



Case Study: Eco-restoration of contaminated waterbody at Rishra, West Bengal

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Keywords

Water, Contamination, Bio-remediation, Phyto-remediation, Floating Gardens, Bioengineering

The Project solution is conceptualised and implemented by Shri C.S. Pradeep Kumar who is a biotechnologist and Founder &CEO, Biostarts Ventures.

Biostarts Ventures is a start-up incubate company at EKTA Incubation Centre – Maulana Abul Kalam Azad University of Technology (MAKAUT-formerly WBUT) under Department of Science and Technology (DST) and Department of Biotechnology (DBT), Govt. of India engaged in developing applications of bio-engineering techniques for sustainable environment management solutions

Symbio Greentech has developed an innovative biotechnological intervention on pollution management by using natural material to protect & restore our Natural Resources. The integrated climate-friendly technologies to clean & restore the contaminated canals, water bodies and degraded river embankment through Biotechnological Interventions and eco-friendly application of natural fibres, Biomass and beneficial microbial consortium and sustainable plants such as Vetiver, Cana and many plant species for sustainable reclamation water, soil decontamination, odour free and clean & green environment.

The methodology based on bio-remediation and phyto-remediation process by the application of Coir / Jute geotextiles as a bio mulch to host the beneficial microbial colony. The beneficial microbes application degrading the organic contaminants and the sustainable plants will act as a biofilter and soil stabilization & to absorb the toxic components in the water.

Bio-Remediation uses living things to break down or remove toxins and harmful substances from soil and water.

Phyto-Remediation is the direct use of living green plants growing for removal, degradation, or containment of contaminants in soils, sludge, sediments, surface water and groundwater.

The uptake of contaminants in plants occurs primarily through the root system, in which the principal mechanisms for preventing contaminant toxicity in water by phyto-remediation. The root system provides an enormous surface area to beneficial along with Geotextiles that absorbs and accumulates the water and nutrients essential for growth, as well as other non-essential contaminants.

The whole methodology will establish with clean water canal to enjoy the green nature and healthy environment. This process is a unique integration of biological techniques for water decontamination and may be the only technology today to clean the contaminated canal water. However, concerned government departments should give a priority for enforcing untreated waste & polluted water into the canal, especially by industries located in the upstream.

Project Details:

- **Location:** The project is a 10000 Sq.M rectangular waterbody located adjacent to RISHRA Railway Station & Morepukur 1st Lane, Rishra, District: Hooghly, West Bengal, which is on the western banks of the River Hooghly (a distributary of the Ganga) around 30 Kms north of Kolkata.



Rishra Municipality,
West Bengal



Aerial View of Water Body near Rishra
Railway Station

Project support under CSR fund and Govt. organizations

- **Project Management Organization** – The project was conceived as part of the Corporate Social Responsibility (CSR) initiative of the Aditya Birla Jan Seva Trust which is part of the Indian textile major Jaya Shree Textiles, a unit of Aditya Birla GRASIM.
- Supporting Organizations – RISHRA Municipality, Dist: Hooghly and Eastern Railway Howrah Division, Howrah
- Project Land ownership: Official Permission was obtained from Office of the DIVISIONAL RAILWAY MANAGER (DRM) Eastern Railway, Howrah who are the owners of the land.
- Municipal jurisdiction: Rishra Municipality, Rishra, District: Hooghly
- **Project Period:** January 2017 to November 2017

The project objective:

1. To install an integrated environmental management project on waterbody eco-restoration of the contaminated waterbody.
2. To do pollution management of the waterbody and surrounding areas through Green technology applications to create a clean environment.
3. To ensure participatory planning and implementation of the project by involving local inhabitants in the proposed project area through awareness programs and training.

Expected outcomes of Water Body Eco-Restoration

- Protection and Restoration of Water Body by Eco-friendly materials
- De-contamination of Waterbody using Bio-remediation and Phyto-remediation
- Sustainable Greening of Waterbody for pollution control in Water, Soil and Air
- Application of NATURAL MATERIALS to Protect & Restore NATURAL RESOURCES
- Usage of Jute (a main product of Bengal) for Environment and thereby using local materials
- Local Community employment generation in preparing the Jute, Coir materials, Plants and income generation through the implementation of Waterbody Restoration.

