



CAUTION MUMBAIKAR CITY UNDER WATER

Mumbai's Floods: How, Why, and What Next?

The 7 islands of yesteryear Mumbai are now one small tapering island, 25 miles long by 2 to 7 miles wide, as seen in the satellite photo, connected to the mainland in the north-west, separated by an estuary. A part of this area is a water reservoir



catchment (Borivili National Park) with two small lakes (Vihar, Powai) and its long winding estuary, the Mithi river which also carries the cities waste water and industrial effluents through 5 main outfalls (Borivali, Goregaon-Malad, Versova, BKC and Love-Grove - Worli) on the west and few on the east side (Mulund, Vikhroli, Trombay, Sewri-Wadala) In spite of this, there were "floods" and excess rain is not the only reason. As anyone

should summarize, the excess water should have just washed itself down to the nearby sea which surrounds Salsette islands on which Mumbai is situated. So what went so badly wrong, paralyzing India's business capital, destroying countless homes, and killing an estimated 500 people and causing direct damages to the tune of Rs.450 Crores ?

HOW did this happen?

Tuesday 26th July saw record monsoon rainfall, 940 mm (over 3 feet) in Mumbai, and elsewhere along the Western Ghats. Water collected in heavily populated areas. Drainage failed completely. The city's main "storm-water drain", the 9-mile long Mithi River, originating from Powai and Vihar Lake upto Mahim Creek, and the Oshiwara, Dahisar and Poisar rivers and their streams flooded and overflowed. A Powai lake beautification project is underway, but no plan to revive dozens of other smaller lakes dotting the suburbs. Mumbai's drains were unable to carry rainwater fast enough to the sea. The land was unable to absorb excess rainfall. Poor drainage and lack of land absorption was compounded by tidal effects: high tide causes a reverse flow of water from the sea into the drainage system. The loss of life due to accidents (mainly drowning and electrocution) was added to by major landslides in the Powai hill area, destroying and burying huts and houses, and people.

The conversion of bigger open duct storm water drains along Eastern Express Highway, Western Express Highway and L.B.S. Road to smaller underground storm water drains have halved the capacity of these vital waste water carriage.

And the same scenario was repeated the next year in the very first down pour, notwithstanding the tall claims made by MMRDA, BMC and Disaster Management Team in their media and press releases about their pre-monsoon checks. The situation is becoming grim day-by-day and piece meal efforts by the central, state and local politicians all contribute to the avalanche nay the FLOODS.



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WHY did this happen?

There are many distinct reasons for the many contributing causes of Mumbai's floods, and we have to address each in turn:

Why did the Mithi River flood?

1. Because its mouth had been constricted to a third of its original width by excessive reclamation of land to construct rails, roads – mainly the Bandra-Worli sea-link and at the Love Grove, Worli Outfall. The proliferation of slums along the coastline, mudflats and the mithi river has also been a contributor. The reclamation of 400 acres of dense mangroves at Goregaon-Malad Link road and 100 acres at Lokhandwala for commercial and residential complexes are few of the other reasons which add to the blatant violation of CRZ rules by the builder lobby in connivance with the bureaucracy and politicians.



2. Large scale reclamation and destruction of mangroves for the construction of the once Kalina low lying area by the State Government for Airport expansion and Runway extension being built at Mumbai Airport, right *across* Mithi River (left, below), and the Bandra-Kurla Complex by MMRDA contributed too. The Satellite picture shows one runway actually *bridging* the river, and another with the river diverted around one end.

Also, the Mithi River does not have any “floodbanks” to speak of anymore, due to uncontrolled construction on both sides, defying common sense & environmental precaution.

The salt-pans of Bhandup and Mulund and the mangroves at Vikhroli and Ghatkopar have been destroyed and reclaimed by MHADA and slum lords



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3. This dire situation arose despite years of warnings by outraged citizens and NGOs like BEAG (Bombay Environmental Action Group) and by CAT (Conservation Action Trust). It can be attributed to lack of wisdom and dereliction of duty among our civic administrators.

Why were Mumbai's drains ineffective?

Because they had been built largely in the days of the British Raj, when the population of Mumbai was one-tenth of what it is now. Improved drainage has not been a State priority. The 20th century drainage network of Mumbai is capable of carrying only 25 mm of rainwater per hour. With drains clogged at several places it proved inadequate for the 940 mm rain which lashed Mumbai in one day alone. It seems that only three drains which drain into the sea have gates whereas, other 183 outlets have no such gates. Problem with coastal areas is lack of adequate gradient for water to flow into the sea. During high tides, the sea water incursion takes place through these drains. Drains without gates become vulnerable points and a salt water deluge engulfs upcountry. It goes without saying that the drainage system needs a thorough overhaul with gates to man the backflow of the sea water. During the last floods of Mithi River the nearby residents had to live under the constant fear of a deluge even after rains, just because high tide water was difficult to control.

The BMC has several plots reserved for Pumping Stations and Sewage Disposal, which did not function during the floods. These areas are supposed to play a vital role in suction of water from low lying areas and pumping the excess water to other areas. Holding ponds-they can store excess storm water until the high tide period is safely past as well as recharge ground water-have been stressed repeatedly in the Natu report of 1975 to the BRIMSTOWAD report of 1993 and also the Chitale Committee report last year.

