

Part 1 Chapter 2

Regional Setting

2.1 Boundary and Area

2.1.1 The boundaries of the MMR were originally defined by the Government Notification UDPH&HD No. RPB 1067/M dated 8th June, 1967. These boundaries were marked by natural features such as Vaitarna Creek and Tansa River in the north, Patalganga River in the south and foothills of Sahyadri in the east. On the west, they were defined by the Arabian Sea. The north-eastern boundaries were co-terminus with the administrative boundaries of Kalyan and Bhiwandi tehsils. The geographical area of the Region was 3965 sq.km. and it included 943 villages and 19 urban centres including Greater Mumbai.

2.1.2 With the enactment of the MMRDA Act, 1974, and setting up of MMRDA on 1st March, 1975, the southern boundaries of the Region were extended to include part of Pen and Alibag tehsils of Raigad District, adding thereby an area of 399 sq.km., 2 urban centres and 159 villages. In the north, 12 villages from Vasai tehsil, covering an area of 9.04 sq.km., were deleted and the boundaries were made co-terminus with Tansa River. The present boundaries of the Region thus encompass a total area of 4355 sq.km. and consists of the following administrative units

1. Mumbai City District;
2. Mumbai Suburban District;
3. Part of Thane District comprising
 - a. Thane, Kalyan, Bhiwandi and Ulhanagar tehsils; and
 - b. part of Vasai tehsil.
4. Part of Raigad District comprising
 - a. Uran tehsil and
 - b. part of Panvel, Karjat, Khalapur, Pen and Alibag tehsils.

Figure-2.1 indicates boundaries of various administrative units in the Region.

2.1.3 Since the preparation of last Regional Plan in late '60s, the number of urban centres in the Region has increased. The 1981 Census identified 38 urban centres as against 19 recorded in the Regional Plan. Of these two, namely Alibag and Pen are on account of enlargement of the regional boundaries. After 1981, a number of changes have occurred in the jurisdiction of the local authorities in the region. A New Municipal Corporation for Thane was set up in 1982. The Municipal Councils of Kalyan, Dombivali, and Ambernath were amalgamated in 1983 to form Kalyan Municipal Corporation. (In 1992, Ambernath was excluded from Kalyan Corporation and was reinstated as a Municipal Council). In 1991, Navi Mumbai Municipal Corporation was established for northern part of Navi Mumbai. New Municipal Councils for Khopoli, Virar, Mira-Bhayander, Nallasopara, Kulgaon-Badlapur, Karjat and Navghar-Manikpur were set

Tehsils / Districts in MMR

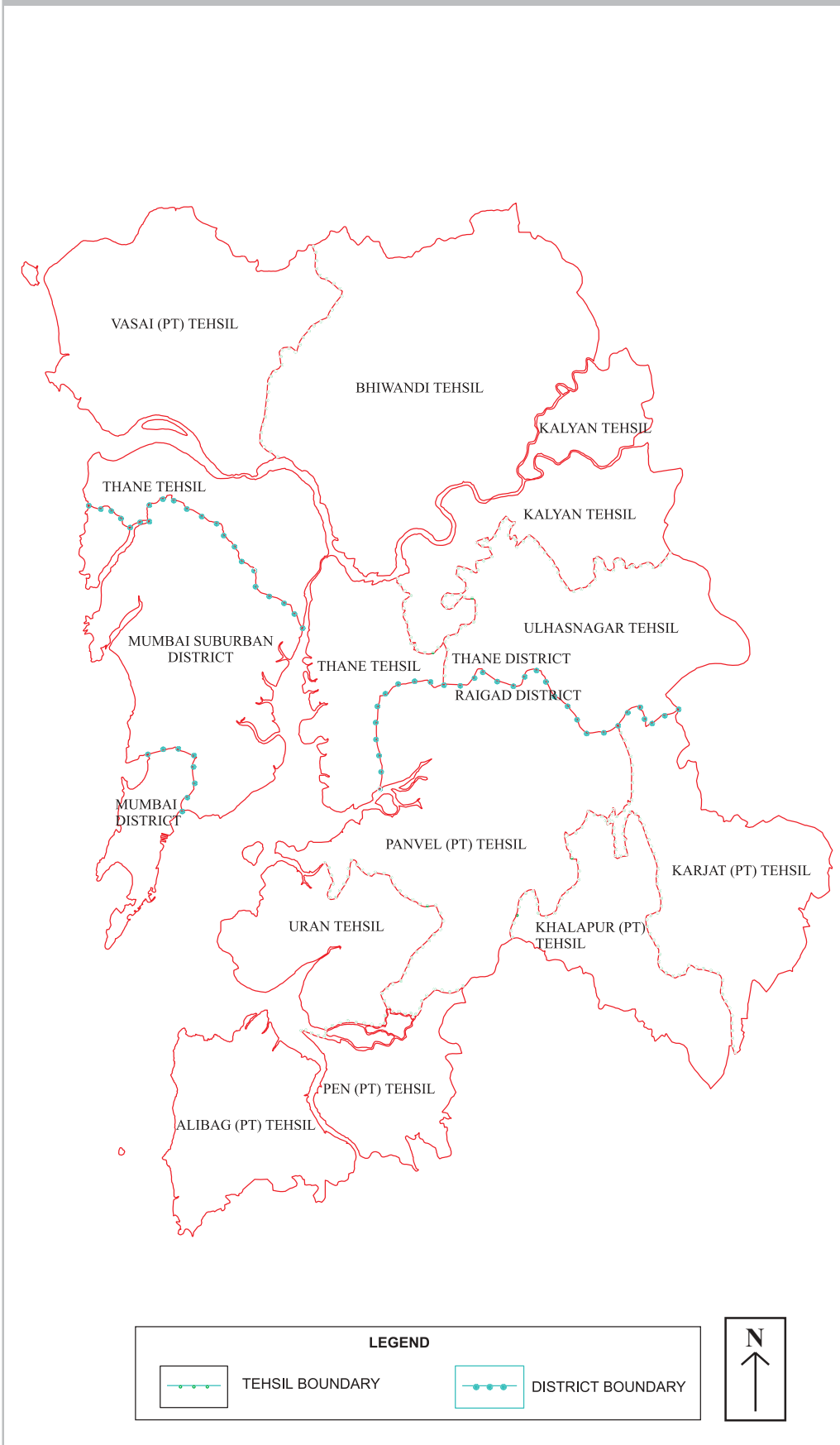


Figure - 2.1

up. The boundaries of some Municipal Councils, namely, Bhiwandi and Mira-Bhayandar were enlarged. This has led to consolidation of numerous small urban centres into a few large ones. The details of the local authorities for different urban centres in the region are given in Table-2.1.

Urban Centres in the Region				
Sr. No.	Description	Area in sq.km.	Population (1991)	Type of Local Authority
1	Greater Mumbai	437.71	9925891	Municipal Corporation
2	Thane Municipal Corporation	128.23	803389	Municipal Corporation
3	Kalyan Municipal Corporation	137.15	820089	Municipal Corporation
4	a) Navi Mumbai Mun. Corpn. (within Navi Mumbai)	129.47	307724	Municipal Corporation
	b) Navi Mumbai Mun. Corpn. (Outside Navi Mumbai)	33.94	10723	Municipal Corporation
5	Ulhasnagar Municipal Council	27.54	369077	Municipal Council 'A' Class
6	Ambernath Municipal Council	34.93	12580	Municipal Council 'A' Class
7	Badlapur Municipal Council	48.58	52154	Municipal Council 'B' Class
8	Panvel Municipal Council	12.17	58986	Municipal Council 'B' Class
9	Uran Municipal Council	2.10	17775	Municipal Council 'C' Class
10	Bhiwandi-Nizampur Municipal Council	28.31	379070	Municipal Council 'A' Class
11	Mira-Bhayander Municipal Council	88.75	175605	Municipal Council 'B' Class
12	Vasai Municipal Council	8.00	39781	Municipal Council 'B' Class
13	Khopoli Municipal Council	30.23	45039	Municipal Council 'B' Class
14	Pen Municipal Council	9.82	21588	Municipal Council 'C' Class
15	Alibag Municipal Council	1.81	16289	Municipal Council 'C' Class
16	Matheran Municipal Council	7.38	4708	Municipal Council 'C' Class
17	Virar Municipal Council	19.58	57600	Municipal Council 'C' Class
18	Nalla-Sopara Mun. Council	31.62	67732	Municipal Council 'C' Class
19	Navghar-Manikpur Mun. Council	—	—	Municipal Council 'C' Class
20	Navi Mumbai (Excluding Sr.No. 4a and 26)	209.00	151206	Gram Panchayat / CIDCO.
21	Karjat	7.53	7670	Municipal Council 'C' Class
22	Neral	11.66	11578	Gram Panchayat
23	Manikpur	4.15	10032	Gram Panchayat
24	Sandor	4.87	8841	Gram Panchayat
25	Gokhiware	5.88	6696	Gram Panchayat
26	Khoni	1.80	13144	Gram Panchayat
27	Taloja Panchnand	5.23	7462	Gram Panchayat / CIDCO.
TOTAL		1467.44	13515650	

