



**Municipal Corporation of Greater Mumbai  
Presentation On  
Relief Measures & Damage Assessment  
due to  
Heavy Rains on the 26<sup>th</sup> July 2005**





# Description of Disaster

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## ■ Nature of event

- Very heavy rainfall started at 1430 hrs on the 26th July 2005.
- 994 mm of rainfall measured at Santacruz Meteorological Centre for a period of 24 hrs starting 0830 hrs on the 26th July, 2005.
- Excessive rain resulted in waterlogging in several suburbs.
- Mithi River overflowed and consequently led to water logging of Western Express Highway.
- Additionally, heavy rains at Raigad, Thane and Konkan region resulted in Dahisar and Poisar River overflowing, compounding waterlogging problem.
- There were 6 instances of landslide on 26th, 3 on 27th, one each on 28th, 30th and 1st August respectively

## ■ Names of severely affected locations

- Kalina, Bandra Kurla complex, Saki Naka, Air India Colony, LBS Road, Marol Military Colony, Dharavi, Versova, Goregaon, Kandivili, Borivili and Dahisar.



# Description of Disaster

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- Overall Assessment of Impact

- Estimated loss of life

- As many as 445 people lost their lives in the flashfloods and the landslides and 194 persons have so far died of various deluge – related illnesses.

- Names of roads blocked/congested

- Most arterial roads and highways in the suburbs were severely affected due to waterlogging and traffic jams resulting from vehicle breakdown in deep waters. Roads that witnessed major traffic jams include Western Express Highway, Eastern Express Highway and LBS Marg.

- Estimated number of establishments/vehicles damaged

- As per the estimates received from the office of the collector B.S.D, The estimated Number of damaged buildings and vehicles is as follows:
    - Residential establishments - partly damaged: 50,000
    - Residential establishments - fully damaged: 2,000
    - Commercial establishments: 40,000
    - Vehicles: 30,000



# Description of Disaster

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- Overall Assessment of Impact

- Effect on train services

- Heavy rains led to railway tracks being submerged and consequent stoppage of services on central (main and harbour lines) and western railways around 4:30 pm on the 26th July.

- Effect on air services

- Heavy rains led to airport being flooded. Additionally there was extremely poor visibility as a result of which flight services in and out of Mumbai were stopped on the night of the 26th July 2005.

- Effect on power supply

- Electricity supply was stopped in most parts of Mumbai's Western Suburbs in the night of the 26th July 2005.



# Communication actions taken

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- Communication channels with Western Railway, Central Railway, BEST and Mumbai Police were immediately established utilizing the hotline infrastructure in the MCGM Disaster Management Cell (DMC) around 3:30pm on the 26<sup>th</sup> July 2005.
- The Indian Navy Flag Officer was contacted for making boats and divers available for rescue operations a little later.
- Municipal Commissioner & Additional Municipal Commissioner (Western Suburbs) in charge of the Disaster Control Room at MCGM personally started coordinating rescue operations.



**Land Slide at Vishvadeep Society, Raigad Vibhag,  
Vikhroli Park Site, Mumbai-400 079 on 01/08/2005**





# Land Slide at Vishvadeep Society, Raigad Vibhag, Vikhroli Park Site, Mumbai-400 079 on 01/08/2005





**Land Slide at Shri Ram Society, (Tarun Mitra Mandal) Anandgad,  
Vikhroli Park Site, Mumbai-400 079 on 01/08/2005**





## **Houses and Nalla (Storm Water Drains) damaged at 'S' Ward, Bhandup, Mumbai-400 078.**





## **Houses and Nalla (Storm Water Drains) damaged at 'S' ward, Bhandup, Mumbai-400 078.**





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# **Houses and Nalla (Storm Water Drains) damaged at 'S' ward, Bhandup, Mumbai-400 078.**