Of Mumbai's 186 storm water outfalls, just six are above the high tide level. Forty-five are actually below the mean sea level, while 135 are above mean sea level but below high tide level. That means these outfalls ideally require balancing reservoirs that can contain runoff until it can be discharged into the sea during low tide.

The BMC is now again harping on the BRIMSTOWAD Project but at the same time plans have been drawn by bureaucrats and politicians to hawk the huge lands occupied by the Pumping Stations and Sewage Disposal Areas for commercial exploitation. Just imagine that this coupled with the proposed narcissist policy of allowing 25% use of open spaces viz. Play Ground, Maidan, Zoo, Recreational Garden to private parties for affluent sections of the society will play the proverbial final blow for such vital areas which act as a sponge and supports ground water retention and replenishment.

Why did the rainwater collect, and not just run off into the sea ?

Because construction and concretization in Mumbai is almost continuous, and Mumbai has the *lowest* ratio of open spaces per head of population of *any* major metropolis on Earth. Natural 'sinks' for excess rainwater (such as open grounds – with vegetation, forests, mangroves, marshes) have been reclaimed and developed, and are therefore in short supply.

Anthropogenically superimposed concrete topography influences the origin and augmentation of flooding/water-logging. The concrete pavements, buildings and



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road dividers produce a triple effect. They reduce the efficiency of the ground to permit seepage of water to depths, obstruct lateral or down slope movement of water to reach a sink, like a river or a natural depression. Pavements and apartments can reduce percolation of water up to 90%. The vertical structures become geographical barriers and divide the city into several sub-basins, which are dislodged and disconnected from the main natural outflow.

Environmental NGO's have been fighting this trend for years, regrettably with limited success.

Why were there landslides?

Quarrying (both legal and illegal) of the hills in and around Powai and proliferation of slums on slopes of Hills at Ghatkopar, Kurla, Worli and Malabar has been so extensive that hill remnants have become unstable and likely to collapse. Hill slopes have also been cleared of vegetation to maximize construction potential, and this has added to the risk of landslides.

Why was there such high rainfall this year?

Climate is changing - the last time such heavy rain was recorded was over 100 years ago. All scientific studies confirm that climate change is significantly anthropogenic (i.e. human induced). One of the predicted effects of global Climate Change is extreme variations in tropical climates, including our rainfall patterns. You can see from the above list of "why's" that most of them are caused by *man*, not by natural causes.

WHAT Next?

What of the Dangers lurking round the corner to the health of Mumbai Denizens?

Health – The recent news of polio virus found present in Mumbai's sewage system is a virtual shocker for the health of Mumbai denizens and a death warrant for its infant population. Not to mention the onslaught of leptospirosis, dengue, filarial etc. during the floods and other bacterial infections playing their part due to contamination of ground water and water mains, which are a common happening during monsoons. The situation is catastrophic and needs remedy on a war footing.

Safety – Electrocuting due to short circuit of underground electrical mains and light poles are also routine during monsoons and many hapless victims lose their life on account of the same.

Environment – The flash floods in Tardeo, Bombay Central, Lower Parel, Parel, Dharavi, Sion, Santacruz, JVPD, Chembur, Ghatkopar (E), Kandivali (E) on even nominal down pours and failure of the drainage system is a regular and accepted feature by Mumbaikars.

The impending textile Mill lands under going development coupled with narrowing of channels leading to the Worli-Love Grove Complex and its outlet and proposed diversion proposed by many a developer to benefit their slum schemes will be added strain on the already crumbled drainage system. These schemes are blessed



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by bureaucrats and politicians and are a serious pointer to the lip sympathy and hordes of reports doled out to convince the electorate of their people centric attitude.

The development of BKC and Dharavi Slums (425 Acres) will give to further hot spots or flash flood prone areas and newer areas hitherto safe will now be under few feet of water viz. Dadar, Prabhadevi, Mahim, Girgaum and Worli in the city and Bandra, Khar, Andheri(E) in the suburbs. The otherwise brilliant idea to convert the 2,700 Acres of Salt-pan land at Bhandup-Mulund to house illegal migrants will wreck a complete havoc on the central and harbour side as these areas have low tidal effects and water is always logged in the mangroves, mud flats and salt pan areas. Suburban destinations like Ghatkopar, Kanjur Marg, Vikhroli, Vikhroli, Mulund on the eastern express highway will be the most hit and even normal discharge of sewage and storm water will be a problem leading to dangerous sanitation situation in already mosquito infested areas causing grave dangers of epidemics to its residents.

What to do to stem the rot?