Table-2.1

- 2.1.4 Although under the MR&TP Act, 1966, normally a Municipal Corporation or a Municipal Council is the Planning Authority for the area under its jurisdiction. A variety of different Planning Authorities were created in the region and a number of new agencies were appointed as Planning Authorities. While a New Town Development Authority was appointed for Navi Mumbai, Special Planning Authorities under section 40 of the MR&TP Act, 1966 were created for many other areas in the Region. The details of the type and names of the Planning Authorities in the region are given in Table-2.2. Boundaries of the various local authorities and planning authorities in the region are indicated in Figure-2.2.

Planning Authorities in MMR

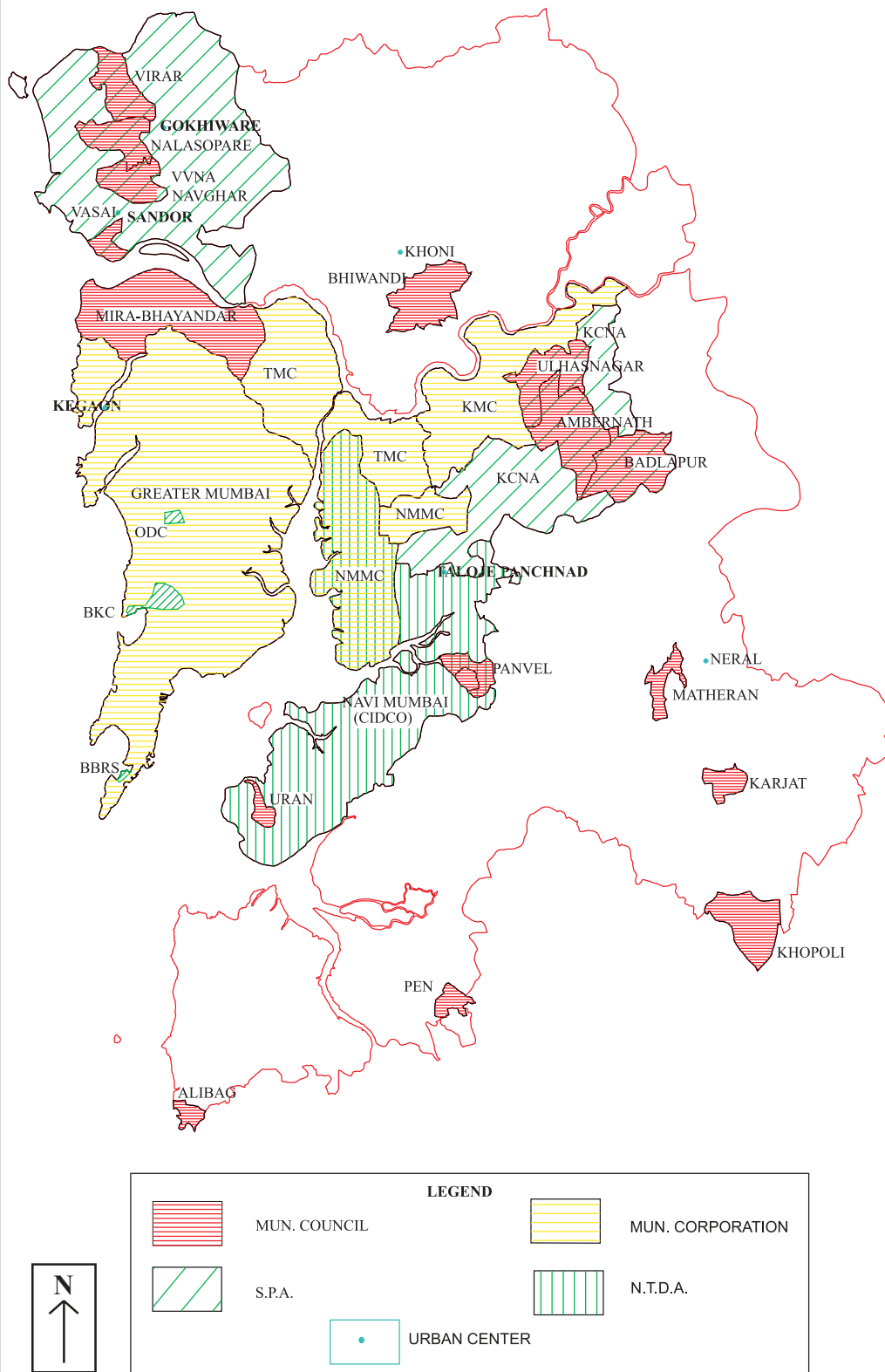


Figure - 2.2

Part 1

2

Planning Authorities in MMR				
Sr. No.	Description	Type of Planning Authority	Name of Planning Authority	Area in sq.km
1	GREATER MUMBAI a. Gr. Mumbai excluding b,c,d & e below b. Backbay Reclamation Area c. Bandra Kurla Complex d. Oshiware District Center e. Dharavi Area f. Marol Industrial Area	Local Authority Special Planning Authority Special Planning Authority Special Planning Authority Special Planning Authority Special Planning Authority	MCGM MMRDA MMRDA MMRDA MHADA MIDC	437.71 2.23 12.62 1.02 1.75 1.30
2	Thane Municipal Corporation	Local Authority	TMC	128.23
3	KALYAN COMPLEX a. Kalyan Municipal Corporation Area b. Ulhasnagar c. Ambernath d. Badlapur c. Rest of Kalyan Complex	Local Authority Special Planning Authority Special Planning Authority Special Planning Authority Special Planning Authority	KMC MMRDA MMRDA MMRDA MMRDA	380.79 137.15 27.54 34.93 48.58 132.59
4	NAVI MUMBAI a. Navi Mumbai excl. b & d but incl. c & e below b. Panvel Old Municipal Area c. Panvel Extended Municipal Area Authority d. Uran e. Navi Mumbai Municipal Corp. (within Navi Mumbai)	New Town Development Authority CIDCO Local Authority New Town Development Local Authority New Town Development Authority	PMC CIDCO UMC CIDCO	350.99 343.70 5.19 6.98 2.10 129.47
5	Navi Mumbai Municipal Corp. (outside Navi Mumbai)	Local Authority	NMMC	33.94
6	Bhiwandi - Nizampur	Local Authority	BNMC	28.31
7	Mira - Bhayandar	Local Authority	MBMC	88.75
8	Vasai - Virar Notified Area a. Vasai Municipal Area b. Virar Municipal Area c. Nalla-Sopara Municipal Area d. Navghar-Manikpur Municipal Area e. Rest of VVNA	Special Planning Authority Special Planning Authority Special Planning Authority Special Planning Authority Special Planning Authority Special Planning Authority	CIDCO CIDCO CIDCO CIDCO CIDCO CIDCO	380.00 8.00 19.58 31.62 — 320.80
9	Khopoli	Local Authority	KHMC	30.23
10	Karjat	Local Authority	KAMC	7.53
11	Pen	Local Authority	PMC	9.82
12	Alibag	Local Authority	AMC	1.81
13	Matheran	Local Authority	MHSMC	7.38
	Total			1885.49

