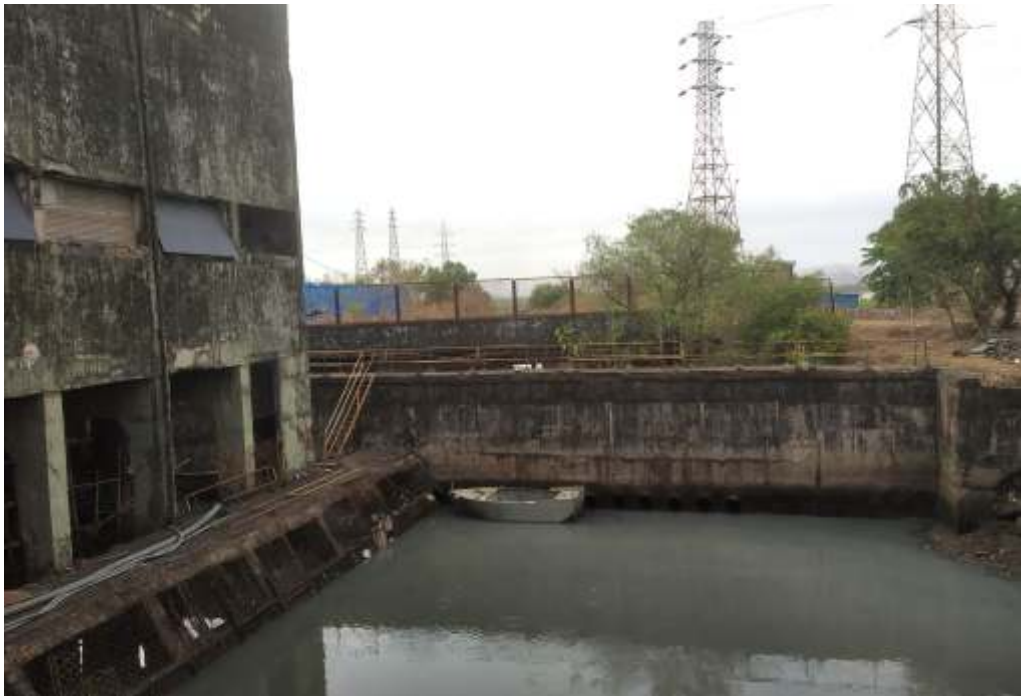
Rejuvenation of stormwater drains and restoration of holding ponds in Navi Mumbai Municipal Corporation area



February
2024

Submitted to

Navi Mumbai Municipal Corporation, Belapur CBD, Navi Mumbai

By

Dr. Goldin Quadros

Principal Scientist, Wetland Ecology Division, SACON

Research Team

Mr. Prathamesh Gurjarpadhye, Mr. Sunilkumar Gupta,
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Preface

The city of Navi Mumbai developed by government of Maharashtra to decongest the Mumbai city was developed between hills and creeks and several low lying areas. In order to manage the floods and storm water retention ponds also called as holding ponds were created as per the Dutch method. These ponds have proved to be useful and served its purpose until recent years due to certain regulatory prohibitions on management of the ponds. The outcome of restrictions has resulted in occurrence of frequent floods and reduction in the carrying capacity of the holding ponds necessitating immediate attention.

For this reason, the Navi Mumbai Municipal Corporation approached SACON to undertake a study on the biodiversity and assess the impacts of desiltation process in the open area of the holding pond on the mangroves. The study conducted over a period of one year documented 465 species of flora and fauna representing several taxa dominated by insects and birds, including the 10 mangrove species within the holding ponds. The diversity included three threatened species six schedule I and three Schedule II species. It was observed that the holding pond has provided an abiotic environment that was adapted by the biotic community.

During the study the impacts of desiltation in the open area on the mangrove flora was also assessed where no change in the species composition or abundance was noted within the mangrove. The NMMC has followed the Wetland rules (2017), the CRZ laws as well as the Bombay High Court Order of 2018 to protect the mangrove plant species while employing the desiltation process. However, the challenge is to work with several stake holders and curtail anthropogenic activities that adversely impact ecological solutions.

Ecological management actions can be replicated with proper monitoring mechanisms that can help in supporting biodiversity and supplementing the country's commitment to sustainable development.

