

## **Rejuvenation and Restoration of the Lakes & Ponds**

### **Proposed Components for Integrated Action Plan (IPA)**

Global Aqua Treatment Technology Pvt Ltd. has expertise and experience in the restoration of polluted lakes. Two Lakes viz., Nainital and Naukuchiatal have been fully restored using aeration technology in the past few years. Lake Nainital was highly polluted with blooms of blue green algae for major part of the year with many episodes of fish mortality during the year. Likewise water transparency in Naukuchiatal was also very poor. Hypolimnion was deficient/without oxygen in both the lakes. To restore both lakes aeration system was designed taking in view the water quality conditions and physical and biological characteristics of the lake. Aeration of the lakes was resorted using compressors and aeration discs. The technology of bottom to top aeration was employed. The thermocline was broken down with the help of aeration resulting into circulation of the water. Gradually nutrients declined, toxic gases reduced and blooms of algae started to decline. The population of the blue greens was reduced significantly. The amount of the muck at the bottom was also reduced with passage of time. The mortality of fish was totally stopped. The water transparency of the lake greatly increased. Biomanipulation of the food chain was also done. As a result the population of the most prestigious sport and food fish Mahseer which has almost disappeared from the lake was developed. Both the lakes now have very good health.

Lake & Ponds has extremely high level of pollution due to inflow of sewage and other waste materials from the township. The lake with high levels of BOD, COD, nutrients, heavy metals, coliform bacteria seems to be lost resilience. Many time froth formation takes place in lake. There seems to be no useful biological life in the lake. A considerable part of the lake remains be infested with weeds. For the “Rejuvenation and Restoration for the City Lake/Ponds,” following multipronged activities will be incorporated to reclaim the polluted Lake/ponds/nallahs and rivers.

#### **1. Bioremediation with beneficial Bacteria and Microorganisms by decomposing deposited sludge**

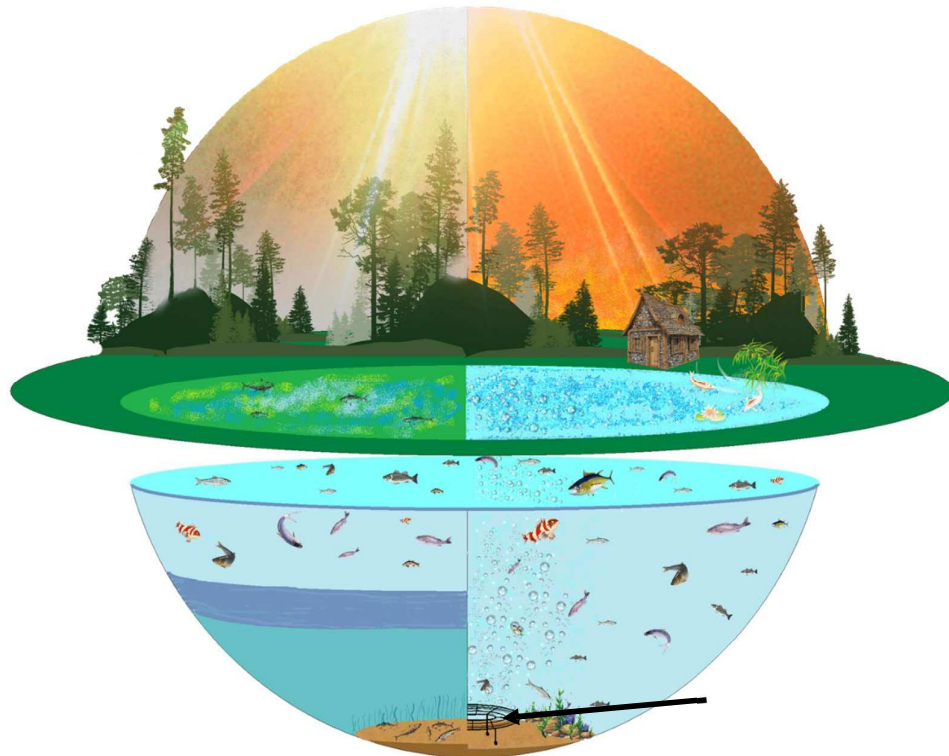
Sufficient quantity of beneficial bacteria and other useful microorganisms will be introduced to reduce huge amount of organic load that is deposited in the lake/pond and improve its water quality for restoring the lake ecosystem.

The sludge reducing bacteria provide effective treatment at low cost in comparison to physical sludge removal. The treatment with bacteria significantly reduces accumulated sludge, minimizes odor, and improves Lake Quality. The treatment has been found to be highly effective in several industrial wastewaters. Following are the major benefits of the sludge digester (Bacteria).

1. Reduction in COD/BOD levels
2. Reduction in sludge yield and accumulation
3. Reduction in foaming improving facility treatment capacity
4. Removal of odor generation
5. Improvement in floc formation and settling characteristics
6. Improvement of FOG removal
7. Removal of nutrients

**2. Micro bubble aeration of lake/ponds water**

To oxygenate the lake water which is generally anoxic or has poor oxygen concentration, reduce BOD level, optimize nutrient load of nitrogen, phosphorus, and other elements in the whole lake column for proper growth of primary producers by improving the water quality, lake aeration will be done through aeration discs fixed at bottom covering the whole lake area connected with compressors.