Table-2.2

2.2

Geography

2.2.1

The region lies between 18° 33' and 19° 31' north latitude, and between 72° 45' and 73° 28' east longitude. Geographically, the MMR forms part of the North Konkan region that lies towards the west of the Sahyadri Ranges. In this Region the Sahyadri recedes inwards and recedes further eastwards; and the river Ulhas draining westwards has developed a large alluvial infilled amphitheatre-like basin. The Region consists of the mainland of North Konkan and the two large insular masses of Salsette-Trombay and Mumbai separated from each other by shallow creeks and tidal marshes which are mostly silted up and filled in. The Region on the whole is a low land, but not a plain. The average elevation of the areas above sea level is less than 100 metres but significant local variations are brought about by a series of north-south trending hill ridges. From the physiographic point of view the Region can be divided into following divisions:

1. Hills

- a. Matheran Ridge.
- b. Panvel Mumbra Ridge.
- c. Bhiwandi Gotara Ridge.
- d. Bhatsai Hills.
- e. Tungar Hills complex.
- f. Kanheri Ridge.
- g. Trombay Hills.
- h. Uttan Hills.
- i. Karnala Hill Ridge.
- j. Kankeshwar and Bhal-Man hills

2. Low Lands

- a. Patalganga Valley.
- b. Upper Ulhas Valley.
- c. Eastern low lands that lie between the Bhatsai in the north and Ulhas in the south.
- d. Lower Ulhas Valley or the Kalyan-basin.
- e. Vasai low lands.
- f. Bhiwandi low lands.
- g. Salsette low lands.
- h. Thane Creek low lands.
- i. Panvel low lands.
- j. Uran low lands or the Patalganga estuary.
- k. Mumbai Islands.

The plain lands between the hills are mostly devoted to paddy cultivation, except along coasts where there are marshy and Khajan lands and salt pans. The hills are covered by forests.

2.2.2 Rivers

Ulhas River and its tributaries, Bhatsai and Kalu, in the northern part of the Region, Panvel River in the Central Area; and Patalganga, Amba, Balganga, Bhogeshwari and Bhogwati in the south are the main rivers draining the Region. Tansa in the north forms the northern limit of the Region. The details of the important rivers in the Region are as follows :

Ulhas river, about 135 km. long, rises in the rainy ravines of the Bhore Ghat and bound by the steep scarps of the Sahyadri and Matheran ridge, flows northwards after leaping over a depth of 90 metres in two water falls one below the other. The valley opens out steadily as the river flows past Karjat toward the north. Near Badlapur, the river is dammed and used for a drinking water reservoir. It supplies drinking water to Badlapur, Ambarnath and Kalyan. After its confluence with Kalu and Bhatsai, east of Kalyan, the river turns west and flows through Mumbra ridge, later it turns northwards to flow for about 10 km. through a picturesquely forest-clad hill country and then turning west

again to develop an estuary. About 3 km. wide, joins the sea south of Vasai. An island, namely Panju island, just east of the estuary on the river is used by the Western Railway for a bridge to connect Salsette with Vasai. The river is distinctly tidal as far as Kalyan, which is reported by historians as a port during the historic past.

Tansa river rises in the Shahapur uplands beyond the limits of the Region and has a westward flow till it cuts through Bhiwandi hills. Thereafter, it turns north and joins Vaitarna river before the latter develops its estuary.

Panvel river is a small stream rising in the northern parts of the Matheran hills and flowing through the Panvel flats before joining the Thane Creek west of Panvel.

Patalganga river rises in the steep western scarps of the Matheran uplands where it branches off from the main ridge near Khopoli and maintains a general westward flow till it joins the Dharamtar Creek with a wide estuary. The tail-waters of the Khopoli power project are let into the river near Khopoli.

Amba, Bhogeshwari, Bhogwati, and Balganga rivers traverse the southern part of the Region. Portion of Amba up to Nagothane is navigable but it gets frequently silted and requires dredging. Bhogwati is also useful for navigational purpose for a small portion of its length from Dharamtar creek. There are also small rivulets which rise in the central Alibag hills and drain into the Arabian Sea.

2.2.3

Coastline

The entire north-south coast line along the mainland presents many interesting features. All along the coast, there are many small creeks, the main ones being Versova, Manori and Vasai Creeks, besides the larger Thane Creek. What is known as Vasai Creek is in reality Ulhas estuary. Panvel Creek has also a similar opening through which Panvel river drains into Thane Creek. Dharamtar Creek is the main creek in the southern part of the Region.

The coastal belt between Vasai and Arnala in the north is marked by beautiful beaches and plantations all along the coast. This 2 to 3 km. wide belt along this coast is famous for its rich horticultural development consisting of coconut and banana plantations, flower gardens and vegetation. In the south, the coastal belt between Rewas and Alibag has great scenic beauty with fine beaches, palm groves, coconut plantations, paddy fields and scattered hamlets.

Between the creeks and the jutting head lands, there lie several large bays and sandy beaches with good coconut groves. The main ones among the beaches are Gorai and Juhu in Salsette, and Dadar and Chowpaty beaches along the western shores of Mumbai Island. Amongst the bays, the salient ones are; the Backbay in the south and the Mahim Bay in the north which have both been carved out in relatively soft rock formations.

The coast has numerous islands off the shore. In fact, Salsette and Mumbai themselves were made up of a number of small islands, which were linked up during the last two or three centuries, partly by silting and partly by reclamation after bridging the narrow gaps between them. There are also a few off-shore islands. The islands of Karanja, Butcher and Elephanta (Gharapuri) in the Harbour Bay are the major ones.

2.3.1 Geologically, the Region falls in the Deccan lava country. Basalt, popularly known as Deccan Trap constitutes predominant formations. They are generally characterised by step-like terraces formed by successive layers of basalt flows. The main types of rock occurring in the Region are basalts and other rocks, such as, trachytes, shells, volcanic breccias and tuffus in small quantities at isolated locations.

2.3.2 The geology of Mumbai differs from that of the rest of the Region. The types of rocks found in Mumbai are -

1. Various types of basalts.
2. Rhyolites.
3. Trachytes.
4. Volcanic breccias.
5. Ash beds
6. Diorites
7. Inter - trappean beds

Some fossiliferous sediments mainly of tufaceous origin partly of fresh water, rich in fauna, are also found in Mumbai area. In addition, a number of basic dykes and aplitic veins also occur. In Thane area acid differentiates, namely Rhyolites and Trachytes do not occur. The area is chiefly made up of basalt volcanic breccias and tachtylic basalts. These have been intruded by numerous basaltic and doleritic dykes. In the southern part of the Region, namely in the areas of Panvel, Pen, Khopoli, Uran and Alibag tehsils both compact and amygdaloidal basalt predominate. They are intruded by a number of dykes. In some places in this area, the soil over burden is found to be 5 to 8 meters deep.

2.3.3 No minerals of economic importance are found in the Region, except bauxite deposits in the Tungan hill ranges at a height of 665 meters. Reserves are estimated to be 1.3 million metric tonnes with mineral content varying between 40 to 60 percent. Basalt rock found in the Region makes good construction material. Both compact basalt and amygdaloidal basalt can be used for variety of construction purpose such as masonry works, road works or aggregate in concrete. Trachytes with fine grains and brown-pink and greenish colours found only in and around Mumbai (Malad, Uttan, Dongri) are also used extensively as building material. Quarrying activity on a very extensive scale is witnessed in the Region.

