

Challenges pertaining to preservation of wetlands in a developing city – a case study of Navi Mumbai, India

**The manuscript was accepted and presented
at the 13 World Lake Conference, Wuhan
China**

November 1-5, 2009



Challenges pertaining to preservation of wetlands in a developing city – a case study of Navi Mumbai, India

G. S. Gill^{* 1}, A. S. Parasnis^{^ 2}, S. C. Deshpande^{# 1}

1. CIDCO (City and Industrial Development Corporation), CIDCO Bhavan, CBD-Belapur, Navi Mumbai, Maharashtra, India. 400614.
2. TERI (The Energy and Resources Institute), 318 Raheja Arcade, Sector 11, CBD-Belapur, Navi Mumbai, Maharashtra, India. 400614.

gurkeeratgill@yahoo.com, anjali.parasnis@gmail.com, scdeshpande.cidco@gmail.com

Abstract: MMR (Mumbai Metropolitan Region) has been a victim of crunch in water resources. It is one of the most densely populated cities in the world and its water demand at source is expected to be 3667 MLD (million liters per day) in 2011. With an objective to decongest the main island city, a twin city called Navi (new) Mumbai has been developed by CIDCO (City and Industrial Development Corporation of Maharashtra), which is the only Indian city to be featured in National Geographic Channel's 'Super Cities of the World' series in the year 2004. With only a few major lakes to meet the annual water demand of the entire MMR the Government has decided to focus on restoring other available resources like fresh water wetlands which include lakes, ponds, rivers, wells and so on. The most recent example that being of the Powai lake of Mumbai which was artificially created as a catchment area for supplying water to the city but it was mistreated by dumping garbage and other waste for almost a decade and then re-considered for its potential when the drinking water levels in the city were plummeting to high alert. Water bodies often fall prey to activities like dumping waste, plastic, rubber, bathing, and washing of clothes and animals. The untreated release of the industrial waste which includes toxic chemicals and heavy metals adds to the pollution. This is mostly done illegally while keeping the competent authorities in the dark. The development authorities realize the potential of the wetlands and make provisions in the budget for their restoration. However, due to lack of public awareness and orientation about Environment related issues, maintenance of the water bodies on a sustainable basis is a major challenge for developmental agencies like CIDCO. Therefore, it is essential to address the issue of wetland management more pragmatically. The present article discusses various constraints and possible solutions while citing some specific examples in the context of Navi Mumbai, India.

Keywords: CIDCO, fresh water, lake environment, MMR, Navi Mumbai, water pollution, wetlands.

1. Introduction

The earth has always been referred to as a blue planet for the exclusive presence of water compared to other celestial bodies. This planet owes the onset and existence of life form to this very fact that water forms the basis of life. Civilizations and settlements were established at the banks of water sources realizing its diversified application, importance and obligation for life.

Although 70-75 % of the earth's surface is covered with water, all of that is not available for use. As seen in Fig. 1, less than 1% of the world's fresh water (~0.007% of all the water on earth) is accessible for direct application by humans [1]. This is the water found

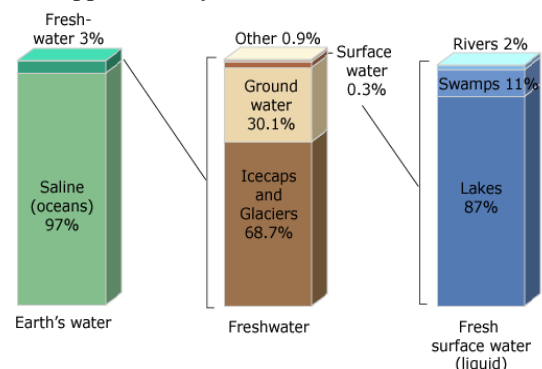


Fig.1 Distribution of Earth's water

in lakes, rivers, reservoirs and those underground sources that are shallow enough to be tapped at an affordable cost. Only this amount is regularly renewed by rain and snowfall, and is therefore available on a sustainable basis.

