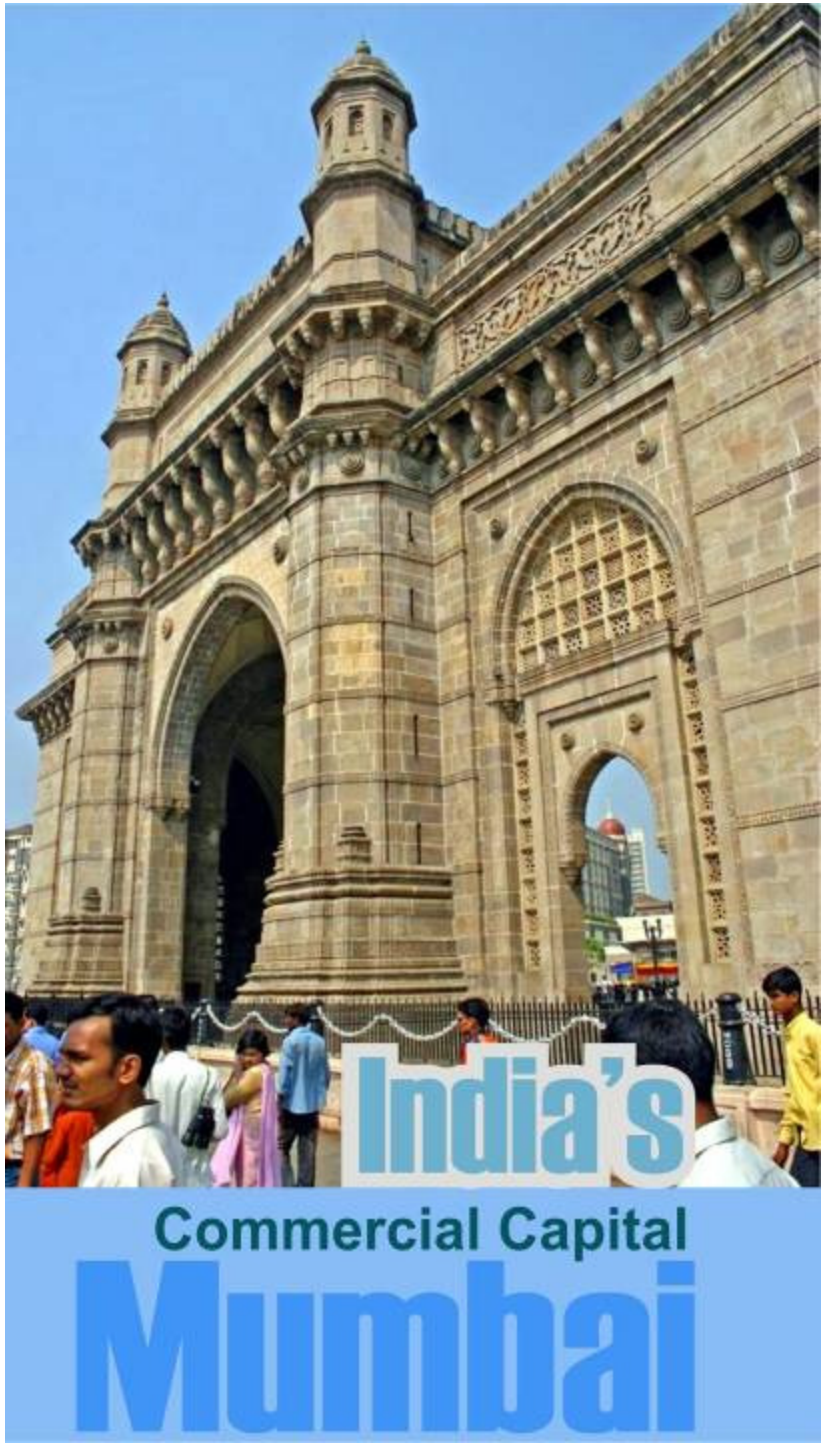
Municipal Corporation of Greater Mumbai, India

MEGACITIES AND DISASTER RISK

- THE CASE OF MUMBAI



Presentation by

S S KSHATRIYA
Municipal Commissioner

MUMBAI

- Largest city in India
- 6th Largest metropolis in world
- Contributes 33% of India's tax collection
- Ranks 49th in Global Financial Center Index

- Bombay Stock exchange is 3rd largest in the world
- Capital of India's pharmaceutical and film production industries
- South Asian regional head office of many multinational corporations
- Large collection of Gothic, Indo Saracenic and Art Deco Architecture

MUMBAI: CHARACTERISTICS

- **POPULATION:**

  2001 - 11,914,398

  2008 - 13,662,885 (World Gazetteer)