2.3.4 A feature of geological importance in the Region is the hot springs at Vajreshwari, Ganeshpuri and Akloli in the northern part of the Region. The temperature of water ranges between 42° celcius to 55° celcius and gas with slightly sulphur smell rises from the waters. The waters are mainly saline containing mostly sodium, calcium, chloride and sulphates. They are believed to have therapeutic value. There are certain other geological features which have educational value. These are:

1. The Gilbert Hill in Andheri with hexagonal basaltic columns of about 27 metres height, most of which is now quarried but similar features at Oshiwara quarry can still be seen;
2. Sewri - another rare site with pillow lavas;

3. Worli Hills with frog beds (intra-trappean beds of great scientific value); and
4. Raised beaches of Manori - indicating vertical movement of continents or recession of oceanic waters.

2.3.5 Till 1967, the Deccan area was believed to be a stable earthquake-free zone. No major seismic activity was recorded in this area for centuries. However, this was proved wrong when a major earthquake of a magnitude of 5.9 on Richter scale occurred on December 10, 1967 in this area with its epicentre near Koyna. Since then, earthquakes have been taking place frequently. Table-2.3 indicates occurrence of the earthquakes till 1989.

2.4 Climate

2.4.1 The climate of Mumbai and its surrounding area is fairly equable since seasonal fluctuations of temperature are not significantly large. The moderating effects of the nearby sea and the fairly high amount of relative humidity in the atmosphere have restricted the variability. The seasonal variations of temperature follow closely the course of the sun. January is invariably the coldest month and May the warmest.

Earthquakes In MMR									
Date			Time as per GMT			Lat.	Long.	Depth in Km.	Magnitude in Richter Scale
Year	Month	Day	Hr.	Min.	Sec.				
1	2	3	4	5	6	7	8	9	10
1964	6	4	0	0	0.00	17.90	73.80	0	6.0
1967	12	10	22	51	23.30	17.50	73.80	27	5.9
1967	12	10	23	52	16.40	17.20	73.90	33	4.9
1967	12	11	20	49	46.00	17.20	73.70	1	5.1
1967	12	12	6	18	36.80	17.30	73.80	29	5.2
1967	12	12	15	48	55.00	17.30	73.90	27	5.1
1967	12	24	23	49	53.40	17.30	74.00	33	5.1
1967	12	25	17	37	39.00	17.20	73.80	33	4.9
1968	10	29	10	0	0.80	17.40	73.80	1	4.7
1974	7	29	23	17	28.40	17.10	73.80	33	4.6
1980	2	6	22	13	7.20	17.10	73.90	32	4.4
1980	9	2	16	39	14.30	17.30	73.80	33	4.7
1980	9	20	7	28	58.00	17.20	73.90	33	4.8
1980	9	20	10	45	30.00	17.30	73.60	19	5.2
1980	10	4	16	37	12.30	17.30	73.80	33	4.8
1983	9	14	21	53	41.10	19.60	73.50	33	4.3
1983	9	25	18	55	28.30	17.30	74.00	33	4.6
1984	9	25	7	45	35.00	17.10	73.80	33	4.2
1984	11	14	11	58	19.80	17.30	74.00	15	4.5
1985	5	27	6	57	12.00	17.20	74.00	33	0.0
1985	12	15	13	10	52.00	17.40	74.00	39	0.0
1986	2	25	21	18	12.00	20.70	73.40	10	0.0
1986	2	25	21	45	26.00	20.50	73.50	10	0.0
1986	2	26	12	47	58.10	20.60	73.90	33	4.3
1986	4	26	23	30	37.30	20.60	73.50	33	0.0
1986	4	28	13	27	53.00	20.70	73.40	33	0.0
1986	12	15	14	44	0.00	17.30	73.70	0	0.0
1987	2	2	9	18	38.00	17.30	74.10	10	0.0
1987	6	5	18	55	54.00	16.90	73.40	10	0.0
1988	9	11	20	39	14.00	17.20	74.00	37	4.3
1989	6	21	15	35	39.00	20.10	72.10	33	4.1

Source : India Meteorological Deptt., Govt. of India.

Table-2.3

With the onset of monsoons in early June there is a reversal of the temperature curve and the temperature during the period of monsoon remains very nearly uniform at about 27° celcius. The slight rise in temperature in October falls gradually till it reaches the coldest month in January. The mean daily maximum and minimum temperatures for different parts of the Region is given in Table-2.4. The monthly variation in relative humidity in the Region is shown in Table-2.5. The variation in temperature and humidity for different months of the year is indicated in Figure-2.3 and 2.4.

- 2.4.2** The prevailing direction of the normal seasonal wind during the year is west-north-west. The mean wind direction in December oscillates between west-north-west to east- north-east and in June south-west is the dominant wind direction. Though the direction is subjected to considerable diurnal and seasonal variations, there is little fluctuation in the velocity during the dry season. The winds are generally light and variable about 8 kmph. During the wet season, however the velocity gradually increases reaching the peak of value about 13 kmph. in the month of July with the direction in the meantime having veered round to west-south-west. In the southern part of the region, namely Alibag, wind velocities are higher with average value of 10

Daily Mean Temperature in different parts of the Region (Degrees In Celcius)										
Month	Colaba		Santacruz		Thane District		Alibag		Raigad District	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
January	30.7	18.6	31.8	16.9	27.7	16.8	29.4	16.9	28.2	17.7
February	29.7	19.2	29.9	17.5	28.2	17.5	28.7	17.6	28.6	18.4
March	30.6	21.7	32.7	20.7	30.3	21.0	30.3	20.2	30.1	21.2
April	31.3	23.8	32.0	23.2	32.0	23.9	30.5	21.9	31.1	24.2
May	33.7	26.6	32.8	26.5	32.9	26.8	33.4	26.2	31.8	26.4
June	30.3	27.2	32.7	27.5	32.1	26.4	32.5	26.7	30.8	26.0
July	31.3	26.0	31.2	25.9	29.7	25.1	30.9	25.8	29.2	25.3
August	29.6	24.7	29.8	25.2	29.1	24.8	29.6	24.9	28.8	24.9
September	31.2	24.8	31.2	24.8	29.6	24.3	31.2	24.5	29.2	24.4
October	32.2	24.6	32.6	23.8	31.7	23.0	32.0	23.6	31.2	23.6
November	34.5	22.9	34.3	21.8	31.9	20.0	34.0	21.3	31.3	20.9
December	33.5	20.9	33.4	19.0	29.7	17.7	31.7	18.6	29.7	18.7

Source : i) For Colaba,Santacruz & Alibag - India Meterological Dept.,
 ii) For Thane Dist - Gazeteer of Thane Dist.1982
 iii) For Raigad Dist. - Gazeteer of Raigad Dist.1993

Table-2.4

Humidity in different Parts of the Region						
Month	Colaba		Santacruz		Alibag	
	Mean Maximum%	Mean Minimum%	Mean Maximum%	Mean Minimum%	Mean Minimum%	Mean Maximum%
January	87	35	81	23	87	35
February	80	39	82	34	88	40
March	86	49	86	37	89	46
April	86	57	85	45	84	60
May	84	59	81	60	79	61
June	85	65	80	63	82	70
July	89	74	87	74	90	83
August	92	82	92	80	94	84
September	90	71	90	66	90	70
October	90	60	88	59	92	59
November	83	38	81	37	85	33
December	83	30	82	26	89	33

Source : India Meteorological Dept.