The UN Committee on economic, social and cultural rights issued a declaration in Geneva on 26 November, 2002 stating that access to water is a human right and that water is a public commodity fundamental to life and health. However, according to recent statistics revealed by the UNICEF (United Nations Children's Fund) [2] and WHO (World Health Organization) [3], there are an estimated 884 million

*Mr. G.S Gill (IAS) is the Managing Director & Chairman of CIDCO

^Dr A.S. Parasnis is a Fellow and Head, TERI- Mumbai

Mr.S.C Deshpande - Corresponding Author is Chief Engineer & General Manager (Technical), CIDCO

people without adequate drinking water ^[4], and 2.5 billion without adequate water for sanitation ^[5].

To bridge the gap between the demand and supply of water is a matter of great concern for the governing authorities. Many initiatives have been taken by global bodies like UNDP (United Nations Development Programme), UNICEF and WHO towards strategically impacting water management, use, allocation and the improvement of water supply and sanitation in the developing countries.

Water availability and access are already key constraints to poverty reduction and food security in India. It has been projected that maintaining enough water for agriculture of reasonable quality will be increasingly difficult due to impacts of climate change; competition for water with industries and urban uses ^[6].

2. Mumbai City And Its Resource Crunch

Mumbai Metropolitan Region (Fig 2) is an area spanning 3887 sq km comprising an island city of Mumbai, its suburbs (jointly referred to as Greater Mumbai) and its satellite towns namely Thane and Navi Mumbai.

Mumbai is one of the largest cities in India and is located at the western coast of the Indian state of Maharashtra. It is one of the top six largest agglomerations in the world with a population of over 18 million. The city significantly contributes to Indian trade and taxation and is often referred to as the financial capital of the country. One of the major problems of the city is its ever-increasing population which is further compounded by the insurgence of large groups of people migrating from all over the country as well as from the bordering nations. Population explosion has put tremendous strain on the

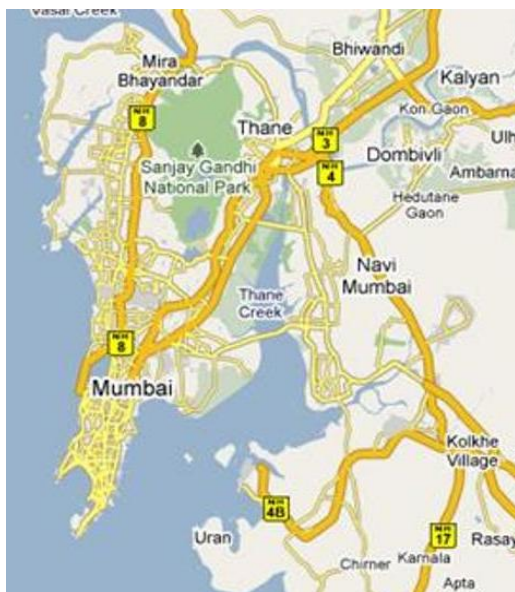


Fig.2 Map of Navi Mumbai and Greater Mumbai the parts of the MMR (Source: Google maps)

basic infrastructure and resources of this city. In fact, Mumbai is set to replace Tokyo as the world's most populous city by 2020 ^[7].

Development inputs are unable to keep pace with the rapidly growing population, industry, trade and commerce resulting in a fast deterioration in the quality of life for the majority of people living in the city. Besides, there are physical limitations to the growth of the city built on a long and narrow peninsula. On realizing the gravity of problems, CIDCO ^[8], was empowered as a town development authority by the government to prepare a plan to build a well-balanced, modern city called Navi Mumbai.

Today, Navi Mumbai covering a total area of 343 sq km, which is 5.3 times bigger than the Island city of Mumbai, is looked upon as a counter magnet for Mumbai. Paving its way for a new revolution, Navi Mumbai is the only Indian city to be featured in National Geographic Channel's 'Super Cities of the World' series in the year 2004 ^[9].

The Mumbai region is expanding exponentially. Due to rapid urbanization and industrialization, natural resources like water, land, and energy are either overexploited or used insensibly and the alternative resources are totally neglected and mistreated, thus posing a variety of challenges to the government with regard to meeting the ever increasing demands for the resources. While extrapolating the consequences of the projected impacts, the Government of India is exploring all the possible alternatives of natural resources which would help meet the projected demands of this city. An average requirement of water is estimated to be 135 lpcd (liters per consumer per day), however, because of water shortage, MCGM (Municipal Corporation of Greater Mumbai) supplies only 90 lpcd which is only 66 % of the average requirement ^[10]. Moreover, taking into account the values regarding the distribution losses, pilferage, and wasteful use and so on, it would be extremely difficult to cater to the requirements of the growing demands with the existing supply system.