# Immediate assistance provided (Rescue and Relief)

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- Transport arrangements made for stranded passengers
  - Around 1.5 lakh people were stranded at the CST and Churchgate local stations due to disruption of railway services. BEST ran extra buses - 52 from Churchgate to Mahim and 86 from C.S.T. to Sion to facilitate their dispersal on the 26<sup>th</sup> July 2005. Additionally, 300 stranded people were provided shelter and food in the Municipal premises of A Ward area.
- Rescue operations completed
  - The Fire Brigade and the Rescue teams of MCGM undertook several major and minor rescue operations. Some of the major operations included
    - Rescuing school children from Daulat Nagar, Borivali on 26<sup>th</sup> July, 2005
    - Rescuing people from 140 BEST buses and other vehicles held up due to water logging; MCGM's Search & Rescue Team was put in operation, which rescued around 3700 people on the 26<sup>th</sup> / 27<sup>th</sup> July 2005. Rescue boats of Navy deployed at Kurla Kalina area.
    - Rescuing passengers of 6 buses at Bandra-Kurla Complex with the help of Navy and Mumbai Police on 27<sup>th</sup> of July 2005.



# Immediate assistance provided (Rescue and Relief)

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## ■ Emergency relief arrangements

### ■ MCGM organized emergency relief arrangements on a war footing.

- Food packets and drinking water were arranged for the stranded people with the help of Non-Governmental Organizations and Social Organizations on the 27<sup>th</sup> of July 2005.
- Over 25,000 people were provided relief across 15 locations across the city including Air India Colony, Kranti Nagar (Jari Mari Road), Filter pada at Bhandup and Panchsheel Nagar. Affected people were shifted to nearby Municipal schools, local buildings and halls on the 27<sup>th</sup> of July 2005.
- MCGM conducted relief operations in several areas through its own Rescue-and-relief teams. For example, 8,750 and 3,250 food packets were distributed in City and Western suburbs. At the Air India colony, MCGM distributed 5,000 food packets and 1,000 litres of milk to the more than 3,500 families stuck in water on 2<sup>nd</sup> August 2005. Relief operations lasted more than 12 hrs and were conducted by a joint team of MCGM and H2O using 1 rib boat, 1 rescue board and 3 rowing boats.
- MCGM also coordinated relief work at other places with the help of social service organisations (such as Nirmala Niketan College of Social Work and Tata Institute of Social Science), over 20 NGOs (including Akanksha, Yuvak Pratishthan, Apnalaya) and industry houses (e.g, Tata Group through Dorabjee Tata Trust).
- A coordination mechanism was set up at the DMC to facilitate relief operations of individuals, industry houses and NGOs on the 2<sup>nd</sup> August 2005.



# Flood Relief Operation at Kurla & Kalina







# Damage to infrastructure

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- The heavy deluge caused significant damages to the municipal infrastructure. A summary of the major damages is as follows:
  - Water supply
    - Pumping stations at Deonar, Chunabhatti and Shiv Tekdi were submerged in flood water affecting pumps, motors and control panels. More over pipelines at Goregaon and Kandivli were affected due to washing out of roads.
  - Sewerage
    - Severe damage was caused to 10 pumping stations and surrounding structures. These included Sewage Pumping Plants at Versova, New Versova, Goregaon, Malad, Saki Naka, Kherwadi, Jai Bharat, Dunccon, Kalina and Brahmanwadi.
  - Storm Water Drains
    - Water entrances, flood gates, manholes, and nallahs at several places were damaged.
  - Roads
    - 951 Roads suffered moderate to severe damages.



# Chembur, M/East Ward





# Chembur, M/East Ward





# Chembur, M/East Ward





# 'L' Ward, Kurla





# 'L' Ward, Kurla





# 'N' Ward, Ghatkoper





# **'N' Ward, Ghatkoper**





# Post-Flood Sanitation measures undertaken

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- Solid waste and debris

- Due to incessant rains, waste had accumulated in various areas in the city. MCGM deployed 107 JCBs, 438 Dumpers and 511 Compactors and lifted a total of 253612 metric tons of garbage from all wards from 29<sup>th</sup> July till 21<sup>st</sup> August, 2005. The waste lifted on a daily basis is almost double of what MCGM lifts on a normal day.

- Carcasses

- A total of 16307 carcasses were disposed of including those of 15000 sheep and goats (mainly from Deonar) and 1307 buffaloes (mainly from Goregaon, Kandivli and Andheri), in a massive operation involving 27 cranes, 87 dumpers and 24 JCBs spread primarily over three days between 27<sup>th</sup> and 30<sup>th</sup> July 2005.