Table -2.5

Daily Mean Temperature at Different Stations in MMR



Figure - 2.3

Humidity at Different Stations in MMR

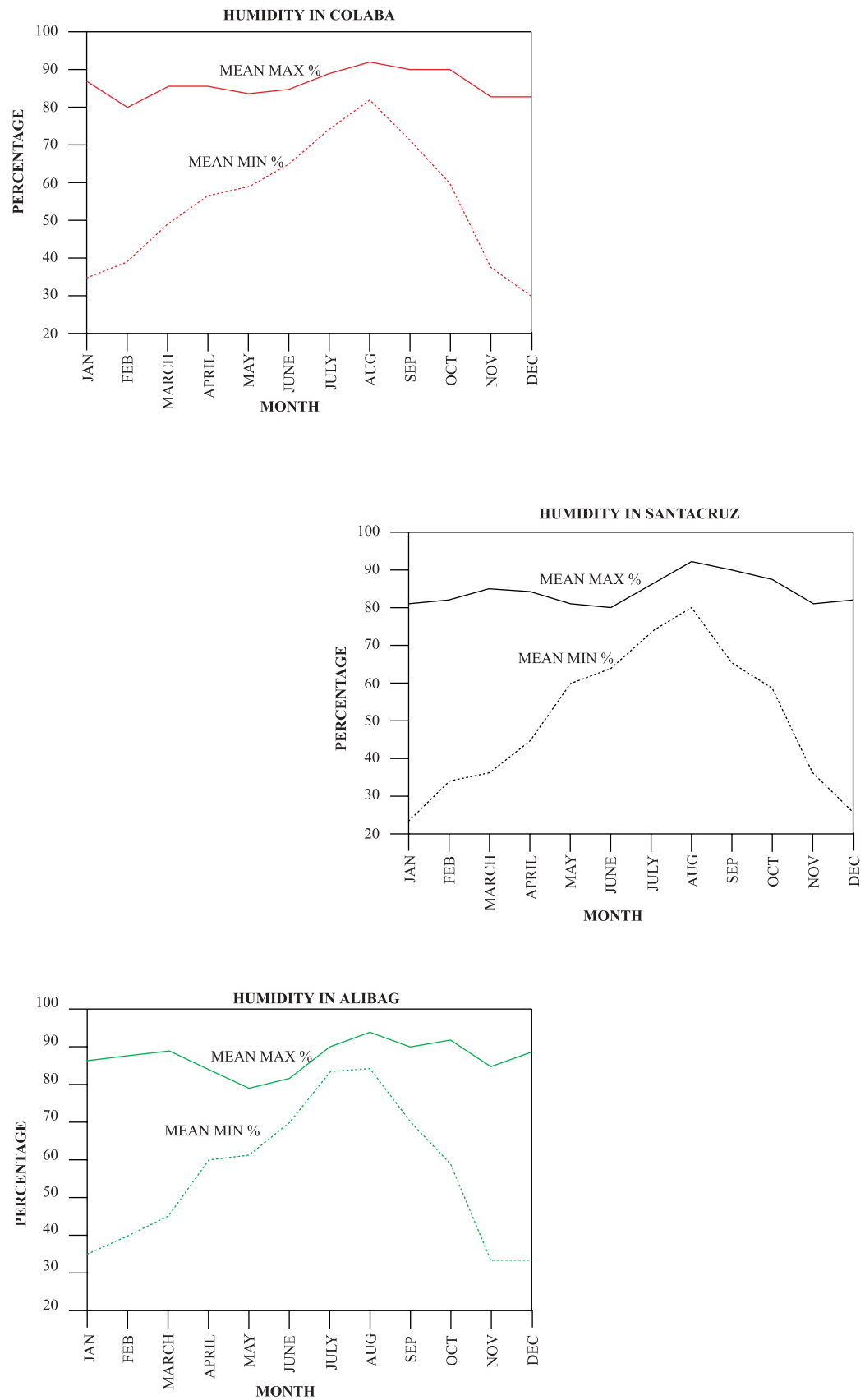


Figure - 2.4

kmph. and peak velocities of about 25 kmph. in July. In the month of June the wind is greatly affected by the irregular and abnormal disturbance from the south-east associated with the first break of monsoon. The weather is often squally and associated with gusty winds during the monsoon. After July the reverse movement commences and by September it gradually moves to west reducing in velocity, till it reaches the other limit of north-north-east in December. Wind data for Mumbai and Alibag are given in Table-2.6. The wind roses for these stations are shown in Figure-2.5.

- 2.4.3** The monsoon generally sets in around the second week of June and continues till late September. July and August are the wettest months all over the Region. There is hardly a day without rain, particularly in the hills and the Ghats in these two months. Towards the later part of the season there are breaks in between, when the oppressive hot weather is associated with high humidity along the coast.

Wind Direction and Speed at different Stations in MMR												
Month	Colaba				Santacruz				Alibag			
	08.30 (Mor.)		17.30 (Eve.)		08.30 (Mor.)		17.30 (Eve.)		08.30 (Mor.)		17.30 (Eve.)	
	Dir.	Avg. Speed (kmph)	Dir.	Avg. Speed (kmph)	Dir.	Avg. Speed (kmph)	Dir.	Avg. Speed (kmph)	Dir.	Avg. Speed (kmph)	Dir.	Avg. Speed (kmph)
January	NE	7.0	NW	7.0	NE	5.7	NW	5.7	NE	3.0	NW	10.0
February	NE	8.0	NW	8.0	NE	6.9	NW	6.9	NE	2.7	NW	12.1
March	N	9.0	NW	9.0	NE	7.8	NW	7.8	NE	1.9	NW	14.5
April	SE	9.0	W	9.0	S	9.0	NW	9.0	SE	1.5	NW	4.4
May	W	8.0	W	8.0	SW	9.3	W & NW	9.3	SW	5.2	NW	17.9
June	SW	10.0	W	10.0	W	11.8	W	11.8	SW	12.5	NW	21.1
July	W	13.0	W	13.0	W	12.7	W	12.7	SW	21.4	SW	25.7
August	W	11.0	W	11.0	W	10.5	W	10.5	SW	26.2	SW	25.4
September	SW	7.0	NW	7.0	W	7.7	NW	7.7	SE	3.7	NW	12.2
October	SE	2.0	NW	2.0	E	4.8	NW	4.8	SE	1.4	NW	9.4
November	NE	4.0	NW	4.0	E	4.8	NW	4.8	NE	2.6	NW	10.1
December	NE	5.0	NW	5.0	E & W	4.9	NW	4.9	SE	2.9	NW	7.9

Source : Draft (Revised) Development Plan for Greater Mumbai, 1981-2001
Regional Plan for Extended MMR (Pen - Alibag), 1981 - 2001

Table-2.6

- 2.4.4** The average rainfall in the Region is over 2,000 mm. The coastal areas in general receive the first onslaught of the squally winds and rains but record much less rains than the interior. Even the plain stations, like Kalyan, Bhiwandi located closer to the hills receive more copious rains than the coastal areas like Mumbai (Colaba), Uran, Vasai and Alibag, Kurla (Santacruz) and Panvel. This is due to local relief conditions. Matheran situated at a height of 760 m. above mean sea level receives 5167 mm. of rainfall which is the highest in the Region. Average monthly rainfall for various centres in the Region is indicated in Table-2.7. This is graphically indicated in Figure-2.6.

2.5 Existing Land Use Survey

- 2.5.1** The existing land use survey of the Mumbai Metropolitan Region (MMR) has been carried out using remote sensing technique which consists of visual interpretation of the imageries and computer analysis of the digital data provided by the satellites. The imageries and the digital data at different points of time have been used to capture temporal changes in the land-use pattern. The data between 1975-85 was provided by Landsat MSS with spatial resolution of 79 m. x 79 m., and between 1985-86 by