In the year 1993, the Government of Maharashtra appointed an expert committee under the chairmanship of Dr M A Chitale (Ex-Secretary, Irrigation Department, Government of Maharashtra) for advice on long-term planning for augmentation of water supply to Mumbai. The committee's recommendations for development of alternate natural resources were readily accepted by the Government. ^[11]

Alarmed by the present scenario, the Government of India is now investing Rs.22 billion with an aim to find a permanent solution to the acute water scarcity in two major cities of India namely Mumbai and Chennai. Out of the 969 projects registered under UIDSSMT (Urban Infrastructure Development Scheme for Small and Medium Towns), the water and sanitation sector accounts for 828 projects. The Eleventh Plan aims to provide drinking water to everybody. To make this happen, it is estimated that investment to the tune of

Rs.540 million would be required. In the light of this background, preservation of wetlands is gaining importance in India. The Government has also sanctioned Rs.1.16 billions for the preservation of water bodies ^[12].

3. Wetlands are not wastelands

3.1 Impact of wetland degradation on Mumbai

Wetlands, the transitory area between the hydrosphere and the land are very important with respect to; ecological aspects and its resource potential. In MMR, wetland makes up 1.12% of the total land area. Mumbai enjoys an average rainfall of 250-300 cm which is much higher than the national average of 120 cm. The consistent rainfall results in maintaining the steady level of ground water table as well as the water level of the wetlands. However, from satellite imageries, it is reasonable to assume that wetland areas have declined considerably in the recent years ^[13]. The condition of wetlands in India is not different than the other countries. Due to lack of awareness, wetlands have been indiscriminately and deliberately destroyed with a short sighted outlook for instant gains. For example, 60 % of wetlands worldwide and up to 90 % in Europe have been destroyed over the past century, due to agriculture, pollution, development of dams, canals, groundwater pumping, urban development and peat extraction ^[14]. In summary, wetlands are globally becoming a threatened landscape.

Degrading wetlands can lead to serious consequences, such as increased flooding, extinction of species, and poor water quality. The catastrophic deluge which engulfed Mumbai on 26, July 2005 bringing the city to a stand still is a self explanatory example (Fig. 3). The impact of the floods was manifested in a variety of ways: Large numbers of people were stranded on the road for more than two days, thousands lost their homes. The death toll was more than 1000. The reports suggest that the floods caused a direct loss of about \$100 million ^[15]. Experts have expressed that the situation would not have been that harsh had the coastal wetlands been preserved. Besides this, reclamation along the Mithi River, encroachment of land by rapacious builders, old drainage and sewage system are found to be other key



Fig.3. Floods disrupted the domestic transport on 26 July, 2005

reasons that lead to water-logging in Mumbai in monsoon.

3.2 Exploring the resource potential of wetlands

MMR is naturally gifted with numerous fresh water wetlands and these can be exploited as decentralized sources of potable water. Navi Mumbai has more than 70 villages and around 150 lakes. Most of the villages purchase potable water supplied through water tankers in summer. The villages could be made self sufficient if wetlands could be properly explored. For instance, it has been estimated that, on an average, a medium sized freshwater wetland has a holding capacity of almost 5 million litres. With a per person potable water consumption of 20 lpcd, the wetland could cater to the requirements of a village with an average population of 2,000 for more than four months of the year including the most critical summer months when water shortages are acute.

But there are still many practical challenges pertaining to the preservation of man made or natural wetlands and its effective use in Navi Mumbai ^[16]. The challenges are mainly an interwoven network of anthropogenic, administrative and geographical hindrances. The practical problems encountered by the CIDCO in the course of developing the twin city of Mumbai are summarized in the following sections.

4. Challenges in preserving Wetlands in Navi Mumbai

4.1 Climate change and sea level rise

LECZ (Low Elevation Coastal Zone).are regions which fall under 10 metres of coastal elevation. Approximately 81 000 sq. km of land in India falls under LECZ, housing a population of over 60 million. 50% of this population reside in urban regions comprising approximately 31 million people ^[17].