**3. Biomanipulation to Maintain the food chain Spectrum**

The integrity of the lake ecosystem depends on the food chains present in the lake. Pond/ Lake hardly has any useful biological life. To develop a balanced ecosystem in lake/Ponds with ecological resilience, environment friendly biological life will be developed at the different trophic levels through Biomanipulation. The technical intervention will be done in such a manner that the population of the undesirable fish species (weed fishes) is reduced. The lake will be stocked with eco-friendly fishes/organisms (beneficial zooplankton, phytoplanktivorous fishes, weed eating fishes and insectivorous fishes) as per requirement. Also aquatic weeds present in the lake will be controlled through different dewatering methods and collected macrophytic vegetation will be used to produce biogas (CNG) and biofertilizer.

**4. Catalytic Oxidation of Polluted Nallah water to be used in lake by Hydrobiox system by the Collection of drain trash**

To reduce the trash and organic load coming from the urban runoff in the lake due to anthropogenic activities, hydrobiox technology will be used so that the undesired materials don't find entry into the lake.

**5. Ozonation of Lake/ponds**

In lakes which have very high organic matter, the aeration with oxygen has to be supplemented with ozone in permissible limit for effective restoration of the water quality of the lake. The benefits of ozonation are as follows-

- Ozone dissolves into water 13 times faster than O<sub>2</sub>
- Kills viruses, bacteria, molds, spores, and cysts up to 3000 times faster than chlorine
- Oxidizes Nitrite to Nitrate
- Oxidizes organic nutrients, chlorohydrocarbons
- Precipitates iron, manganese, and heavy metals from water
- Produces increased water clarity
- Has been shown to affect soil absorption rates of salts and other compounds

As Lake /ponds is highly polluted, oxygen in water column is almost absent, nutrient concentrations are very high due to inflow of sewage, organic matter is also very high, aeration is to be supplemented with ozonation.

**6. Removal of Water Hyacinth & unwanted weeds**

- Water Hyacinth is considered one of the most noxious invasive aquatic weed. This plant is a floating aquatic perennial, with distinctive bladder-like swollen leaf petioles giving buoyancy. It has shiny rounded leaves with thick masses of feathery dark roots which can reach 2.5 m in length. It proliferates rapidly in lakes, dams and irrigation channels and chokes them.
- Dewatering of water hyacinth will be practiced with biological, mechanical/manual measures. The most common practice is trying manual methods but regeneration being faster than removal; lakes sooner than later get covered with water hyacinth. In recent years, harvesters are used for cleaning lake. The harvester vehicle is equipped with harvesting equipment.

**7. Biomethanation Production(CNG)**

**BIOGAS & MANURE GENERATION FROM WATER HYACINTH BY ANAEROBIC BIOMETHANATION PROCESS**

**The HYDROMETHANATION Process consists of**

- Reception and storing of press mud
- Mechanical agitation for slurry preparation
- Anaerobic Digestion / Gas holding
- Biogas generation
- De-watering of slurry to produce organic fertilizer

### **The Salient Features of Hydro methanation Process**

- Digester / Bioreactors are specially designed tanks.
- The Hydromethanation process takes place in closed vessels, thereby avoiding odour nuisance or leakage of biogas into the atmosphere.
- The Hydromethanation process produces both energy and organic fertilizer. Biogas produced by generators will be used preferentially to supply the Biogas requirements of the plant. The surface area required for a Hydromethanation plants only 20% of that required for an aerobic composting installation.
- The high quality biogas of the Hydromethanation process is converted into power in a power plant by the gas engine generator. Thus the Hydromethanation plant produces plenty of excess power for sale.
- The quality of Hydromethanation humus is very high. In the Hydromethanation process all disease-producing micro-organisms are eliminated. The maturity is Grade IV or better according to the German classification. The organic matter content is 30-40%. Humus does not contain easily mineralizable carbon or pathogenic bacteria.
- Anaerobic digestion by the Hydromethanation process requires only 15-20 days as compared to a minimum of few months required for aerobic methods.

In the Hydromethanation process, sewage can be conveniently and economically co-digested with solid waste.

### **8. Laboratory for Water Quality Monitoring**

The continuous monitoring of the water quality including the physiochemical features, bacterial load, gases etc. will be very important for the management of the lake. A well equipped laboratory will be established to cater the analytical requirement of the water quality monitoring. The samples for the water quality analysis will analysed in the laboratory on daily and weekly basis as per requirement. The Laboratory will be equipped with necessary equipment like water quality analysers, laminar flow, BOD, COD analyser, H.P.L.C. etc.

### **9. Fisheries Development**

Biodiversity development including fisheries for the balanced ecosystem of the lake will be one of the strategies for conservation of the lake. This will include development of the environmental friendly fish species and other useful aquatic life. The effort will also be made to stock Dolphin in the lake after its restoration.