-management of water connection people are relying on ground water.
- No check on ground water use.

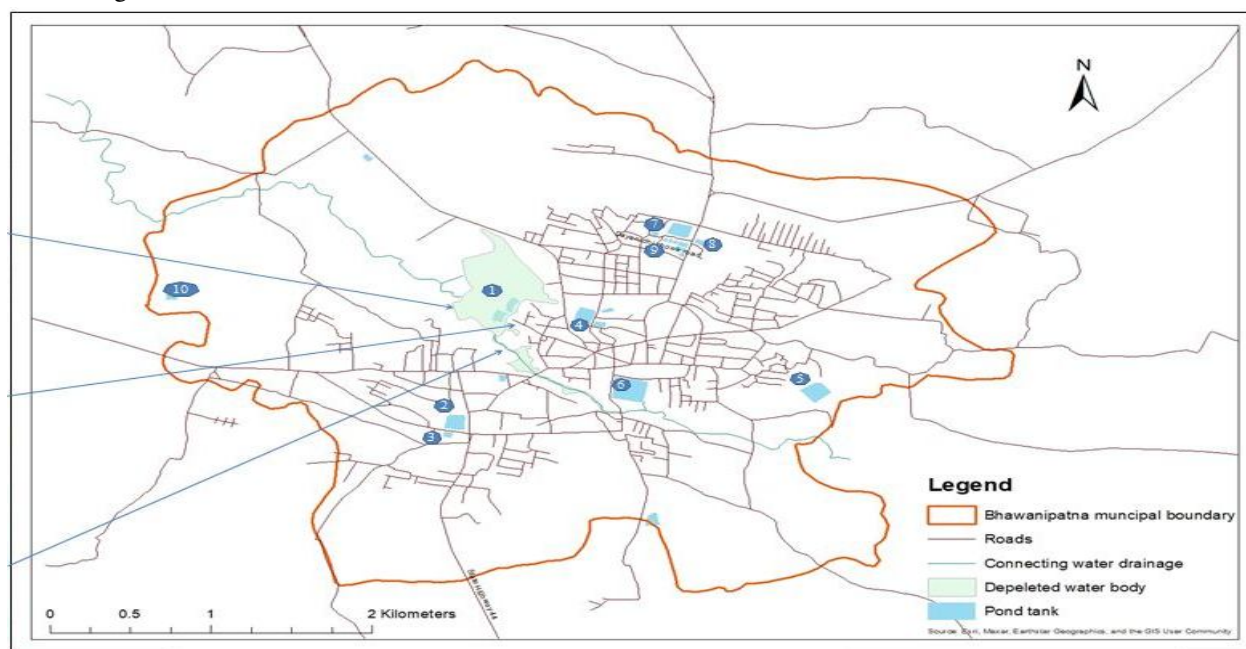
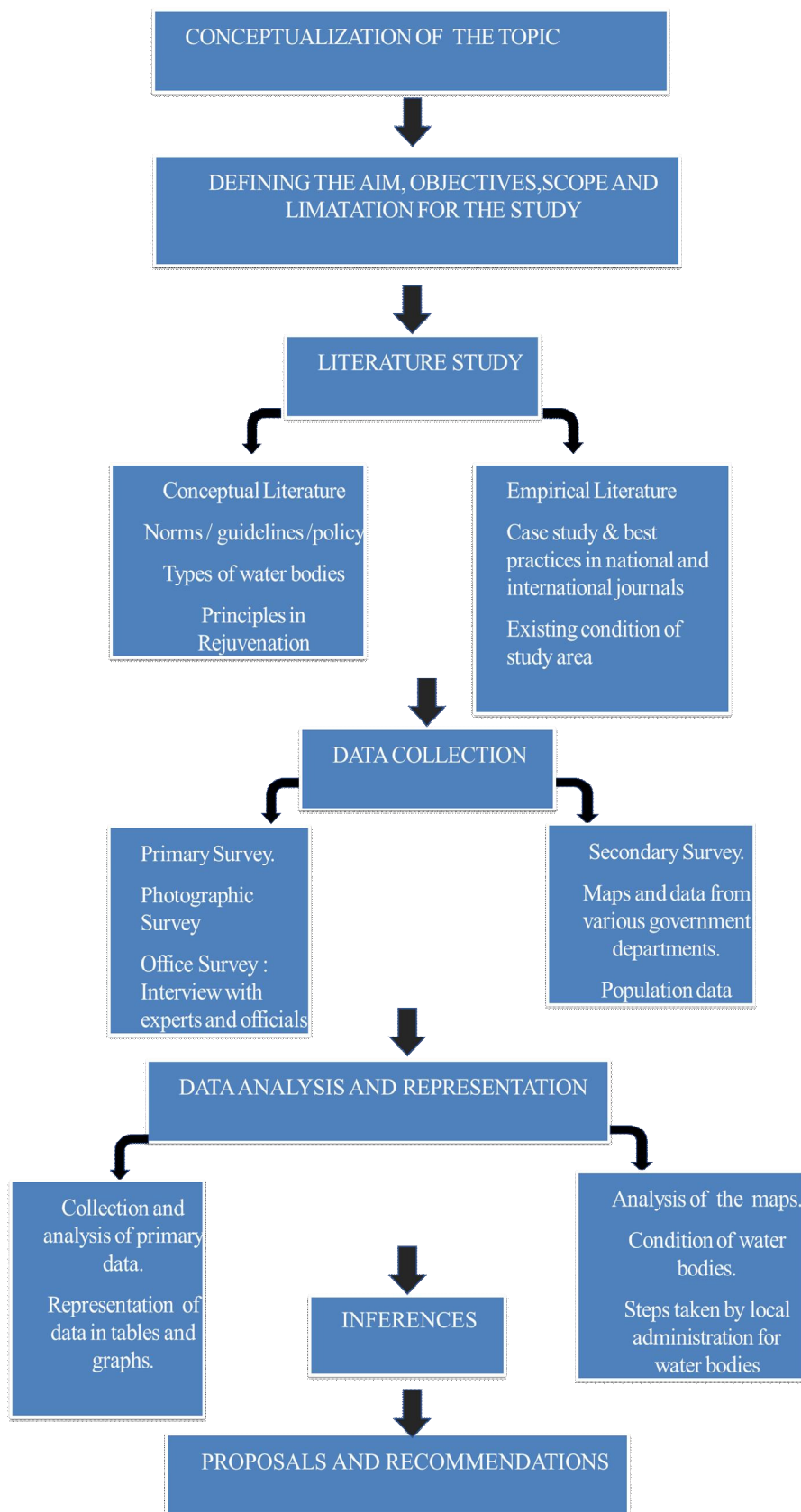