Navi Mumbai falls under the category of LECZ and is highly vulnerable to the impact of climate change. It is developed in a low lying-area through reclamation at a height of 2.2 metres which is just equal to the mean sea level. The average high tide level of Navi Mumbai is 3.5 metres as compared to that of 5 metres of Mumbai.

According to the IPCC (Intergovernmental Panel on Climate Change) ^[18], the sea level is expected to rise at the rate of 2.4 mm (millimetre) per year. By the middle of the century the rise will be 38 cm. A one-metre sea-level rise will inundate 6000 sq km in India, of which Mumbai, Kolkata and Chennai will be the most affected. This would mean a loss of billions of dollars in infrastructure, social, physical assets and capital through inundation of low-lying areas, drowning of coastal marshes and wetlands, erosion of beaches and flooding and increase in the salinity of rivers, bays and groundwater.

Navi Mumbai's 125 km long ^[19] coastline fosters vast stretches of mangroves, paddy fields, salt pans and fresh-water lakes. There is inevitable incursion of salt water which contaminates the fresh water bodies leaving them unfit for any practical application.

The biggest challenge pertaining to the preservation of coastal wetlands is the rise in sea level due to global warming as well as increasing rainfall in the region. The issues related to climate change which were earlier perceived by the masses as being merely hypothetical are now gaining a different perspective in the light of the latest surveys conducted in Navi Mumbai's coastal areas. For example, a report prepared to assess the impact of developing special economic zone on 15 villages located in Navi Mumbai clearly highlights the losses incurred due to the rise in sea water level on the paddy fields. Because of salinity and rising of sea level, there has not been even a single crop since 1989. The paddy fields, salt pans get flooded during high tides not only in the monsoon season but also in summer. According to the feedback obtained from the villagers, it was evident that rice was grown before 1989 and the yield used to be satisfactory ^[20].

The CIDCO has been proactively taking necessary steps to circumvent the impacts of ingress of sea water

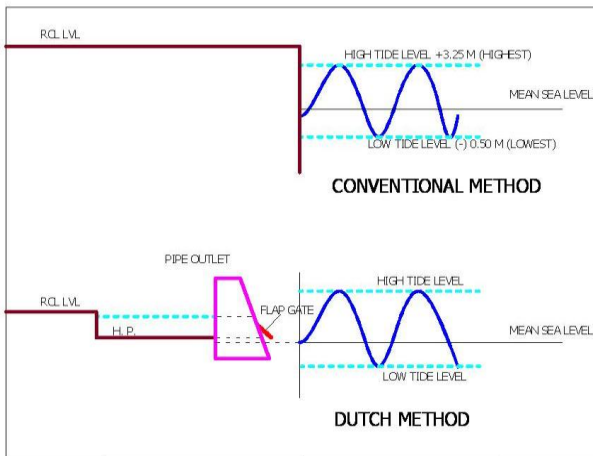


Fig.4 Diagram representing the Dutch method used for land reclamation in development of Navi Mumbai



Fig. 5 A holding pond of Navi Mumbai

by constructing uniquely designed holding ponds with unidirectional flap gates along the coastal belt (Fig 4 and 5). The ponds store the water during high tides and release the water during low tides. In all, there are 30 man made holding ponds in Navi Mumbai. The CIDCO has also designed and commissioned six detention ponds which help regulate a controlled flow of water runoff from the hills, which would have otherwise created a menace during high tides. These ponds are only functional in the four monsoon months and run dry rest of the year. These ponds are some times used for recreational purposes and for seasonal fish breeding but these are not perennial. It is often found that people deliberately encroach the holding ponds and break open the flap gates allowing the inlet of sea water for fish breeding which is all done illegally. This activity gives rise to undesired entry of sea-water into the holding ponds. The entry of sea-water helps in the growth of mangroves and increases the silt inside the ponds. The holding ponds then do not serve the purpose they had been constructed for and to take care of this is an additional pinch for the authorities.

4.2 Industrialization and urbanization

Navi Mumbai hosts variety of Industries within its specialized industrial zones such as engineering, chemical, textile, food processing, and electronic zone. There are more than 5000 manufacturing units at these industrial estates with a gross total of about half a million employees. The flourishing Industries, recorded a total turn over of Rs. 2829 billion in 2007 ^[21, 22].