- **AREA**:

  437.71 sq km

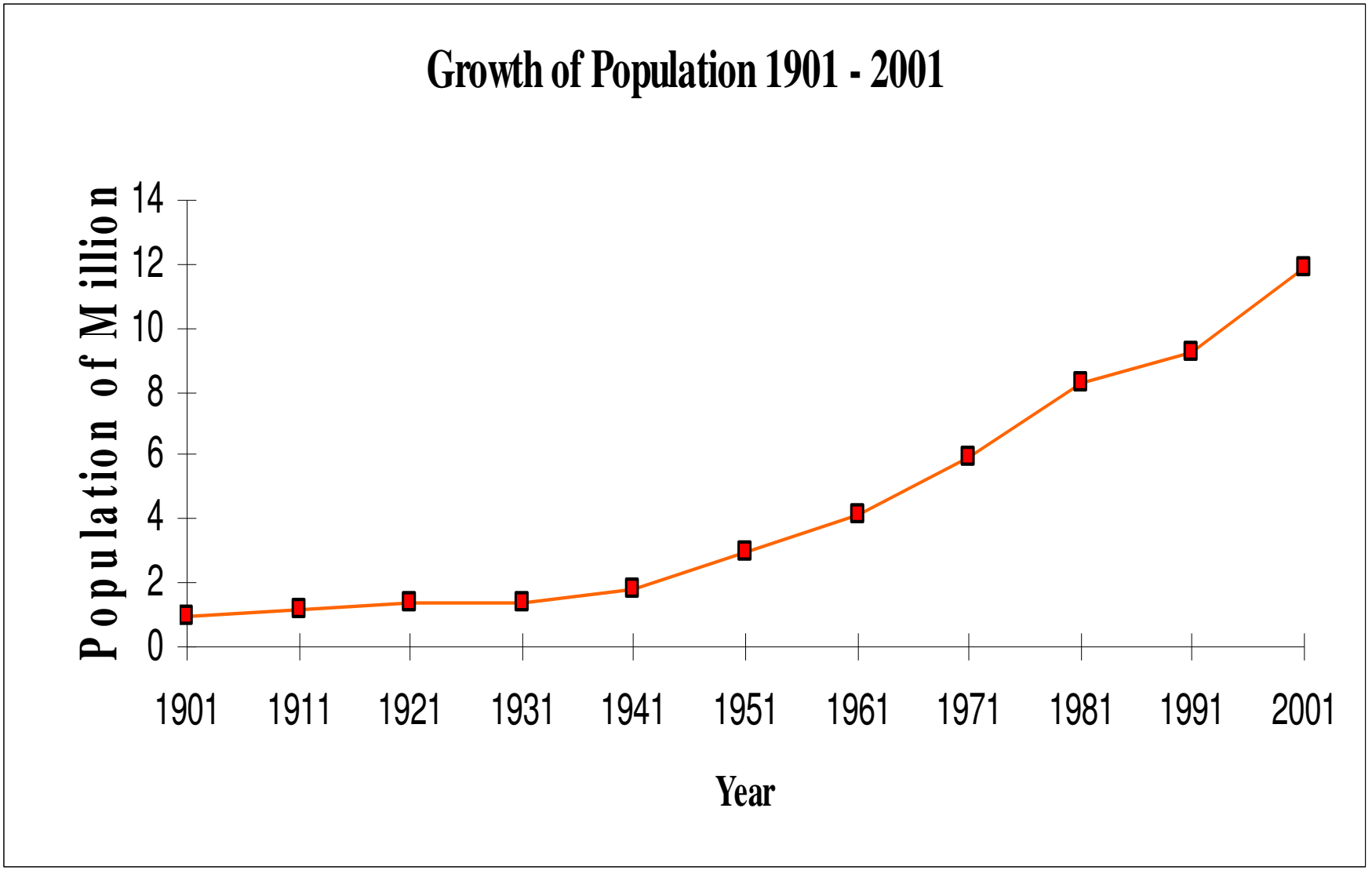
- **DENSITY:**

  27,000 persons/km^2

- **ALTITUDE:**

  10-15 meters above sea level some points just 1 meter above Mean Sea Level

GROWTH OF POPULATION 1901-2001



OBJECTIVES

- Provide State of Art Infrastructure
- International Financial Centre
- Eco-friendly City
- Build Disaster Resilient City

POTENTIAL HAZARDS TO MUMBAI CITY

1) Hydrological & Climatological Disasters

- Floods
- Cyclones
- Cloud Bursts
- Sea Erosion

2) Geological Disasters

- Earthquakes
- Landslides

3) Chemical & Industrial Disasters

(Chlorine gas leak in July 2010)