# Post-Flood Sanitation measures undertaken

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- Because of the severe rains and the fact that people had walked extensively through flood waters, risk of epidemics of water-borne diseases such as gastroenteritis, hepatitis and also of leptospirosis was high. MCGM implemented several preventive and therapeutic measures to minimize these risks.
- Preventive measures
  - Several preventive measures to minimize risk of infection from all possible source were undertaken. Extensive spraying of disinfectants and insecticides was undertaken to control pests, and minimize flies and mosquitoes. In addition, water purification tablets and prophylactic medications were also distributed.
    - Disinfection of open spaces and waste collection areas
      - Over 24 metric tons of bleaching powder disinfectant and over 2 metric tons of carbophenol powder were sprayed to disinfect public spaces
    - Larval mosquito control measures
      - Vector detection activities were resumed in less than 48 hours after the deluge
    - Adult mosquito control measures
      - Insecticide was sprayed and fogging operations completed in all identified 1174 vulnerable locations immediately after the deluge



# Post-Flood Sanitation measures undertaken

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- Fly control measures

- Fly menace was also effectively controlled by removing garbage from the 29<sup>th</sup> July to the 20<sup>th</sup> August 2005 on a war footing.

- Vigorous application of disease prevention methods played a significant role in minimizing the emergence of severe outbreaks of water borne and vector-borne diseases such as gastroenteritis, hepatitis.

- Treatment measures

- In view of the fact that lacs of people had to wade through dirty waters on the 26<sup>th</sup> and 27<sup>th</sup> of July 2005 there were apprehensions of major outbreak of leptospirosis which requires early diagnosis and treatment in all suspected cases, for reducing the risk of mortality.
  - MCGM therefore decided to provide comprehensive healthcare services though 130 odd specially constituted medical teams that have treated over 3 lac patients virtually at their door steps through health camps and outreach program.





# Post-Flood Sanitation measures undertaken

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- Essential medicines like paracetamol, doxycycline, septran and chloroquine have so far been distributed free of cost to all the patients throughout the city.
- Augmentation of beds in Hospitals to provide intensive therapy to worst affected
  - Between 29<sup>th</sup> July 2005 and 21<sup>st</sup> August 2005, MCGM admitted 10985 patients in its hospitals with deluge related diseases (gastroenteritis, enteric fever, malaria, hepatitis and suspected leptospirosis) and successfully treated more than 98% of these with 210 cases of mortality.
- Collaboration with private, governmental organisations and NGOs to extend additional care
  - MCGM worked closely with doctors from multiple agencies to make healthcare available in the most affected areas e.g. in Kurla and Kalina, MCGM has been working with doctors from Tata Power, local NGOs and volunteer organisations to provide healthcare



# Post-Flood Sanitation measures undertaken

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- Creation of adequate drug reserves and admitting capacity in public health institutions
  - MCGM has collaborated with the State Government and several other institutions to make additional doctors and admission capacity available to the people affected by the crisis. In addition, significant drug reserves have been created to manage the post-flood complications.
    - Additional physicians to manage increases in patient load
      - Government of Maharashtra has arranged for an additional 31 doctors from Government Medical Colleges in Aurangabad, Pune and Dhule. In addition 40 doctors from 6 private colleges/hospitals are also assisting MCGM doctors at wards and peripheral hospitals.
  - Additional admission capacity to manage seriously affected patients
    - Over 4,500 beds have been made available to admit patients of water / vector borne diseases – 2,200 beds at the Municipal hospitals, 2000 beds at ESIS hospitals and 300 beds at government hospitals
  - Creation of adequate drug and medication buffers
    - MCGM, with help from the Government of Maharashtra, has created a central stock of essential medicines like doxycycline, septran, paracetamol, chloroquine and chlorine tablets exclusively for relief operations. In addition to this, field officers have been authorized to directly purchase necessary medicines.