Population migration to the city has been overwhelming as a result of this industrialization. According to the survey conducted by the Tata Institute of Social Sciences in the year 2000, it is evident that 43% of the families currently settled in Navi Mumbai migrated from Mumbai ^[9]. The population density of the city has grown remarkably in the developed areas. Even though there is an allocation of around 344 sq km for Navi Mumbai the actual area available for development is only 175 sq km. In such a situation wetlands and marshy areas easily fall prey to destruction without their importance being taken into consideration.

4.3 Pollution

Uncontrolled penetration of anthropogenic activities has severely deteriorated freshwater bodies and their vicinity making it much more difficult for the governing agencies to restore the lakes. Wetlands are easy targets for activities like dumping waste, plastic, rubber, bathing, and washing of clothes and animals. The soap lather is released in the lakes thus polluting the water and severely impeding the lake water ecosystem by increasing the COD (Chemical Oxygen Demand) and the BOD (Biological Oxygen Demand) levels. Unhygienic, wretched conditions of lake water

ecosystem and lack of appropriate maintenance of the same leaves the water untouched thus leading to stagnation of water. The undisturbed water acts as a breeding site for mosquitoes, insects and so on. In neglected, unattended and stagnated water sources algal bloom are bound to flourish leading to eutrophication thus amending the normal pH levels of the water bodies hampering the diversity of flora and fauna and adversely affecting the lakes ecosystem.

CIDCO in collaboration with TERI ^[23] have conceptualized an ambitious project with an objective of protecting the lakes and its environment by developing sustainable models. A detailed discussion about the same is made in the proceedings of this symposium in a paper titled “*Fund raising and eco friendly models for preserving a Historic Lake in Navi Mumbai, India on sustainable basis*”.

4.4 Lack of proper documentation

Official documentation or digital inventory database to provide details of wetlands in the Navi Mumbai are presently lacking. GIS (geographic information system) mapping and other available options are not yet exploited to their potential. Apart from general concepts, the quantitative description like size and depth of wetlands including the volume of water it can hold, amount of present intake and type of recharge need to be well documented. A proper tabular and graphical representation in electronic format would facilitate further analysis of the data while planning future course of action for preservation of wetlands on a larger scale.

4.5 Cultural challenges

Indian culture and tradition is well renowned across the globe. Devotees are emotionally and sentimentally attached to the rituals and do not wish to compromise with it. Rivers have been given supreme importance in Hinduism. Although sources of water have always been treated as sacred in Indian culture, the rivers and lakes are being polluted by discarding the leftover of rituals and other customs thus polluting



Fig.6 Ganpati Idol immersion in one of the water bodies in Mumbai. The size of the idols can be as huge as 20 feet.

the river. The discarded substances which often include milk, curd, ghee, honey, leaves, threads, idols (Fig 6) and floral offerings substantially degrade the ecosystem. The issue is very sensitive and with political intervention it becomes even more complicated to handle and control the lake water and its environment from religious activities.

4.6 Administrative challenges

Preservation of wetlands in India is now gaining importance which is evident from the fact that the Prime Minister’s Council on climate change drafted and recently published, an eight point national mission under NAPCC (National Action Plan on Climate Change) with distinct clause on the National Water Mission. ULB’s (Urban Local Bodies) have also realized the importance of exploring alternative sources of water and have identified the freshwater lakes as decentralized systems of water supply. But there is a complexity of socio-political issues coupled with economic factors which make it difficult for the ULB’s to shield the lake and its environment.

There are still gaps in the policies which need to be filled up to translate the National vision into reality. Lack of funds is a major hindrance in maintaining the wetlands. Funds are allotted but sustainable strategies are not developed. Periodic investments add a burden on the authorities and the wetlands fall back in the race of priority. Some of the initiatives which could be necessary in this regard are summarized below.

4.6.1 Strengthening the regulatory framework

Open dialogue and connectivity across various departments of the Government would help in enlisting key issues in the context of wetland preservation. The significance of wetlands could be appropriately highlighted and translated in the form of concrete policies. A well-defined plan for implementation of policies could then be handed over to the implementation agencies.

4.6.2 Legal framework

Law and enforcement in the context of wetlands should be followed more rigorously. Submission of periodic reports under the EPA (Environment Protection Act) should be made mandatory for the apex nodal agencies.