The situation at the time of Starting Water body Restoration

The 10000 Sq.m water body is contaminated due to the dumping of organic and inorganic waste from surrounding communities and incoming greywater from neighbouring households. There is a makeshift vegetable market 50 m from the waterbody, which is a source of waste and effluent dump leading to water pollution, algae formation, water hyacinth and stinging odour. Just adjacent to the waterbody on the northern side are also some railway colonies, which have poor sanitary conditions often leading to flow of greywater to the water body

There is one major grey water drain is connected to the water body with the continuous flow of water inlet from the Railway quarters residents, un-organized settlements and the market area. The west side of the water body having housing complexes and the grey water is flowing through small drains.



Water Body situation before restoration

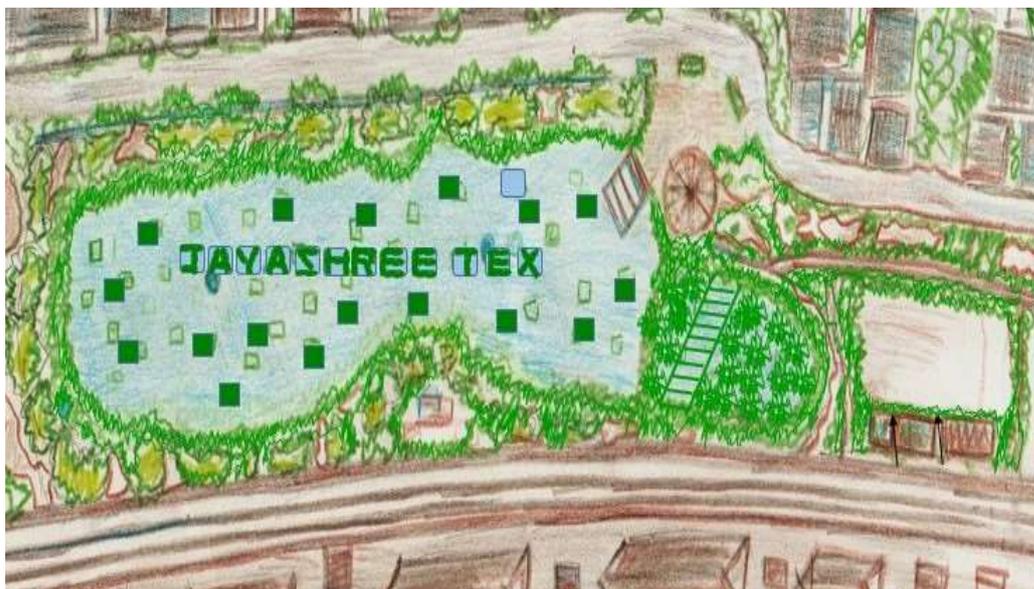


Fig: Concept drawing of Bioengineering Intervention on Water Body Restoration
(Source: C.S.Pradeep Kumar – Biostarts Ventures)

Project Initialization & Implementation Methodology

The project initialization done by the presence of representatives from Aditya Birla Mr. Ankur Khond (Project Manager), Biostarts Ventures Mr. Pradeep Kumar, Mrs Preethi Bhaskaran (Operation Manager) Rishra Railway of Station Master- Mr Chaubey), families living in the Rishra Railway quarters and labours who are part of the project.

The primary task on the prepared area of the project site was cleaning of the open area. Since the location was almost a dump area where most of the wastes were coming from the neighbourhood area which was the Railway station, Vegetable Market (Occupied), Eatery Vendor at the Railway station flying visitors with wastes packaged in plastics and the residential who were not aware that they were contributing to the pollution of the water body directly and indirectly.