4) Accident Related Disasters

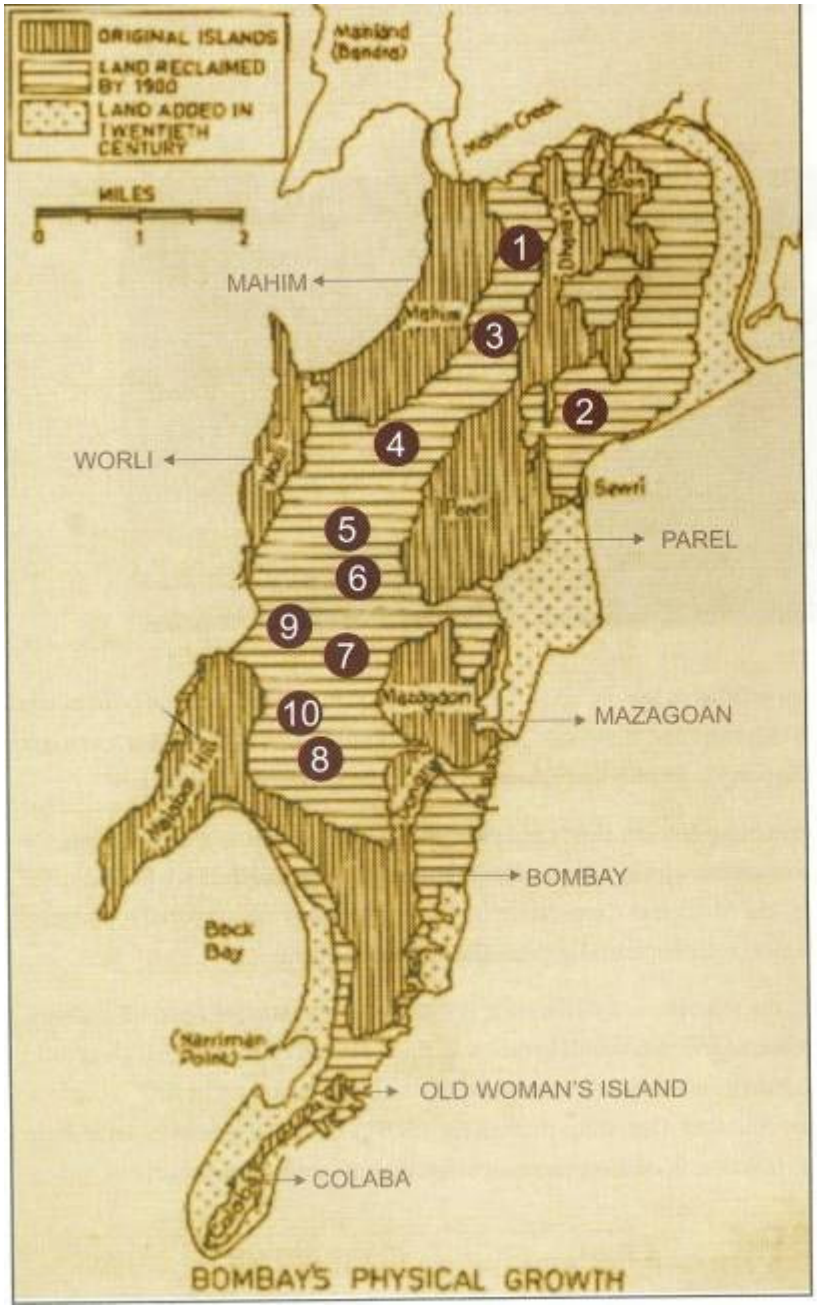
- Fires
- Oil Spills
- Major Building Collapses
- Festival related Disasters
- Air, Road & Rail Accidents

5) Epidemics

- Malaria
- Swine Flu
- Gastroenteritis
- Dengue

VULNERABILITIES OF MUMBAI CITY

- Insular Location
- Physiographic constraints- city is confined to 35^0 Wedge
- Large tracts of reclaimed land
- Extreme population and structural density



VULNERABILITIES OF MUMBAI CITY

Flooding

- Rainfall Characteristics
- Flooding of Rivers
- Inadequate Storm Water Drainage System
- Increase in Impermeable Surface Cover

VULNERABILITIES OF MUMBAI CITY

Rainfall Characteristics - Average 2363 mm/year

- Almost 60% of average rainfall during 2 months in a year
- Often **35-40 % in 2-3 events**