4.6.3 Empowering the agencies and the networks

Government bodies such as developmental agencies, ULBs and corporations need to be actively involved by assigning a specific mandate to manage wetlands within the area of their jurisdiction. Special purpose vehicles need to be established to achieve the specified goals. Bilateral and multilateral agencies as well as NGOs (non government organizations) need to be involved in order to build a cohesive network which could ensure implementation of policies at local level.

4.6.4 Capacity building

Lack of awareness about wetlands within organizations is a serious concern for the administrators. Trained and educated professionals with added awareness pertaining to various issues and challenges regarding comprehensive wetland management would help an organization to correctly interpret and implement the policies.

4.6.5 Effective communication

The success stories should be communicated to drive the efforts in the right direction. Potential of communication channels should be utilized to create awareness among masses.

5. Conclusion

Learning lessons from Mumbai's developmental experiences, the CIDCO has become conscious about the mangroves, wetlands and their importance. In collaboration with TERI, the CIDCO has already taken an initiative to preserve around 150 freshwater bodies in the coastal areas of Navi Mumbai. To sensitize people about wetlands, the CIDCO and TERI have developed an online quiz on wetlands which has been uploaded on the CIDCO's web-page.

To highlight the importance of mangroves, the CIDCO has proposed a 289 hectares mangrove park in Navi Mumbai. The Park will house a 5000 sq.metres visitors centre and will have numerous trails through mangroves. The park is expected to harbor 150 species of birds that visit mudflats along the Palm Beach road. Apart from that the park will also have an aquarium that will exhibit variety of aquatic animals associated with mangroves.

In conclusion, the CIDCO is determined to be at the forefront in addressing the critical issues of water crisis through wetland management by adopting approaches like integrated long-term planning and proper regulatory framework. Through a series of concerted and consistent efforts the current challenges could easily be transformed into opportunities for the next generations.

Acknowledgement

We take this opportunity to thank Dr Gurtek Singh Gill professor of Geology, Punjab University, Chandigarh, India for his valuable suggestions and comments.

We extend our thanks to Mr Prathmesh Chourey, Research Associate, TERI- Mumbai for providing timely help and inputs.

References

- [1] http://www.globalchange.umich.edu/globalchange/2/current/lectures/freshwater_supply/freshwater.html
- [2] <http://www.unicef.org>
- [3] <http://www.who.int/en>
- [4] http://www.unicef.org/media/files/Joint_Monitoring_Report_-_17_July_2008.pdf
- [5] http://www.unicef.org/media/media_44093.html
- [6] http://www.iwmi.cgiar.org/research_impacts/Research_Themes/Theme_1/index.aspx
- [7] http://news.bbc.co.uk/2/hi/south_asia/1093424.stm
- [8] www.cidcoindia.com
- [9] <http://tiss.edu/news056.pdf>
- [10] <http://www.bcpt.org.in/webadmin/publications/publications/watersupply.pdf>
- [11] <http://darpg.nic.in/arpq-website/Conference/Pune/water%20supply%20initiatives.ppt>
- [12] http://www.thaindian.com/newsportal/business/mumbai-chennai-to-get-rs2200-crore-for-water-projects_100232170.html
- [13] <http://www.mumbai-central.com/likhaai/ara/wetlands.html>
- [14] http://www.futurepundit.com/archives/cat_trends_habitat_loss.html
- [15] <http://info.worldbank.org/etools/docs/library/239534/Best%20Project-Pooja%20Kurray.pdf>
- [16] Datta Parab and Prabhakar Deshpande, "Gavatali Te Sehatali"- Navi Mumbai Pravas, Janiv Prakashan, October 2008.
- [17] http://www.indiawaterportal.org/data/climate/ccindia/MD_sealevise.html
- [18] <http://www.ipcc.ch/>
- [19] <http://www.cidcoindia.com/UserFiles/File/Broucher%20%20-%20IITF.pdf>
- [20] http://tiss.edu/SIA_MMSEZ.pdf
- [21] <http://www.cidcoindia.com/UserFiles/File/Broucher%20%20-%20IITF.pdf>
- [22] <http://www.navimumbai.com/industrial.asp>
- [23] www.teriin.org