Fig 4 - MAP OF BHAWANIPATNA MUNICIPALITY SHOWING WATER BODIES

V. METHODOLOGY



VI. PROPOSAL

A. Lakes And Ponds Restoration Methods

Restoration of lakes for improvement in water quality requires therefore interventions that address both the factors responsible for an increase in nutrient load and the accumulated nutrients. The various lake restoration methods can be considered under two broad categories:

1) Preventive Or Indirect Methods

- a) *Drainage Basin Alterations*: This approach is useful primarily for controlling nonpoint sources of pollution which are incidental to the land use of the drainage basin of the lake. The drainage basin alterations involve structural and land treatment measures and interception of nutrients and sediments before they reach the lake. The main soil erosion management practices include terracing, contour farming, grassed waterways, conservation cropping systems, crop residue management or increases in the amount of residue left after harvesting, and creation of shelter belts.
- b) *Diversion of Wastes*: This is a frequently-used solution for improving the water quality of eutrophic lakes. In the cases cited, sewage effluents were the main source of lake eutrophication. Their diversion resulted in a marked improvement in quality as measured by increase in transparency, decrease in phytoplankton biomass, and increase in species diversity.
- c) *Legal Control Measures*: Some political jurisdictions can impose legal controls on the land use and discharge of nutrients so as to restrict uses with direct or indirect pollution potential or effects.

2) Ameliorative Or Direct Methods

a) In-Lake Physical Methods

- Mechanical Harvesting of Biomass
- Lake Deepening or Dredging
- Admission of Unpolluted Waters (Dilution/Flushing)
- Aeration of Water
- Hypolimnetic Drainage
- Lake Drawdown
- Lake Bottom Sealing

b) In-Lake Chemical Methods

- Phosphorus Precipitation
- Use of Algicides and Herbicides

c) In-Lake Biological Methods

Species manipulation is the main in-lake biological method for lake restoration. The method considers the introduction or promotion of organisms that are inimical to the target organisms. In nature, predation by zooplankton and fish species keeps a sort of control on algal populations. Biological in-lake control measures are still in their infancy and are not widely used.

d) Out side-Lake Physical Methods

- Mechanical Treatment
- Reduction in Sediment Input

e) Outside-Lake Chemical Methods

- Clarification
- Active Carbon Adsorption
- Ammonia Stripping
- Nutrient and Ion Removal
- Disinfection

f) Out side-Lake Biological Methods

Primary treatment of sewage is achieved with plain sedimentation. The fresh solids contain most of the settleable solids in the raw wastewater. An aerobic digestion destroys about 67 percent of the volatile matter, and about a quarter of it is converted to fixed solids.

The secondary treatment includes trickling filters and activated sludge. Advanced waste treatment methods and processes remove more contaminants from wastewater than are usually taken out by conventional secondary treatment plants.

OTHER PROPOSAL

Creation of a pond through rainwater harvesting:

Ponds can be created in a cost-effective manner and don't require a sizable initial investment. They play an important role in providing ecosystem services and help improve the life quality of residents around them.

Environmental Education and Awareness:

This effective management method is increasingly popular in conserving pond environments in urban areas and is essential to keep the lake protected after the revival and rejuvenation processes get completed. The project will help educate the local populace of the need to conserve existing water bodies.

Revival of the area's original wetland ecosystem through set-up of bio-intensive beds to help the growth of indigenous plants and trees: Local plants take easily to an area and do not require a lot of maintenance which makes them ideal for cultivation. They also help in improving the water and air quality of the area where they are planted

VII. CONCLUSIONS

The study clearly highlights the fact that the city of Bhawanipatna is gifted with water bodies around it that have a huge potential for sustainable development of the city. Water is one of the essential resources for human survival But in the lieu of fastened urbanisation and growth there are increasing pressure on the natural assets especially water bodies which are facing degradation and threat of eviction. Lack of public awareness, poor infrastructure support, absence of proper management framework have been constantly influencing the deteriorating condition of water bodies and their associated neighborhoods. Investment in regeneration and rejuvenation of these water bodies and networking among such public spaces in Bhawanipatna can boost tourism, a labor intensive industry that provides proportionally more income opportunities for the cities low-skilled laborers and the poor. Furthermore research could be carried out not only to upgrade the existing condition of each Talav, but interlink them and develop a network and stretch of continuous public space which would enhance the quality of life and livability in the city.

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