Percentage of Annual Rainfall

Year / Month	June	July	August	September
2004	13.2	38.4	40.0	8.4
2005	21.0	43.7	10.2	25.1
2006	16.7	40.3	31.3	11.7
2007	37.0	20.4	25.7	16.9
2008	37.5	29.5	19.5	13.4
2009	14.8	48.7	13.4	23.1
Avg.	**23.4**	**36.9**	**23.4**	**16.4**

AREAS VULNERABLE TO FLOODING

- Flooding Spots: 266
- Chronic Flooding Spots: 55
- Slum localities within high tide line: 57

VULNERABILITIES OF MUMBAI CITY

Coast Vulnerable To Inundation

- Length of coastline: 170 km




MCGM INITIATIVES

FOR

DISASTER RISK REDUCTION

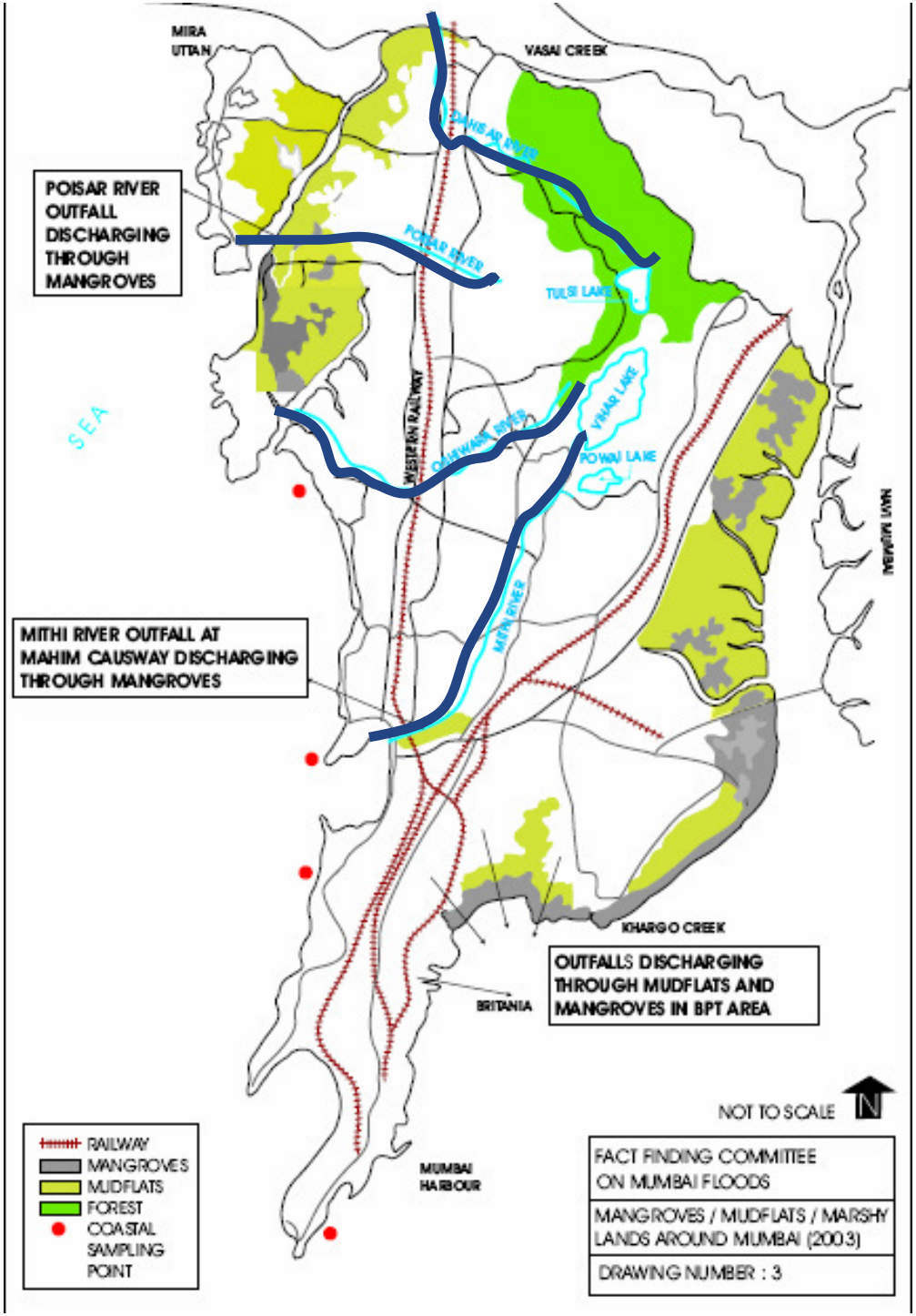
RIVERS IN MUMBAI

Mithi River

Oshiwara River

Poisar River

