MONIKA JAGGI

Neela Hauz Biodiversity Park

From Barren to Beautiful

Neela Hauz Lake before and after restoration

"Nature is not a place to visit. It is home."

- Gary Snyder

THIS quote does not hold true in today's time as the stench of apathy and greed is polluting our environment every day. Even with environmentalists crying their hearts out, the environment is turning dry and dirty.

Water bodies are important components of the natural water cycle on which an entire ecosystem is dependent. Once these natural catchments and reservoirs are destroyed, the cycle is disturbed. Water bodies also contribute to keeping up a healthy groundwater table that has gone very low in India.

Delhi is already grappling with a serious water shortage. An environment department survey by Delhi government in 2014 revealed a sad state of water bodies in the capital. Out of 611 water bodies, 274 have already dried up, while the rest 337 that still have water are in a terrible state.

The Neela Hauz Lake was also going the same way. Once a beautiful fresh water lake (covering around 2.5 hectares), which fed the plethora of flora and fauna, it turned in to a dumping ground for debris and raw sewage from the surroundings. But with the concerted efforts of local residents, environmentalists and the Delhi Development Authority (DDA), the lake is now the symbol of environmental regeneration at the Neela Hauz Biodiversity Park. The regeneration model has proved so successful that officials have submitted the concept to the Delhi Jal Board for implementation in other water bodies across Delhi.

Neela Hauz is a mini biodiversity park and includes the Neela Hauz Lake fringing the undulating landscape terrain abutting the Sanjay Van Forest. It is being developed on the south central ridge located near Vasant Kunj. It is spread over an area of 10 acres. According to folklore, Neela Hauz was the main water source for the Rajput city of Qila Rai Pithora and also a halt on the trade route to Delhi. Studies have shown that Neela Hauz was part of a much larger watershed that drained this part of the Aravallis and, through a system of nallahs, reached the River Yamuna. It was the biggest natural water body in South Delhi and used to be a major fresh water source for the entire South Delhi.

Initially, the catchment area of this lake was covered with the dense forests of Sanjay Van. Later a part of it was removed to make an institutional area. The forest was also invaded by keekar (*Prosopis*) and other acacia species, which the British had introduced, leading to the loss of native species. For a period of time, the lake was encroached upon – while some part of it was filled with debris, the central portion was sedimented, and untreated sewage water was thrown in because of which the lake was completely silted and covered with water hyacinth (*Eichhornia*). About a decade ago, the lake was completely filled with debris during the construction of a flyover over it.

Back from the Dead

In response to a petition filed by local residents in Delhi's High Court, Neela Hauz was handed over to DDA under its Delhi Biodiversity Foundation. The revival process started immediately in collaboration with the Centre for Environmental Management of Degraded Ecosystems (University of Delhi).

The DDA took responsibility to revive the dead lake through a Constructed Wetland System (CWS). The lake is critical to maintain water levels in south Delhi, especially the Mehrauli block, where the water table has fallen drastically.

So the question arose, where to get water from since much of its catchment had been taken up by institutions, rainwater flows into the Neela Hauz had been substantially reduced and natural drains had been blocked by encroachment. It was decided to use raw sewage mixed with STP-treated water to maintain water levels in the lake since it is otherwise dependent solely on rainwater. The lake was desilted and the silted material was used for landscaping its embankments. The raw sewage and STP-treated water (designated as waste water) passed through a constructed wetland system before it enters into the lake. The storage capacity of the lake is enhanced by constructing a mini run-off river check dam in order to attract aquatic birds.

CWS involves both physical and biological processes with zero energy input. CWS constitutes of two oxidation points and four physical channels/tanks.

Figure showing treatment of sewage water by Constructed Wetland System

In the first oxidation step, sewage is stored and retained in a large surface area for 24-48 hours so that atmospheric oxygen can break down all organic material by natural microbes (aerobic bacteria).

In the second step, water is stored in a pond where aquatic plants like lemna absorb nitrates and phosphates from water, further improving quality. The lake's Biological Oxygen Demand (BOD) levels, along with the level of phosphates and nitrates, fell sharply. These nitrate and phosphate-rich lemna are also used as fertilisers after collecting them from the water. After passing through these two oxidation points, the biodegradable material gets oxidized and the bacterial biomass (particulate organic matter) and other silt gets settled.

Then, the water is passed through various physical channels or treatment points. First, the water passes through a channel having river bed pebbles of large size which filters the waste water by removing large sized particulate organic matter. This water then passes through three tanks – Tank I has smaller pebbles; Tank II has still smaller pebbles; and Tank III has the smallest pebbles. These three tanks remove particulate organic matter of all sizes.

In the next step, water flows past a series of alternating ridges and furrows. The former has gravels while the latter has 20 different aquatic plants species (e.g. *Typha*, *Phragmites*, *Alternanthera*, *Ipomoea*, *Solanum,* etc.). The microbes present in the rhizosphere of these aquatic plants cleansed the water of biotoxins, while sludge and fine particulates were removed via a gradual process of passing the water through a cascade which also harbours some aquatic plants and finally enters into another pond with floating aquatic plants. The purpose of this pond is to get any left out fine particulate organic matter sedimented. Different gradient levels of pebbles as well as microbes from these plants naturally improve the quality of water before it enters the lake.

The lake water has DO of more than 4 mg/l and BOD less than 4 mg/l and COD less than 0.7 mg/l and pH around 7.2 and the sulphates and chlorides are less than permissible standard. The lake has many aquatic birds. A total of 100 species of birds have been recorded.

According to Prof. C.R. Babu (Project Incharge of the Biodiversity Parks Programme of Delhi Development Authority), "No energy is being consumed in the process. We are only using physical materials such as river bed pebbles and gravel and aquatic plants with special properties to clean the water. Sewage treatment plants in Delhi are not as efficient as the constructed wetland system in improving the treated water quality. We have successfully treated sewage and STP-treated water to the level that the treated water has the same quality as that of river water by an all-natural process".

The water body at Neela Hauz now treats close to a million liters of water every day through natural processes.

The Neela Hauz Biodiversity Park was dedicated to the Nation by the former Lt. Governor of Delhi, Dr. Najeeb Jung in November 2016. More than 15,000 saplings of native trees and shrubs belonging to six biological communities have been planted. These saplings belong to more than 75 species.

Within two years the Neela Hauz Biodiversity Park will become a paradise for bird lovers and for nature lovers. Since its revival, 70 bird species have been sighted at Neela Hauz. Migratory birds have started to visit the lake again. Walking trails have also been developed around the lake with proper sitting areas at regular intervals. Submerged, free floating and rooted water plants and phytoplankton and zooplankton have been introduced in the water body. Grasses such as *Chrysopogon, Heteropogon* and *Cenchrus* have been planted to stabilize slopes around the water body.

Water analysis

Parameter	Before CWS	After CWS
Acidity level (pH)	7.8	6.78
Biochemical Oxygen Demand (BOD)	40	4.0
Chemical Oxygen Demand (BOD)	80	0.7
Dissolved Oxygen	0	3.4
Phosphates	103	14
Total Dissolved Solids (TDS)	600	298

Dr. Monika Jaggi is a Senior Scientist in CSIR-NISCAIR