By definition therefore, we can do something to address the root causes, and prevent recurrence of disasters or at least try to reduce the extent of damage when they happen next. Direct donations will help the bereaved and displaced, but they won't solve the problem. NGOs and environmentalists had been crying hoarse against unwise and unplanned development activity in Mumbai, mushrooming slums & sometimes illegal construction, dangerous and mostly illegal quarrying. Public Interest Petitions had been filed and fought to address specific instances of illegal construction, and also to prevent quarrying within city precincts (BEAG). Proactive measures including reviving of urban eco-system should be taken:

1. Stricter enforcement of existing laws (Coastal Regulation Zone, FSI rules, and Quarrying bans) is crucial: taking infringements to court should be a "last resort", and not a primary means of redressing wrongs.
2. Secondly, municipal plans should take into account environmental risks and hazards, not least due to climate change and global warming, of which there is now ample evidence. Haphazard marking of High Tide Lines (HTL) and Coastal Regulatory Zones (CRZ) by Coastal Zone Management Authority to suit individual builders projects have created havoc on entire development along Mumbai' coastline. The rise in sea levels has further compounded the problems of ingress of sea. Sustainable development of old settlements along the seashore and fisherman colonies should be allowed to develop after keeping a buffer zone of not more than 100 meters from the sea and creek demarcation as shown in sanctioned development plan.
3. Dense mangroves should be protected and minimum 50 meters corridor of mangroves should be additionally planted along the sea and creek boundary demarcation (Not HTL) as shown in sanctioned development plan to prevent soil erosion and adverse tidal effects including effects of tsunami and hurricanes.
4. All the waste water and effluents released from residential and industrial units released into the drain should be treated at regular intervals of 2 kms along the drainage channel and that sewage pumping stations should be



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erected to treat such waste water, before releasing the waste water into the sea. There should be gates at all outfalls so that ingress of sea water during high tide can be controlled.

5. Wave breakers should be erected along the entire Mumbai coastline at a distance of 1 km. to preserve the beach, marine life and plantations.
6. Dredging of sea bed should be carried out after carrying out due diligence so that alluvial sand is not lost.
7. The 25 meters No Development Zone (NDZ) barrier on either side of creeks should be extended to constructions along the Mithi river and extended up to Mahim and the Worli Love Grove Station Complex.
8. At Buildings Proposal approval stage, each construction project should have coverage area of not more than 60% so that there is seepage of water into the ground and that less water is diverted to the city drains. The basement approval policy of municipality should also be amended and that the basement area should also have no more than 60% ground coverage. Mere water harvesting schemes with no watch dog to oversee its implementation is a hog wash.
9. Alternative green technology should be developed and incentives/exemptions in VAT should be given to develop organic solutions and cleaning agents using green field technology so that the number of chemicals used in daily washing of utensils, clothes and toilet cleaning chemicals washing down the drain are minimized. The harmful chemicals (phosphates etc.) pollute the sea and its marine life and the damage is irreversible. The use of green organic solutions would give agrarian industry a boost and help farmers and indigenous entrepreneurs. The fishermen would be able to increase their yield and quality of products exported would fetch a premium in markets of developed nations. The effect on the marine ecology being positive would restore healthy marine life and vegetation, and restore the once pristine beach of Mumbai, and beach tourism would flourish earning valuable foreign exchange and employment for its youth.
10. A Green Field Project to restore marine ecology may be undertaken that would protect, enhance, and/or create habitat for marine life:
 - i. Construction of two backwater channels along the BKC, Versova, Gorai Creek by creating two openings in the existing levee, and adding rock and woody debris to prevent erosion at inflow and outflow area.
 - ii. Placement of properly sized (density) gravels and large woody debris in the channel to provide, rearing and refuge habitat for local fish and crabs. Plant riparian vegetation along the channel to provide vegetative cover and shade for the fish and to serve as wildlife habitat and several species of birds and other fauna.
 - iii. Construction of a low berm (adjacent small prop wall to major wall) along the road to control periodic floodwaters and to protect



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the road and houses from flooding. The flood damage reduction objective of this project is to provide the same level of protection that exist pre-project.

- iv. Construction of low-impact, passive recreation features including a paved parking lot, sidewalk, stairs, pedestrian footbridge, trash receptacles, benches, and a small information kiosk.
- v. The entire 2,700 acres of Salt-pan land along the central corridor could be converted into bio-marine diversity forest project along the lines of Central Park, London, whereby the land lost in open spaces (200 Acres app.) under the changed DCR 58 to suit the builders lobby by the state government and covertly supported by all political parties could be partially compensated. Perhaps these notorious social/public servants can claim to be the one after promulgating the above concept.

What about Mumbaikar?

It has become increasingly evident that the government along with BMC, the Collectorate, and Pollution Control Board has aligned their interests with those of the construction industry and slumlords, and regrettably against the interest of the people of Mumbai. The outrage against these agencies is gaining voice and the situation is akin to the emergency situation in some of our neighbouring countries, only that there are many dictators.

The utter neglect about the welfare of its citizens is an insult to injury to the Mumbaikars who contributes Rs.58,000 Crores to the national exchequer every year.

We look forward to our discerned readers to elicit the right response to address the issues and to rally and impress upon the corridors of powers that effective measures are not only necessary but are so vital to our existence and that of our generations to come, otherwise a whole lot of just not the denizens and city, but the *Vasudeo Kutumbakom*, Bhartiya culture will be lost out to the sea.