Dahisar River

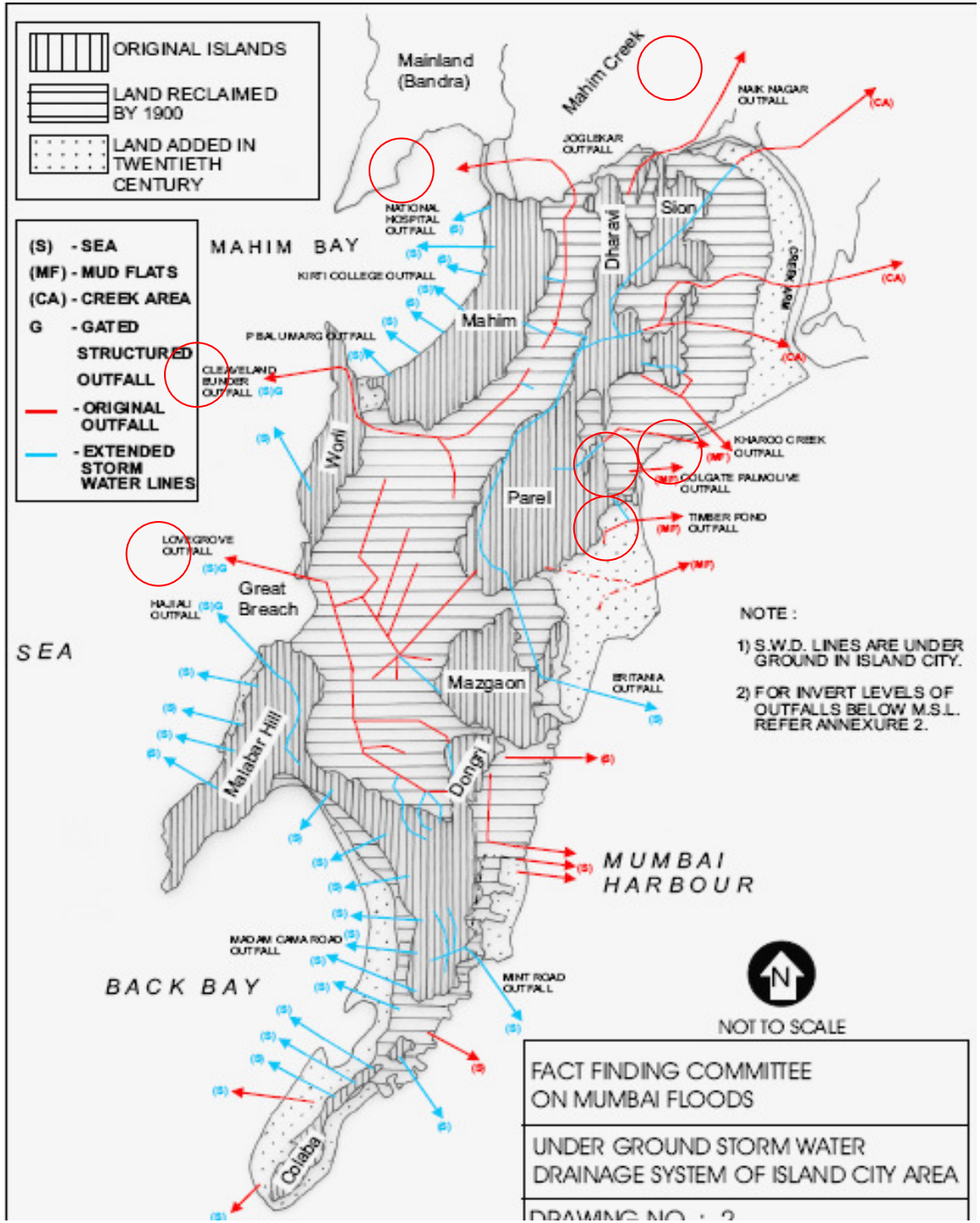


MEASURES INITIATED TO MITIGATE FLOODING OF RIVERS

- Mithi River: The largest drainage system in the heart of the suburbs.
  - Construction of 7.4 km long RCC retaining wall.
  - Construction of a 25 meter long and 4.5 meter high weir to discharge water slowly from the river during periods of heavy rainfall.
  - Creation of a holding pond for flood protection in its micro-catchment.
- Dahisar River:
  - Training of 1800 meters of the river.
- Poisar River:
  - Training of 3550 meters of the river.
- Oshiwara River:
  - Widening and training of three watercourses.