Wind Direction and Speed at Different Stations in MMR

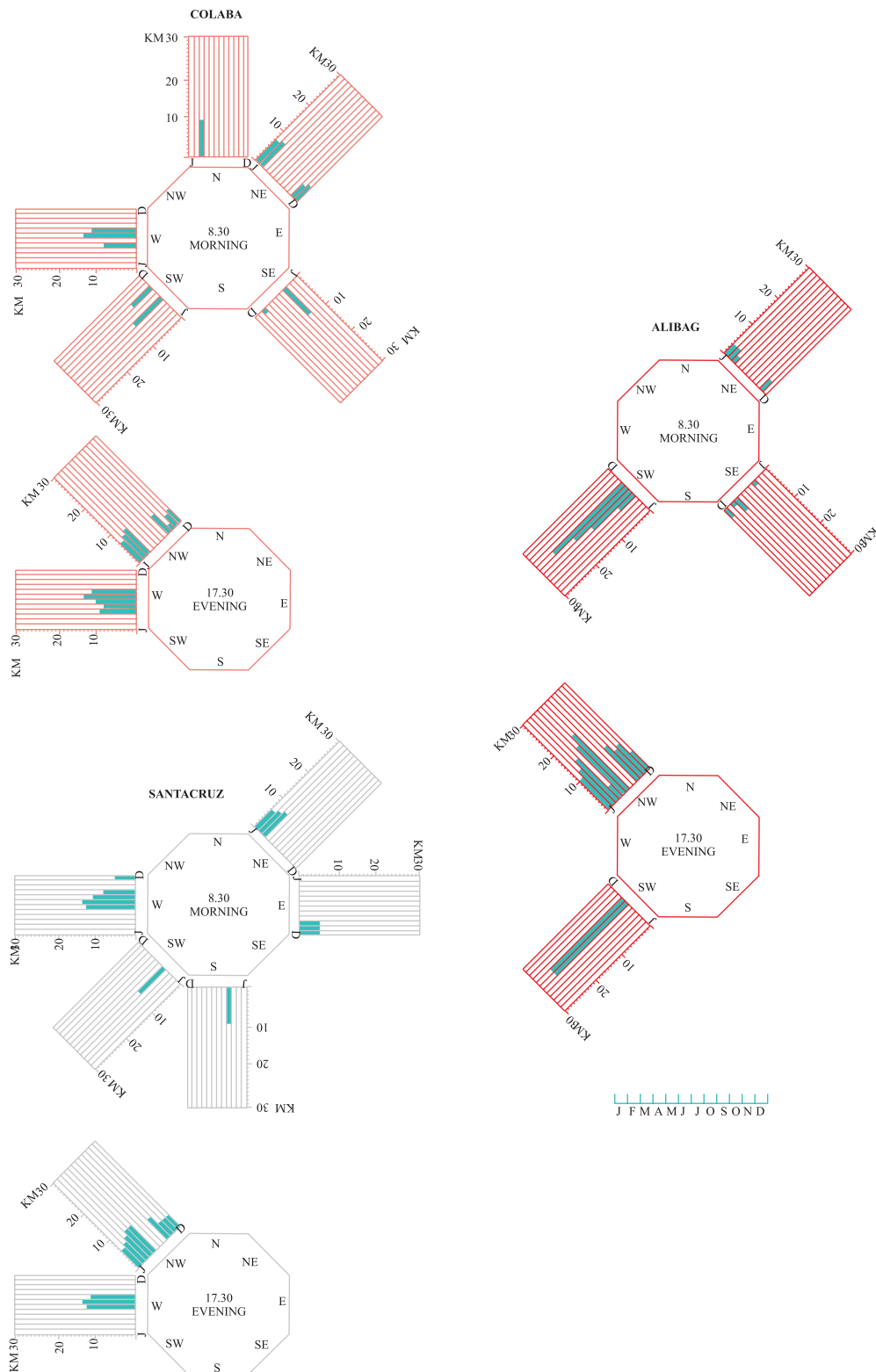


Figure - 2.5

Landsat TM satellite with 30 m. x 30 m. resolution. The data for 1987 was provided by SPOT satellite with resolution of 20 m. x 20 m. While the Urban Sprawl Map for the period 1968-1988 has been prepared using data from all the satellites, the land use map at a scale of 1:50,000 has been prepared using Landsat TM satellite and more detailed land use maps at 1:25,000 by using SPOT satellite. The Survey of India's topo-sheets at 1:50,000 and 1:25,000 scale have been used in conjunction with the satellite data for mapping.

Rain Fall at different Centres in MMR					Normal Rain fall in mm (based on 50 years data)					
Month	Colaba	Santacruz	Thane	Kalyan	Bhiwandi	Vasai	Alibag	Panvel	Karjat	Matheran
January	3.1	4.1	3.1	2.3	3.6	3.1	2.5	1.3	1.5	2.0
February	1.3	2.0	1.0	1.0	1.0	1.3	0.8	1.3	0.8	1.5
March	0.8	1.5	1.5	0.8	1.3	0.8	0.5	0.8	1.8	2.3
April	2.5	1.5	2.3	1.8	2.0	1.3	1.8	1.8	2.8	4.1
May	17.3	18.3	25.1	13.5	21.3	17.3	18.8	17.0	19.1	25.1
June	476.0	464.8	541.3	432.6	502.4	450.9	558.5	484.6	512.8	773.9
July	725.9	613.4	922.0	946.1	1015.7	684.8	699.5	1073.9	1312.7	2035.6
August	414.8	328.9	539.7	553.5	584.2	380.7	394.7	676.1	850.7	1461.0
September	295.7	286.0	326.7	294.1	336.3	278.4	312.2	369.6	433.8	658.6
October	75.7	64.5	93.2	87.1	95.3	75.7	69.6	93.7	118.6	168.1
November	15.7	17.5	19.1	20.6	12.9	15.7	20.1	18.0	20.6	31.5
December	0.8	2.3	2.3	2.6	2.0	1.5	1.8	3.1	3.3	3.8
Annual	2029.6	1804.8	2477.0	2355.4	2578.0	1911.5	2080.8	2741.2	3278.5	5167.5

Source : Gazetteers of Greater Mumbai Dist.(1986), Thane Dist.(1982), Raigad Dist (1993)

Table-2.7

2.5.2 Urban Sprawl

The Urban Sprawl Map for MMR at 1:1,00,000 scale depicts spatial growth in urban built-up area in MMR for the three time-periods, namely, 1968, 1983 and 1987 (Figure-2.7). Till 1968, urban built-up area of MMR, admeasuring 235 sq.km., was largely confined to Greater Mumbai. The growth between 1968-1975 also took place mostly in Greater Mumbai by bringing in open lands under urbanisation and by reclaiming many low-lying areas along Mahim Creek, Malad Creek, Thane Creek and areas of Chembur, Ghatkopar and Sakinaka. After 1975, growth was observed along transportation network beyond Greater Mumbai, mainly at Mumbra, Kalyan, Bhiwandi and Badlapur. In these regions, large areas of agricultural lands were brought under urban development. Since 1983, growth was observed mainly in Navi Mumbai, Thane, Panvel and along Manori Creeks (Charkop) in Greater Mumbai.

The growth rate of physical development, as represented by the annual increase in the land covered by built-up areas over the past two decades, was 4.6%. The growth rate however, has not been uniform, either over time or over different zones in the MMR. Between 1968-83 it was 2.0%, whereas between 1983-87 it increased nearly eight-folds to 15.6%. In Greater Mumbai, no significant growth is observed in the CBD or in the rest of the Island City. Until 1983, the growth has also been very slow in the suburbs. After 1983, however, substantial development has taken place, especially, in the western suburbs. The details are given in Table-2.8.