# Other actions taken

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## ■ Water supply

- The Hydraulic Engineer's department ensured normal operations during this period. However, due to flooding of suction tanks and failure of electric supply, consumers of some areas could not get water. The measures taken by this department include the following:
  - Supply of water to the affected areas using more than 50 tankers delivering 57 lakh litres of water through 631 tanker trips
  - Repair of pumps damaged by the deluge: The pumping stations at Deonar and Chunabhatti were overhauled and put into service on 29<sup>th</sup> July 2005 while the Shiv Tekdi pumping station was made operational on 28<sup>th</sup> July 2005.
  - Repair of pipelines at Goregaon and Kandivili that had burst following collapsing of roads due to heavy rains.
  - Additional Chlorine dose at all reservoirs, as safety measure

## ■ Sewerage

- Immediately after the receding of floodwater, restoration programme was taken up at all the pumping stations which included dewatering of flooded premises and then repairs of pumps on a war footing. All the pumps have been operationalised.



# Damage Assessment

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- Detailed Damage Assessment Report has been prepared, the summary of which is given in the next few slides





# Proposal for Central Assistance (Summary of Form-I)

<b>Sr. No.</b>	<b>Items</b>	<b>Urban Development</b>	<b>Total</b>
9	Emergency supply of drinking water in rural areas and urban areas	10,83,000	10,83,000
10	Provision of medicines, disinfectants, insecticides for prevention of outbreak of epidemics	1,52,90,000	1,52,90,000
14	Provision for temporary accomodation, food, clothing, medical care etc of people affected/ evacuated	29,08,000	29,08,000
16	Repair/ restoration of immediate nature of the damaged infrastructure relating to communication, power, public health, drinking water supply, primary education and community owned assets in the social sector	1,82,92,375	1,82,92,375



# Proposal for Central Assistance (Summary of Form-I)

Sr. No.	Items	Urban Development	Total
18	Operational cost ( Of POL only) for Ambulance Service, Mobile Medical Teams and temporary dispensaries.	13,38,000	13,38,000
19	Cost of Clearance of Debris	3,55,87,200	3,55,87,200
20	Draining off flood water in affected areas	45,000	45,000
22	Disposal of dead bodies/ carcasses	8,96,000	8,96,000
<b>Total</b>		<b>7,54,39,575</b>	<b>7,54,39,575</b>





# Proposal for Central Assistance (Summary of Form-II)

<b>Health</b>	MCGM Medical Colleges	47,30,000
	Peripheral Hospitals	1,14,62,454
<b>Municipal Properties &amp; Buildings</b>		82,80,000
<b>Water Supply System</b>		25,18,14,000
<b>Utilities</b>	Abattoir	3,54,50,000
<b>Education Department</b>		13,00,000
<b>Gardens</b>		18,64,480
<b>Roads</b>		191,13,64,296
<b>Waste Management and Drainage Systems</b>	Sewerage Operations	1,36,66,032
	Solid Waste	9,04,42,670
	Storm Water Drains	14,49,01,000
<b>Total Cost</b>		<b>247,52,74,932</b>

# Major Damages- Properties

Major Damaged Items	Level of damage (Severe, moderate)	Damaged item in physical terms ( units such as Km, number etc)	Total losses Rs in Laks
Bridges (4 bridges along Ghatkopar Mankhurd Link Road)	Moderate	4 Bridges	15.55
Foot Over Bridge across Dahisar river at Patilwadi, Dahisar (W)	Severe	1Bridge	10.00
side wall parapet chajja Juhu Dispensary	Moderate		7.00
Compound wall & Shahabad pavement	Moderate	125 RM 250 SM	5.25
Compound wall with storm water drain	Moderate	50Rm	3.75
Coumpound Wall	Moderate	70 R M	3.50
Compound wall	Moderate	80 Rm	3.50
Compound wall of Sindhi Galli, Gulalwadi school	Moderate	Compound wall 50 R.K.etc.	3.00
Compound wall & Shahabad pavement	Moderate	50 RM 200 SM	2.70
Compound wall with grill damaged . Asphalt pavement damage		50 RM 100 SM	2.50
Compound wall & pavement damaged	Moderate	50 RM 200 SM	2.50
Compound wall damage	Moderate	70 RM	2.10
Compound wall of Amboli Cemetry	Moderate		2.00
Shed with A.C.roofs, compound pavement & compound wall damaged.	Moderate	20 RM 100 SM	2