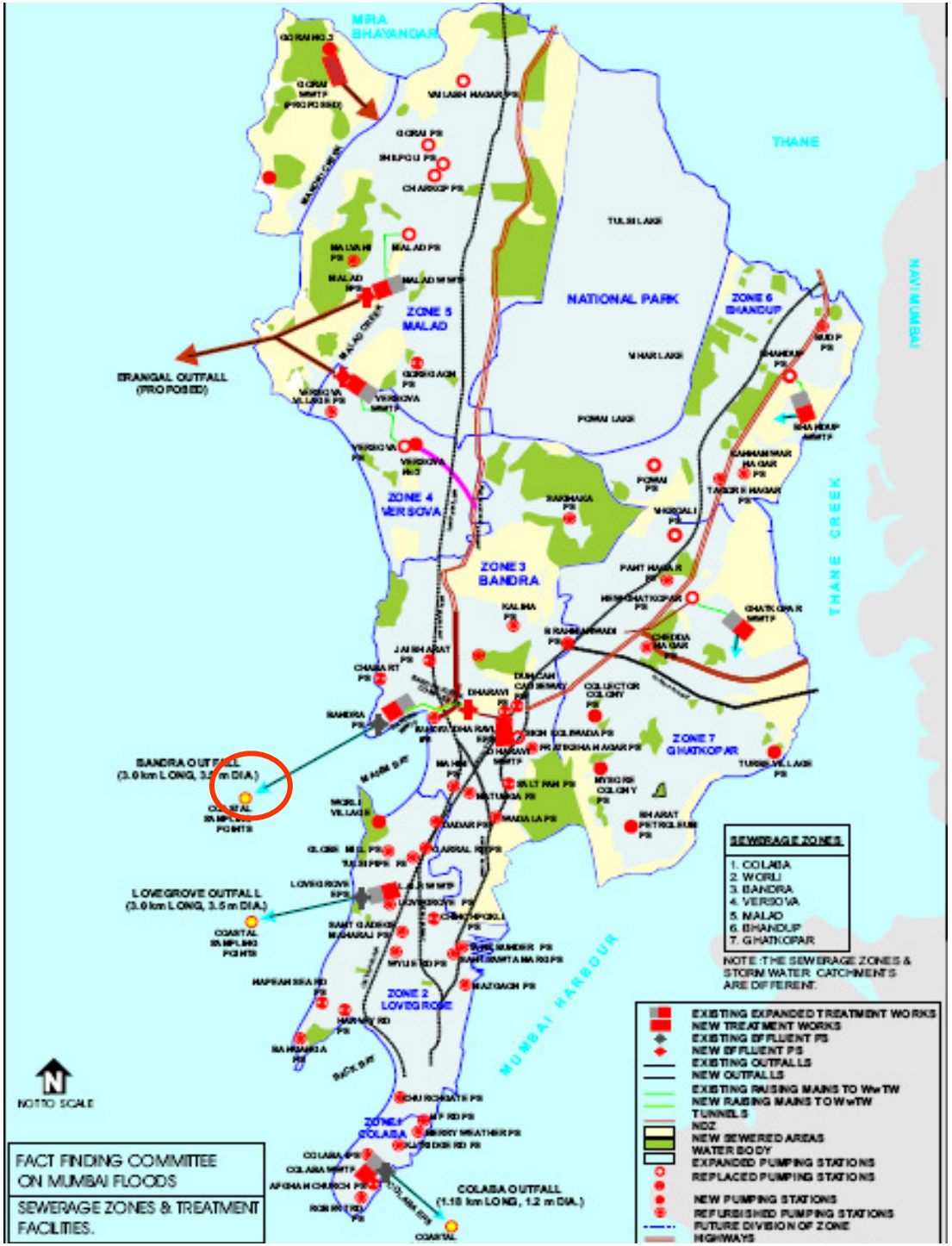
MARINE OUTFALLS

CITY



MARINE OUTFALLS

SUBURBS



AUGMENTING STORM WATER DRAINAGE SYSTEM

Implementation of BRIMSTOWAD project

- SWD system is being augmented four times - design for rainfall of 50 mm/hour with run-off coefficient of one.
- Since 2006, the SWD system is being cleaned/desilted to the bottom-most level. Annual expenditure incurred -over INR 500 million.
- Rehabilitation of old drains, particularly in the Island City.
- Installation of 9 storm water pumping stations in progress. 2 Pumping Stations already commissioned.
- Portable dewatering pumps installed at flooding spots

INSTALLATION AUTOMATIC WEATHER STATIONS & FLOW GAUGES

- 35 automatic weather stations installed for real time rain fall intensity
- The data is monitored, analyzed and the warnings are issued of flooding
- Flow Gauges installed upstream of Mithi River to monitor water flow and issue warning to population living down stream.