2.5.3 Existing Land Use

The Existing Land Use Map has been prepared in two stages. First, two different sets of existing land use maps for 1987 were prepared: one at 1:50,000 scale covering

Rainfall at Different Stations in MMR

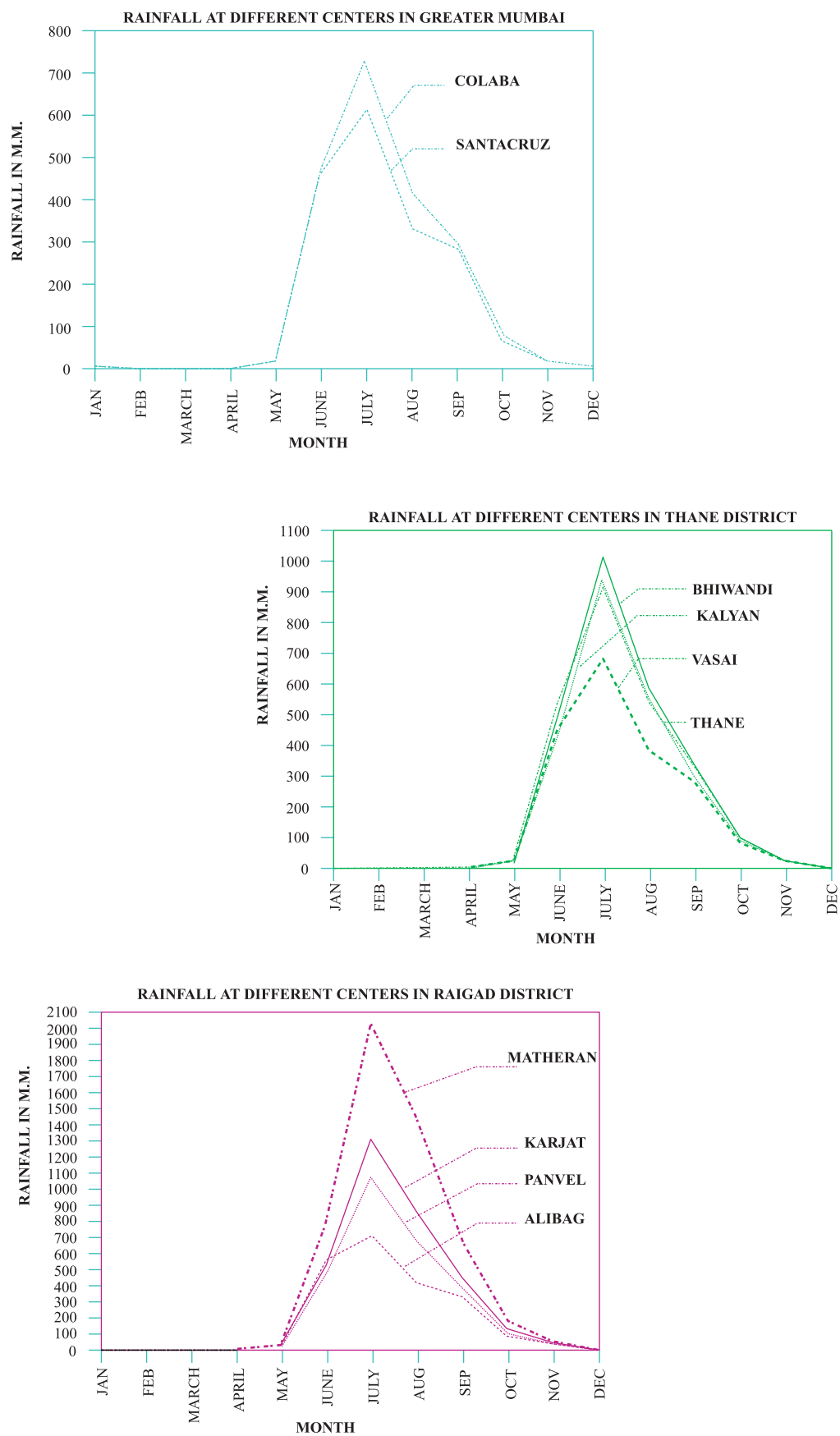


Figure - 2.6

Urban Sprawl

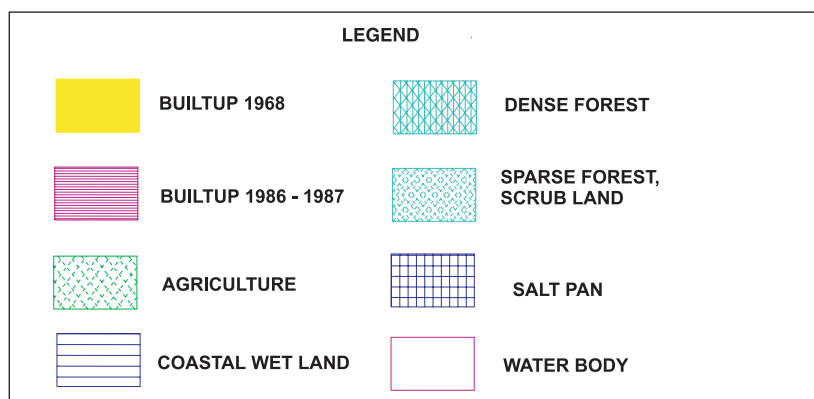
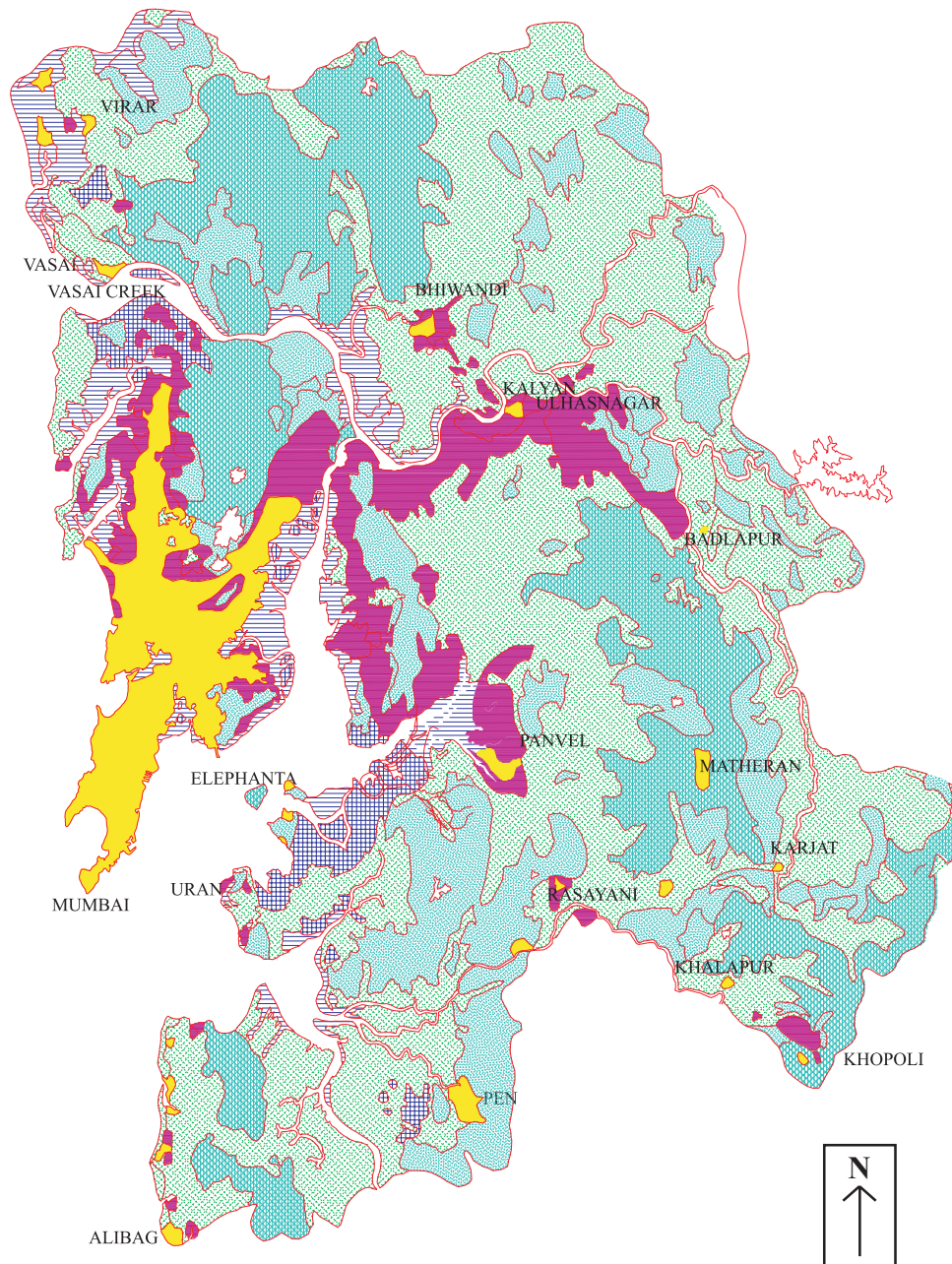