# Major Damages-Water Supply System

Major Damaged Items	Level of damage (Severe, moderate)	Damaged item in physical terms ( units such as Km, number etc)	Total losses (Rs in Laks)
Strengthening of dams - Tulsi, Vehar & Powai	Moderate	Lumpsum	2000
Internal road and drains of the Ghatkopar Yard office of Water Works Section	Severe	300 R.M.	60
Repairs to erroded portion of embankment of Service Rd. from Kalher to Modak Sagar.	Severe	2.0 KM	39.4
Patchwork to the major potholes on service Rd. from Kalher to Modak Sagar	Severe	16.0 KM	37
Replacement of damaged Pressure Transmitters at various locations	severe	60 Nos	30
Removal of landslide material behind Trombay High level Reservoir, providing drain and approach road towards hill side	Moderate	Road 270 Mts SWD 300 Mts	22
Reconstruction of damaged portion of spill way basin,steps, fencing etc.	severe	500 Cu.M	20
Strenthening of downstreams side of 'masonry dam on Dahisar river due to heavy scouring and erosion at Toe level.	severe	RB 250 Cu.M Concrete 250 Cu.M	20
Repairs & resurfcacing of Service Road between Gundavali to Anjur and K.B. to Pogaon	Severe	3.5 KM	19
Various electrical & mechanical tools & spares	Severe	190 Nos. & Trans. oil - 150 Litres	18.76
Reconstruction of collapsed cmpnd wall with foundation at Ghatkopar High Level Reservoir	Severe	130 RM	15
Construction of Toe wall and retaining 'wall in stages. (Specialized job @ odd location)	severe	50 R.M	15



# Major Damages-Solid Waste Management

Major Damaged Items	Level of damage (Severe, moderate)	Damaged item in physical terms (units such as Km, number etc)	Total losses (Rs in Laks)
Upgradation of Garages/ Chowkies/floorings	Severe/Moderate	lot	527.00
Addl. Manpower costs	Moderate	21,546 hours	70.07
Buildings/Garages repairs cost	Severe/Moderate	13 Nos.	61.60
Additional cost of disinfectant cum deo-dorant spraying	Severe	lot	60.70
Damages to Vehicles- repair cost	Severe/Moderate	211 Nos.	41.33
Addl. services rendered	Moderate	1694 No. of Shift	41.28
Additional cost on lifting of extra load of garbage	Severe	16300 MT	32.82
Additional cost in hiring of cranes, JCB's, poclain,	Severe	537 Shifts	29.97
Cost incurred on disposal of dead animals	Moderate	16,700 Nos	8.96
Damages to Store Materials – replacement cost	Severe	lot	8.85
Damaged Equipments – replacement cost	Severe/Moderate	25 Nos	7.20
Damages to installation platform etc. - replacement cost]	Moderate	70 Nos.	7.00
Damages to consumables – replacement cost	Moderate	lot	5.75



# Major Damages-Storm Water Drains

Major Damaged Items	Level of damage (Severe, moderate)	Damaged item in physical terms ( units such as Km, number etc)	Total losses Rs in Laks
Damupada, Gautam Nagar, Kandivali (E).	Severe	1 KM	250.00
Heavy siltation in SWD / nalla	Heavy	15000 c.m.	100.00
Janu pada, Thakur village, Kandivali (E).	Severe	0.3 KM	75.00
Ramchandra nalla near Gopal Hall, Malad (W)	Severe	0.2 KM	62.00
Nalla retaining wall, compound walls in brick and stone masonry at various location collapsed in Mogra nalla system.	Severe	0.4 KM	60.00
ii) Majas nalla	Severe	0.25 KM	54.88
Mithi River	Severe	0.08 KM	41.48
Hyundai Plot near Mahesh Nagar	Severe	0.04 KM	34.00
Piramal nalla, Prem Nagar	Severe	0.1 KM	31.00
Swamiji School, Opp. SBI Colony, Borivali (E), Dahisar River	Severe	0.12 KM	30.00
Y.R. Tawde nalla near SuryaKiran Bldg.& near L.T.Rd. culvert, Dahisar (E),	Severe	0.1 KM	25.00
iv) Krishna Nagar nalla	Severe	0.11 KM	24.15
Vasari Hill	Severe	0.075 KM	23.25
Dindoshi Bhavani CHS Makbool Compound	Severe	0.075 KM	23.25
Tirupati Tower Opp. Hotel Shivam Sundaram, Thakur Complex, Kandivali (E).	Severe	0.09 KM	22.50