Signed by
Virendra Rambahal Tiwari
Date: 21-02-2024 13:35:26

V. R. Tiwari
(Director WII)

Summary

The City and Industrial Development Corporation (CIDCO) of Maharashtra planned the city of Navi Mumbai to be developed by the Government of Maharashtra to decongest the Mumbai city. The Navi Mumbai city is developed between the hills and the creeks, however there are several low-lying areas that are below the high tide level. To manage the floods and the storm water CIDCO adopted the Netherlands strategy called the 'Dutch Method' of having a series of retention ponds called as holding ponds for Navi Mumbai city. These holding ponds have several gates that are designed to open during ebb tide and enable in managing the flood waters. CIDCO also developed a network of 11 holding ponds and more than 75 kms of storm water drainage lines to manage the water. In addition, several bunds were created along the coastline to avoid submergence and prevent the water ingress into the city. This system has worked fairly for several years, however, in recent times due to incessant rains the citizens of Navi Mumbai have experienced adverse conditions affecting life and property.

The Navi Mumbai Municipal Corporation (NMMC) is of the opinion that with the increasing impacts of Climate Change the likelihood of increasing occurrence of intense rains and storms coupled with the regular phenomenon of high tides will lead to more frequent floods in the city. It has also observed that the capacity of storm water drains and holding ponds has gradually reduced over the past 25 years. In its endeavour to provide the citizens of Navi Mumbai an infrastructure and facilities that ensures health and well-being, the NMMC has reinitiated the project of rejuvenation of storm water drains and holding ponds.

In order to overcome the flooding situation, NMMC has planned to have an integrated stormwater management work. The NMMC is undertaking the project titled "Rejuvenation of Storm Water Drain and Restoration of Holding Ponds in Navi Mumbai Municipal Corporation area". Assistance of Dr. Goldin Quadros, Principal Scientist, Wetland Ecology Division, Sálim Ali Centre for Ornithology and Natural History (SACON) was requested by the NMMC (letter no. NMMC/ACE(Civil)/02/2022 dated 11/01/2022) on its project to assess the flora and fauna of the Holding Pond. Subsequent to the communications between the organisations a field site visit was undertaken on 23rd February 2022, to understand the problems at hand and advise on the work to be undertaken keeping in mind the probable remedial measures. Consequent to the field visit a detailed proposal to undertake the field study of the Holding Pond located at Belapur CBD sector 12, Navi Mumbai was sanctioned by the NMMC to SACON.

In the recent past, due to deteriorated condition of the stormwater drains, siltation of holding ponds, large scale paving of the areas, change in climatic condition, especially high intensity rainfall has led to the frequent flooding situation in the NMMC area, particularly in the low-lying areas. The holding ponds were functioning well in controlling the floods until the flap gates that controlled the high tide water from entering the pond. The ingress of the creek waters during high tide resulted in the transport of mangrove seedlings and saplings that established well in the protected environment of the holding pond. The satelite imagery shows excess growth of mangroves since the year 2012 when the state government implemented regulations to protect the mangroves. The imageries of 2022 indicate that the entire holding pond is full of mangrove vegetation, however, the drone pictures procured by NMMC revealed large patch of unvegetated areas that could be desilted. Hence in order to increase the water holding capacity of the pond, desiltation of the accumulated mud from the non-mangrove area was proposed. Conversely it was also decided that the impacts of desiltation be assessed on the existing mangrove vegetation. The desiltation activity was undertaken in the holding pond mudflats was undertaken during the onset of monsoon. Hence the objective for the study assigned to SACON is "***to assess the impact of desiltation process in the open area of the Holding Pond on the mangroves***".

To achieve the objective, the following abiotic and biotic components were evaluated in addition with the interactions with the local community.

1. Assess the water and sediment quality in and around the proposed project site.
2. Mapping of mangroves and their seasonal distribution in the holding ponds.
3. Documentation of floral and faunal diversity, including birds in the holding pond.
4. Interactive meetings with the locals to evaluate their dependence on the ecosystem surrounding the holding ponds.