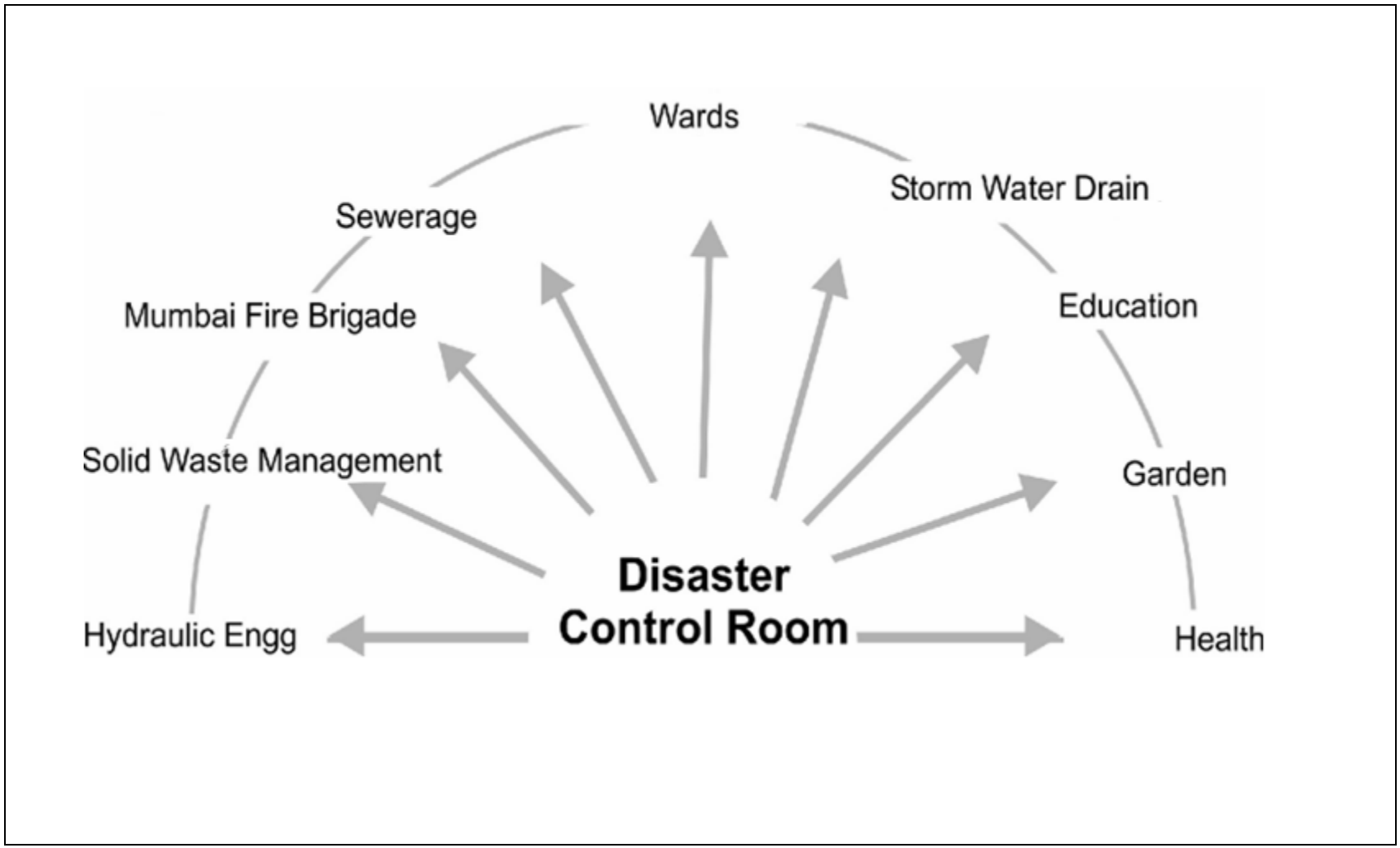
CONSTRUCTION OF CYCLONE SHELTERS

- Construction of Four Cyclone Shelters
- Under normal conditions to be used as Municipal Schools
- Accommodate about 3000 Disaster affected persons