# Major Damages- Roads

Damaged Item	Level of damage (Severe, moderate)	Damaged item in physical terms ( units such as Km, number etc)	Total losses Rs in Laks
paint to kerb stone dividers etc.	Severe	2000000 R.M	2100.00
Anik Wadala Rd.	Severe	81600 Sq M	571.20
Minor Rds. received from F/S Ward	Moderate	113847 Sq M	455.39
Marve Road, Malad (W)	Moderate	98868 Sq M	395.47
L.U.Gadkari Marg	Severe	44520 Sq M	311.64
Lane marking	Severe	180000 Sq M	300.00
M.G.Road	Moderate	68400 Sq M	273.60
Gorai Village Rd.	Severe	28800 Sq M	201.60
Akurli road	Moderate	46800 Sq M	187.20
Lagoon Road, Malad (W)	Severe	24750 Sq M	173.25
Sant Rohidas Marg	Moderate	24000 Sq M	168.00
Minor Roads in G / North Ward	Moderate	41850 Sq M	167.40
Roads in Kandivali Industrial Estate	Moderate	40950 Sq M	163.80
L B S Marg	Moderate	37350 Sq M	149.40



# Major Damages- Sewerage Operation

Major Damaged Items	Damaged item in physical terms (units such as Km, number etc)	Total losses Rs in Laks
Damage to the sewer network, manholes, missing of manhole covers etc.	L.S.	90.00
Dewatering of drywell by using the D.G.Sets and pumps	L.S.	7.60
Building damage such as collapsing of wall, damage to the doors and partitions and painting, electrical wiring etc.	L.S.	3.00
Refurbishing Motor of 185 KW -6 Nos.	6	3.00
Refurbishing Main L.T. Panel-1 No	1 No.	3.00
Store articles damaged/missing such as coconut oil, engine oil. Diesel, soaps, etc.	L.S.	2.80
Civil repair Works - Walls, Doors Partitions painting and electirc wring	LS	2.20
Store Article Damage - Lub oils, Deisel and verious cleaning materials		2.15
Refurbishing of Choke Removal Machines - 1 No.	1 No.	2.00
Refurbishing of Jetting Machines-1,Choke Machines-6,OKC Machines- 8,Compressor with motor- 1, Air Compressors- 7, Air blowers- 3, Welding Machine- 1, Portable pumps- 6, Poinger drilling machine-1, Heavy duty drill Machine-1, Battery charger-1,	1 No.	1.72
Damage to Office furniture, telephone units, office records.		1.66
Office record and replacement cost of damaged furniture, such as various sanctioned papers, files, S.R. of employees, office correspondence/demand/ sanction/advance/imprest registers, stationary, permanent records , Table & chairs, etc.	L.S.	1.50
Refurbishing of Gully emptier- 2 Nos.,Mudsuckers - 3 Nos.,Combination Unit- 1 No.	LS	1.20
Replacement of Office Automation System such as EPABX system , wireless, P.Cs., telephone instruments, etc.	L.S.	1.05