Project Components

1. Community mobilization and Awareness campaign in association Rishra Municipality & Railway Officials
2. Removing the weeds from near the water body , desilting and dredging
3. Creating a Barricade to isolate the wastes at one area for a programme management and treatment of the organic wastes
4. Surface cleaning especially removal of the plastics and other wastes which cannot be decomposed
5. Separating the marshy land and the normal
6. Preparation of the drainage system that exists in the area
7. Making terrace at the slopes for green intervention for protection and cleaning
8. Preparation of floating gardens
9. Plantation on Floating gardens and Embankment
10. Solar aeration system and LED Lighting
11. Water testing and real-time water quality monitoring
12. Maintenance for one year



Community Mobilization by Aditya Birla Jan Seva Trust – Birla Grasim in Association with Rishra Municipality, Govt. of West Bengal

The intervention concept:

The technical intervention applied for water body restoration is through Floating Gardens, which is a key Bioengineering feature. These floating gardens are made up of natural fibre, plants and Beneficial Microbes (BM) for decontamination of water and greening of the waterbody.

The Floating garden is prepared with coir fibre beds and coir geo logs. The jute and coir fibre blended logs are fitted on recycled plastic pellets, which act as floating structures. Then Vetiver spp. along with Canna indica is grown on the coir geo bed and set afloat. The Waterbody side is fitted with coir geo logs for increasing the microbial application surface area and the embankment protection by jute geo-textiles and plantation development for preventing the soil erosion.

Bio-Remediation uses living things to break down or remove toxins and harmful substances from soil and water. The Beneficial Microbes (BM) application incorporated with natural substrates and sustainable plants can reverse these situations in a natural and economic way. The Beneficial Microorganism is to be hosted plant roots & in the coir and accelerates the natural decomposition of organic compounds, which produces bioactive substances and eliminates pathogenic microorganisms through a process of fermentation and enzyme action. Pathogenic microorganisms promote decomposition and controls and ultimately near elimination of the production of harmful gases that contaminate water and produce bad odours. Therefore, applications with BM can possibly restore the natural equilibrium of aquatic systems and bring forth beneficial and sustainable effects.

Phyto-Remediation is the direct use of living green plants growing for removal, degradation, or containment of contaminants in soils, sludge, sediments, surface water and groundwater. The uptake of inorganic contaminants in plants occurs primarily through the root system, in which the principal mechanisms for preventing contaminant toxicity in water by Phyto-remediation. The root system provides an enormous surface area to beneficial along with geotextiles that absorb and accumulates the water and nutrients essential for growth, as well as other non-essential contaminants like nitrate, phosphate, heavy metals and other toxic elements absorption by phyto-remediation by the plants to minimize the growth of algae

The entire system work as bio & Phyto-remediation floating island by integrated bioengineering techniques create an aesthetic green ambience and thereby decontamination of water body in terms of Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) reduction and eventually led to creating clean water bodies. It is replicable with easy maintenance.

Components used in Waster Body Restoration

1. Floating Garden (1 Mt x 1 Mt) - 150 Nos - 300 Sq.m
2. Floating Solar aerators and LED Light - Includes 8 Sq. M floating garden, Floating Solar panel with Aerators and LED Lights
3. Area of embankment Restoration - 5000 Sq.m
4. No.of Vetiver plants used in Floating Garden and Embankment - 60000 Nos.
5. No, of ornamental plants used for landscape - 15000 Nos.
6. No.of Coir Geo log used - 1200 Nos
7. No.of trash boom – 2 nos. of 40 meters each

Methods: Following approach and methodology is adopted:

1. Various sewage water entry points are studied which are discharging into the waterbody.
2. Water Analysis of the contaminated water body is conducted to understand the extent of water pollution in terms of BOD, COD, TSS, pH, TDS, conductivity etc..
3. The biological wastewater treatment system is based on the bio-remediation and phyto-remediation technology in which useful plants and microbial consortia are used through bio-engineering method to clean the contaminated water.

Bio-Phytoponic Solar Aeration system is installed to further rapid up to the cleaning process. The system is designed as an integrated model for Bio-remediation, Phyto-remediation, water aeration (working in day time) and LED lights (at night) using solar energy with automatic controls

Project Implementation Stages



Material used for water body eco-restoration



Site & Material preparation



Floating Garden Preparation

Floating Garden Installation

Project Implementation Stages



**Water Body restoration – A CSR initiative by Aditya Birla Jan Seva Trust
Jaya Shree Textiles, A unit of Aditya Birla GRASIM. Rishra, West Bengal**

Results: The Bio-remediation & phytoremediation study by using a natural fibre, Beneficial Microbes, Biomass and sustainable plants found a remarkable reduction in total dissolved organic solids, nitrates, phosphates, silicates, sulphates, chlorides, calcium, magnesium, sodium, potassium and iron in different wastewater and improving the BOD and COD levels. The treated water can be directly disposed into any surface water body or land as the concentration of the pollutants are below the standard permissible limits of effluent discharge.