The physico-chemical and the biodiversity was studied during the Post Monsooon, Winter, Premonsoon and Monsoon seasons. The water quality assessed showed the dilution effect on the pH, Salinity and Dissolved Oxygen; while the turbidity, Total dissolved solids and Conductivity was high during the Monsoon season. The water showed similar behavior as that of the open creek waters during the monsoon season, during the other seasons the sewage influence played a significant role. The sediment of the holding pond also showed a dilution effect due to the monsoon with lower values of Phosphorus and Total Nitrogen, while the Organic Matter in the holding pond was high. The values of the water and sediment parameters were comparable with the open creek area indicating similar behavior of the holding pond with

the open estuarine ecosystem. Plankton play the role of nutrient recyclers and primary producers of the aquatic ecosystem and are highly influenced by water quality. Plankton play an ecological role by maintaining biological stability and water quality. 38 species of phytoplankton and 27 species of zooplankton were recorded from the holding pond and the adjacent creek mouth area. Both the holding pond and the creek mouth area had low Phytoplankton and Zooplankton during the monsoon season and showed direct correlation between the presence of Phytoplankton and Zooplankton.

Benthic organisms live in the sediment and play an essential role in food chains, including food for humans and some play a critical role in the breakdown of organic matter. They are also a link between primary producers and higher trophic level organisms such as fishes and seabirds. Benthic organisms are sensitive to any change in the physicochemical parameter. 24 species of macrobenthic fauna from sediments of the holding pond representing six phyla viz., Annelida, Nematoda, Gastropoda, Mollusc, Arthropoda, and Cnidaria were recorded. 19 species of meiobenthic fauna from sediments of the holding pond representing eight Phyla, Annelida, Nematoda, Gastropoda, Mollusc, Arthropoda, Retaria, Kinorhyncha, Platyhelminthes respectively were recorded. The megabenthos comprised of 13 species which included crabs, mollusk and flatworms. The result shows during Monsoon megabenthos, macrobenthos and meiobenthos diversity is less than in post-monsoon, winter, and pre-monsoon seasons. Insects comprise of the most diverse faunal group are affected due to anthropogenic activities such as sewage, runoff from agriculture, and industrial pollution. 131 species of insects were recorded that including 26 different families. We also recorded eight species of Arachnids that are considered as biocontrollers in agroecosystems. Seven reptile species which includes Near-Threatened Bengal monitor Lizard *Varanus bengalensis*, and Vulnerable Indian Flapshell Turtle *Lissemys punctate* and two mammal species i.e. Grey Mongoose *Herpestes edwardsii* and Indian Palm Squirrel *Funambulus palmarum* were recorded around the holding pond. It is generally believed that mangrove habitats are widely utilized by marine fauna and recognised as nurseries for fish. The nearshore waters of industrialised cities are prone to different types of pollution and the distribution and abundance of fish in such environments are dependent on physical, chemical, and biotic factors. In the holding pond, we could record six species of fish that could adapt to pollution stress. Further, the birds are not exactly aquatic creatures but a large number depend on the aquatic environment for their survival. The holding pond and the surroundings provided an array of feeding guilds to the birds where we recorded 93 bird species belonging to 15 orders and 38 families.

The most important component of the study was to assess the impacts of desiltation of the open area on the Mangrove vegetation in the holding ponds. We recorded eight species of true mangroves and two species of Non-Mangrove Halophyte representing the family; Acanthaceae, Euphorbiaceae, Lythraceae, Salvadoraceae, and Verbenaceae with the dominance of *Avicennia marina acutissima.* It was interesting to note that the mangrove vegetation did not show any changes in diversity or abundance. This could be attributed to the fact that the dredging did not include any excavation of the mudflat soil. However, a slurry of the mudflat soil was prepared with the existing water in the pond and the slurry was deposited within the mangroves. This process has helped in further strengthening the existing mangrove plants while preventing the establishment of fresh saplings due to the non-availability of shallow mudflats.

Our interactions with the locals revealed a fairly good understanding of the importance of the holding pond and the mangrove ecosystem. However, the holding pond also faced several anthropogenic pressures like encroachment, disposal of solid waste, and blockages in the connecting channels. The NMMC had during the year replaced the flap gates that also helped in better functioning of the holding pond.

Taking the present study into consideration we have proposed several recommendations based on the Wetland Rules 2017. Most important is the fact that the Holding Pond is in the CRZ I area and was constructed over 50 years ago for the welfare of the citizens of Navi Mumbai. Since man-made structures created for specific purposes like aquaculture can be excluded as per the Wetland Rules (2017). The holding pond is created for the specific purpose of holding flood waters and prevent destruction of life and property. Moreover, the wetland rules also permit the maintenance and management of water bodies for retention of water and desiltation of water bodies is permitted. Only precaution that the NMMC has to take is protect the existing mangrovs as per the Bombay High Court Order of 2018.

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