# Major Damages- Hospitals

Hospitals	Major Damaged Items	Damaged item in physical terms ( units such as Km, number etc)	Total losses Rs in Laks
Dr.R.N.Cooper Hosp. Juhu	Plant & Machinery	3 X-Ray machines, 1 EEG machines, 2 autofilm processors, 1 sonography machines, 2 microscopes, 2 ventilators, path. equipment, A/C plant, pump and intercomm system	68.00
KEM Hospital	Plant & Machinery	X Ray machine -3 nos, Lift 1, Pump 1, Medicines	47.30
Dr.R.N.Cooper Hosp. Juhu	Medicine & Surgical Material	(injectibles, antibiotics, suture material, IV set)	25.50
S.K.Patil Hospital	1 Compd wall	130 Mt Length	5.00
Dr.R.N.Cooper Hosp. Juhu	2 Gen. Store Material	Linen, pathology, reagents & chemicals	4.00
MAA Hosp. Chembur	9 Compound Wall 200 Ft. Length & 15 Ft. length	2 walls	3.75
MAA Hosp. Chembur	6 Generator	1 No.	3.00
MAA Hosp. Chembur	1 X-ray M/c	Units	2.05
Sion Hospital	Electrical Items	Electrical Cables, switches, etc. damaged	0.72
Bhagwati Hosp. Borivali	9 Pager -15	15 Nos	0.45
Bhagwati Hosp. Borivali	8 Furniture of Conference Hall	full set	0.40
Bhagwati Hosp. Borivali	10 M.S.Cabin furniture	full set	0.40
Bhagwati Hosp. Borivali	3 Computer CPU	2 Nos	0.30
Bhagwati Hosp. Borivali	14 Linen	600 Mtrs (Approx)	0.30





# Improvement of Storm Water drainage system in Mumbai

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## ■ Cause of Flooding

- Inadequate dilapidated drainage system in Island City, which was constructed approx. 150 years ago
- Rapid development eliminating holding ponds.
- Increasing the coefficient of run-off due to fast development
- The slum encroachments over existing nalla banks have reduced the waterways



# Appointment of Consultants

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- The Corporation therefore thought of studying the whole SWD system
- M/s.Watson Hawksley International Pvt. Ltd. Appointed as consultant in the year 1989
- The consultant surveyed the existing drains & nallas
- The city and suburbs area SWD Network is divided into 121 chachments
- Consultants studied deficiencies, identified difficulties in cleaning and maintenance.
- They reviewed design criteria and prepared a master plan for augmentation of SWD system
- The consultants submitted their final report in the year 1993
- It is popularly known as **BRIMSTOWAD** Report



## Major recommendations in the BRIMSTOWAD report

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- Removal of obstructions of water mains, cables, etc. in the SWD system
- To rehabilitate old/dilapidated SWD system in City and augmentation of SWD in certain stretches
- To remove encroachments, structures within/above nallas/SWDs
- To change the design criteria from 25 mm/hr to 50 mm/hr rainfall intensity and coefficient of runoff as 1.00 from earlier value of 0.50
- To augment the SWD system for new design criteria with tidal effects
- To train, widen and deepen nallas
- To augment railway culverts at various flood prone areas
- To provide pumping stations at the city outfalls at Haji Ali, Love Grove and Worli





## Financial implications of the BRIMSTOWAD report

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- The total cost of improvement suggested was Rs.616.30 Cr.
  - Figures based on 1992 prices and planned span of 12 years
- Works could not be taken up systematically mainly because:
  - Financial constraints
  - Encroachment on sites
- In the past 10 years, works of about Rs.260 Cr. could be completed.
- At today's prices, the cost of the remainder of the project works out to Rs.1200 Cr.
- Works proposed to be completed in three years

■ Phase I	2005-2006	Rs. 350 Cr
■ Phase II	2006-2007	Rs. 400 Cr
■ Phase III	2007-2008	Rs. 450 Cr
■ Total		Rs. 1200 Cr
- State and Central Governments have been requested for financial assistance



## Phase I : 2005-2006

Sr	Nature of Work	Block Estimates
1.	Lining/Reconstruction of arch drain along Patthe Bapurao Marg, Grant Road	Rs. 25.00 Cr
2.	Lining/Reconstruction of Double Barrel arch drain at Britannia Outfall, Reay Road	Rs. 15.00 Cr
3.	Augmentation of Mahalaxmi Railway Culvert and other related works at Saat Rasta and Chinchpokli and construction of pumping station at Haji Ali	Rs 50.00 Cr
4.	Augmentation of SWD in BDD Chawl area and construction of Pumping Station at Love Grove	Rs. 40.00 Cr
5.	Training of Textile Mill Nalla from G/South Ward office to Dr. Annie Besant Road including rehabilitation of stuctures and construction of pumping stations at Cleveland Bunder	Rs. 120.00 Cr
6.	Widening, deepening and training of Mithi River	Rs. 40.00 Cr
7.	Covering of roadside open SWDs in suburbs	Rs. 60.00 Cr
	<b>TOTAL</b>	<b>Rs. 350.00 Cr</b>