Sustainability Indicators

The following were the sustainability indicators for the project:

1. The restoration of the waterbody was done using green and sustainable technology applications and the results reflect in the Pre and Post Water Quality tests.
2. The local community was involved for - 250 – 300 man-days leading to employment generation during the installation with a payment of Rs. 1,20,000 to 1,50,000/-
3. An aerator system operated by solar power is running for reclamation of water
4. Community Awareness of different stakeholders in surrounding areas on the protection of natural resources through natural means.

Water Body Eco-Restoration - Water Test Reports

3. Sample(s) Sample Id (GEEC CODE) : WW/56/A				
a) Nature : Waste Water				
b) Date of collection : Not mentioned				
c) Environmental Condition : Not mentioned				
d) Mode of Collection : Supplied by SYMBIO Greentech Pvt. Ltd.				
e) Date of Receiving : 06-05-2017				
4. Analysis Started on : 06-05-2017				
5. Analysis Completed on : 11-05-2017				
Analysis Report:				
Sl. No.	Parameter	Method of Analysis (APHA 22 nd Edition, 2012)	Unit	Concentration Location: SYMBIO- Sample-C
Chemical Analysis Report:				
1.	Conductivity(at 25° C)	2510B	µS/cm	877
2.	Turbidity	2130B	NTU	>500
3.	Total Dissolved Solids (as TDS)	2540C	mg/L	660
4.	Total Suspended Solids (as TSS)	2540D	mg/L	1416
5.	Chemical Oxygen Demand (COD)	5220B	mg/L	220
6.	BOD (3 days at 27°C)	5210 B	mg/L	111
Note: The results relate only to the items tested & analyzed as on received basis.				

WATER TEST – PRE RESTORATION 05/05/2017

3. Sample(s) Sample Id (GEEC CODE) : WW/98				
a) Nature : Waste Water				
b) Date of collection : Not mentioned				
c) Environmental Condition : Not mentioned				
d) Mode of Collection : Supplied by SYMBIO Greentech Pvt. Ltd.				
e) Date of Receiving : 11-08-2017				
4. Analysis Started on : 11-08-2017				
5. Analysis Completed on : 14-08-2017				
Analysis Report:				
Sl. No.	Parameter	Method of Analysis (APHA 22 nd Edition, 2012)	Unit	Concentration Location: Water Body at Rishra, CSR Project under Aditya Birla Jan Seva Trust, C/o Jayshree Textiles
1.	pH	4500I ⁷ B	--	7.9
2.	Conductivity(at 25° C)	2510B	µS/cm	516
3.	Turbidity	2130B	NTU	28
4.	Total Dissolved Solids (as TDS)	2540C	mg/L	370
5.	Total Suspended Solids (as TSS)	2540D	mg/L	44
6.	Chemical Oxygen Demand (COD)	5220B	mg/L	50
7.	BOD (3 days at 27°C)	5210 B	mg/L	20
Note: The results relate only to the items tested & analyzed as on received basis.				

WATER TEST – POST RESTORATION 11/08/2017

Conclusions: It is a strong belief of **Shri. C.S.Pradeep Kumar** that this biotechnological intervention has a high scope of providing effective solutions to the urban wastewater management problem and restoration of contaminated water bodies. The intervention being simple, cost-effective and easy to understand for local communities, it has the potential for successful replication on a large scale thereby making a significant contribution in sustainable Urban Natural Water resource protection & restoration.

Project Initiative by

Aditya Birla Jan Seva Trust, C/o Jaya Shree Textiles,
Aditya Birla Group – GRASIM Rishra, P.O-Prabasnagar, Dist-Hooghly, Pin-712249, West Bengal

Project Implementation by

BIOSTARTS VENTURES

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