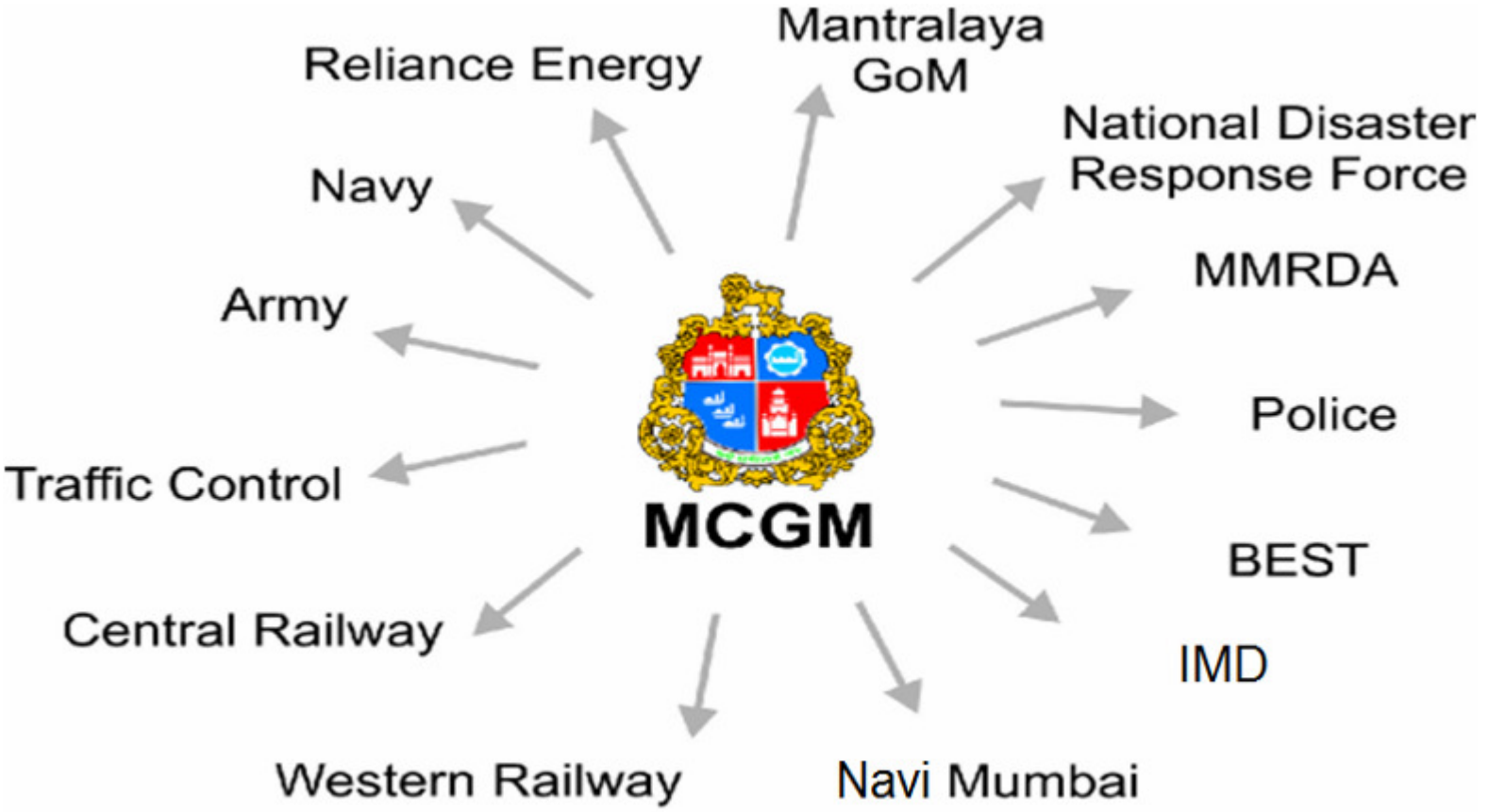
ESTABLISHMENT OF EMERGENCY OPERATION CENTRES

- **State of the Art Emergency Operation Center at Municipal Head Office & at all Wards**
  - Operational 24 x 7
  - Latest Communication Systems
  - Early Warning System

COORDINATION WITH INTERNAL DEPARTMENTS



COORDINATION WITH EXTERNAL AGENCIES



An MCGM Initiative
DRMMP
Disaster Risk Management Master Plan

DISASTER RISK MANAGEMENT MASTER PLAN (DRMMP)

Collaborative Project between Earthquake Megacities Initiative and MCGM

- EVALUATE the physical and socio-economic impacts of hazards
- ACQUIRE the competency to plan for and effectively manage emergencies
- DETERMINE a series of options to reduce risks
- DEVELOP a coherent approach to managing the overall risk
- ASSESS earthquake and flood risk scientifically
- IMPROVE coordination among stakeholders
- ENHANCE capacity building

GOALS OF DRMMP

International Strategy for **Disaster Reduction**

On June 8, 2010 Mumbai signed 2010 -11

World Disaster Reduction Campaign

"Making Cities Resilient"

"My City is Getting Ready"

under UN- ISDR program



Thank You....

Making Mumbai a better and safe place to live in