## Phase II : 2006-2007

Sr	Nature of Work	Block Estimates
1.	Lowering of culverts under Tansa Mains and training of Nallas at Chunabhatti, Pratiksha Nagar area	Rs. 5.00 Cr
2.	Remodelling of Railway Culverts at Wadala Gate # 4 and augmentation of SWD in Nadkarni Park and Korba area	Rs. 10.00 Cr
3.	Widening, deepening and training Mithi river	Rs. 80.00 Cr
4.	Training of Nallas in Gazdarband, Santacruz (W)	Rs. 30.00 Cr
5.	Improvement of Poisar River System, Irani Wadi, Kandivli area	Rs. 25.00 Cr
6.	Augmentation of SWD under Jaoji Dajaji Road upto Haji Ai Bat (including improvement to Floodgates)	Rs. 25.00 Cr
7.	Removal of obstructions from SWDs and Nallas	Rs. 30.00 Cr
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## Phase II : 2006-2007

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Sr	Nature of Work	Block Estimates
8	Improvements of SWD in Dadar TT, Hindu Colony and Dharavi area	Rs. 30.00 Cr
9	Training of Subhash and Rafiq Nagar Nallas in Chembur	Rs. 15.00 Cr
10	Strengthening of arch drains by lining in city area	Rs. 15.00 Cr
11	Widening, deepening and training of Nallas in Kanjur Marg area (balance work)	Rs. 10.00 Cr
12	Covering of Roadside open SWDs in Suburbs	Rs. 125.00 Cr
	<b>TOTAL</b>	<b>Rs. 400.00 Cr</b>



## Phase III : 2007-2008

Sr	Nature of Work	Block Estimates
1	Modification of culverts in Kurla Car Shed area	Rs. 10.00 Cr
2	Training of Mhatre Nalla, Borivli (W)	Rs. 10.00 Cr
3	Improvements of SWD in Valnai area, Malad (W)	Rs. 5.00 Cr
4	Improvement of SWD system at Milan Subway area	Rs. 5.00 Cr
5	Widening, training and deepening of Vakola River	Rs. 25.00 Cr
6	Improvement of SWD system in Azad Nagar, Wadala, Reynolds colony in MbPT area	Rs. 10.00 Cr
7	Improvement of SWD in Koliwada, GTB Rly. Stn. Area	Rs. 10.00 Cr
8	Construction of Box drain along NJ Marg & P. D'Mello Rd. upto outfall	Rs. 5.00 Cr
9	Conversion of Dhapa Drains to Pipe Drains	Rs. 20.00 Cr
10	Training of Kajupada Nalla from Anand Nagar to Creek at Dahisar	Rs. 10.00 Cr
11	Covering of Kajupada Nalla under 120' wide DP Road	Rs. 10.00 Cr.
		<b>Contd...</b>



## Phase III : 2007-2008

Sr	Nature of Work	Block Estimates
12	Training of Nallas in Market Lane, Marve Rd., Malad	Rs. 5.00 Cr
13	Improvement of SWD in Usha Nagar and Datar Colony area, Bhandup	Rs. 5.00 Cr
14	Improvements of SWD in Nahur, Nanepada, Mulund	Rs. 5.00 Cr
15	Purchase of Desilting machines like Poclain, Dredger, Mahabali, Dumpers, Jetting Machine, Suction Machine.	Rs. 15.00 Cr
16	Setting of workshop in Eastern and Western Suburbs	Rs. 20.00 Cr
17	Widening, deepening and training of Mithi River	Rs. 60.00 Cr
18	Training of Laxmi Baug nalla part II including diversion of local nallas at Ghatkopar (E)	Rs. 15.00 Cr
19	Strengthening of arch drains by way of lining in city area	Rs. 65.00 Cr
20	Covering of Roadside open SWD in subrubs	Rs. 140.00 Cr
	<b>TOTAL</b>	<b>Rs. 450.00 CR</b>