Figure - 2.7

the entire MMR, and other at 1:25,000 scale showing details for Greater Mumbai and Navi Mumbai. The land use plan at 1:50,000 broadly showed major land use categories at Level-I, but wherever detailed land uses of Level-II category could be identified, they were shown as residential, industrial, recreational, open spaces, quarries, etc., as the case may be. These maps depicted existing land use according to three-level classification system. This system has six major land use classes at Level-I, namely, urban built-up land, agriculture, forest, waste land, coastal wetland and water bodies. They are further divided into 28 Level-II classes. The urban built-up lands are still further sub-divided into 14 Level-III classes. These categories are summarised in

Urban Sprawl in MMR				(Builtup area in Sq.Km.)	
Zone	1968	1983	1987	% Annual Growth Rate	
				1968-83	1983-87
1. Greater Mumbai	219.16	255.01	301.29	0.60	4.30
(a) CBD	22.13	23.13	23.13	nil	nil
(b) Island City	53.48	53.48	53.48	nil	nil
(c) Eastern Suburbs	64.80	78.75	95.43	1.30	4.50
(d) Western Suburbs	78.75	99.65	129.25	1.60	6.70
2. Thane M.C.	0.36	1.48	48.11	9.70	138.80
3. Kalyan M.C.	1.54	25.39	74.43	20.50	30.80
4. Navi Mumbai	4.60	15.70	75.90	8.50	48.30
5. Rest of MMR	8.43	20.37	75.75	6.05	38.70
Total	234.09	317.95	575.48	2.00	15.90

Table-2.8

Annexure-A.2.1. In second stage, these two land use maps were integrated at 1:100,000 scale and updated to reflect latest developments up to 1991 (Figure-2.7). This figure indicates land uses in 12 categories by combining a number of similar Level II class land uses.

Built-up land is the first major land use category covering all types of built-up areas and includes airport, port, and all industrial land, whether built-up or otherwise. The built-up land admeasures 561.45 sq.km. accounting for 12.68% of the total area of the Region. About 42% of the land is under agriculture and 27% under forest. A little less than half the land under forest (i.e. 45.35%) is under dense forest and the rest under sparse forest. The coastal wetlands which include tidal mud flats, salt-pans, mangroves, beaches etc. account for 8.45% of the Region's area. The broad Land Use distribution is shown in Table-2.9 and in Figure-2.8. Existing land use on the map is shown in Figure-2.9.

Detailed land use statement into 12 land use categories for the different sub-regions of MMR is given in Table-2.10. Owing to differences in the classification system used in the Final Regional Plan in 1973 and the standardised classification system used now, the present land use distribution cannot be compared with the situation prevailing two decades ago except to the extent made possible by Urban Sprawl Map referred to in para 2.5.2. The total area of the Region is 4236 sq.km. based on the computerised maps prepared for Geographical Information System (GIS). This does not match with the area of 4355 sq.km. based on the revenue records. For the rest of the Report, area of 4236 sq.km. is used.

Existing Landuse Distribution in MMR -1987			
Sr. No.	Landuse	Area in Sq.Km.	Percentage (%)
1	Urban Built-up land	561.45	12.68
2	Agricultural land	1,856.92	41.93
3	Forest land	1,142.55	25.80
4	Salt-Pans	80.05	1.81
5	Coastal Wetlands	315.11	7.12
6	Wasteland	348.20	7.86
7	Water Bodies	124.02	2.80
Total		4,428.30	100.00

Table-2.9

2.6 Land Use Analysis of Urban Centres

2.6.1 The foregoing analysis presents only a broad picture of existing land uses at regional level. In these analysis the cities and towns in the Region are broadly classified as 'urban built-up areas' and more detailed break-up is not given. To fill this gap, detailed land uses for various urban areas are compiled from the Development Plan Reports of the various towns. The total area of Development Plans for various urban centres in the

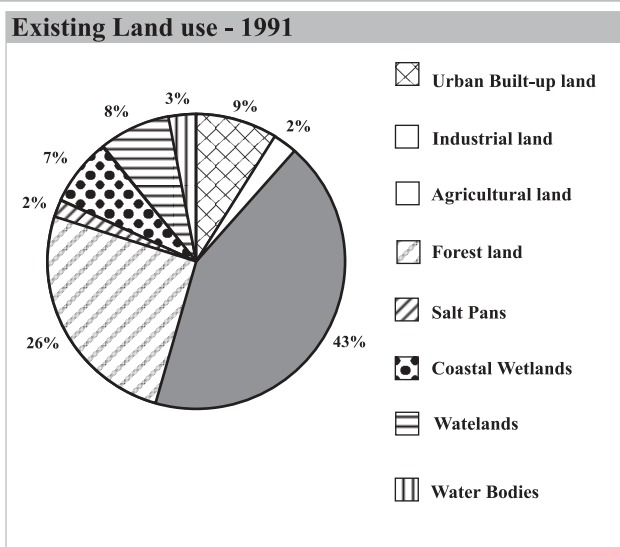


Figure - 2.8

Region is 1879 sq.km., of which only 44.5% or 837 sq.km. is the development area (Table-2.11). The rest is either not needed or not suitable for future development. The proportion of development area varies considerably from one urban centre to another. For example, whereas for Greater Mumbai it is 58.6%, for Kalyan Complex it is as low as 17.9%. The existing development in these urban centres is spread over an area of 395 sq.km. and accounts for 47.2% of the development area. Residential zone is the largest zone which covers 48.9% of the development area. Only about a third of this zone is actually developed.

2.6.2 Next to residential use, industry emerges as the largest user of urban land in MMR. The total area zoned for industrial use is 163.72 sq.km., of which about 109 sq.km. or 66.72% is presently developed (Table-2.12). Greater Mumbai has the major share with 47.12 sq.km., or 43% of the present industrial use in the Region, followed by Navi Mumbai with 24.97 sq.km. or 22.86% and Kalyan Complex with 17.02 sq.km. or 15.58%. The land under industrial use has increased steadily from 53.84 sq.km. in the early 1970's to 109 sq.km. today. The total area of the industrial zone envisaged in the Regional Plan was 140 sq.km. This has increased to 163.72 sq.km. on account of increase in industrial zone in Navi Mumbai primarily for ONGC's oil terminal facilities at Uran and Nhava and increase in the area of MIDC's Talaja Industrial Area and RCF's fertilizer complex at Thal in Alibag tehsil. On the other hand, some of the industrial areas were dropped from the MIDC's development programme, namely Wangani (266 ha.) and Bhiwandi (209 ha.).

Existing Landuse

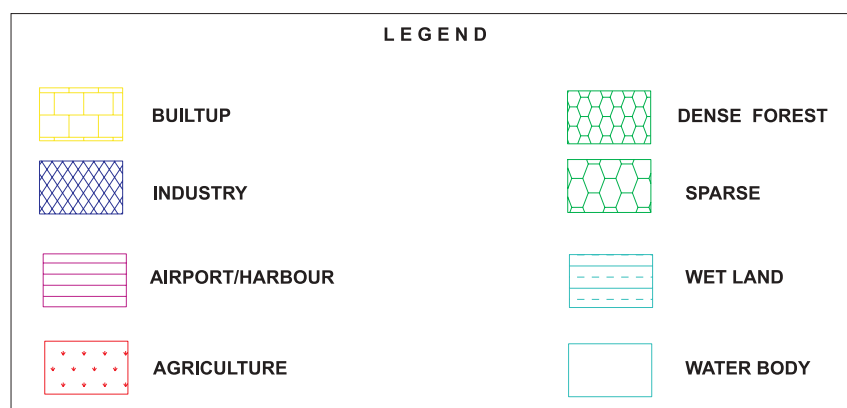
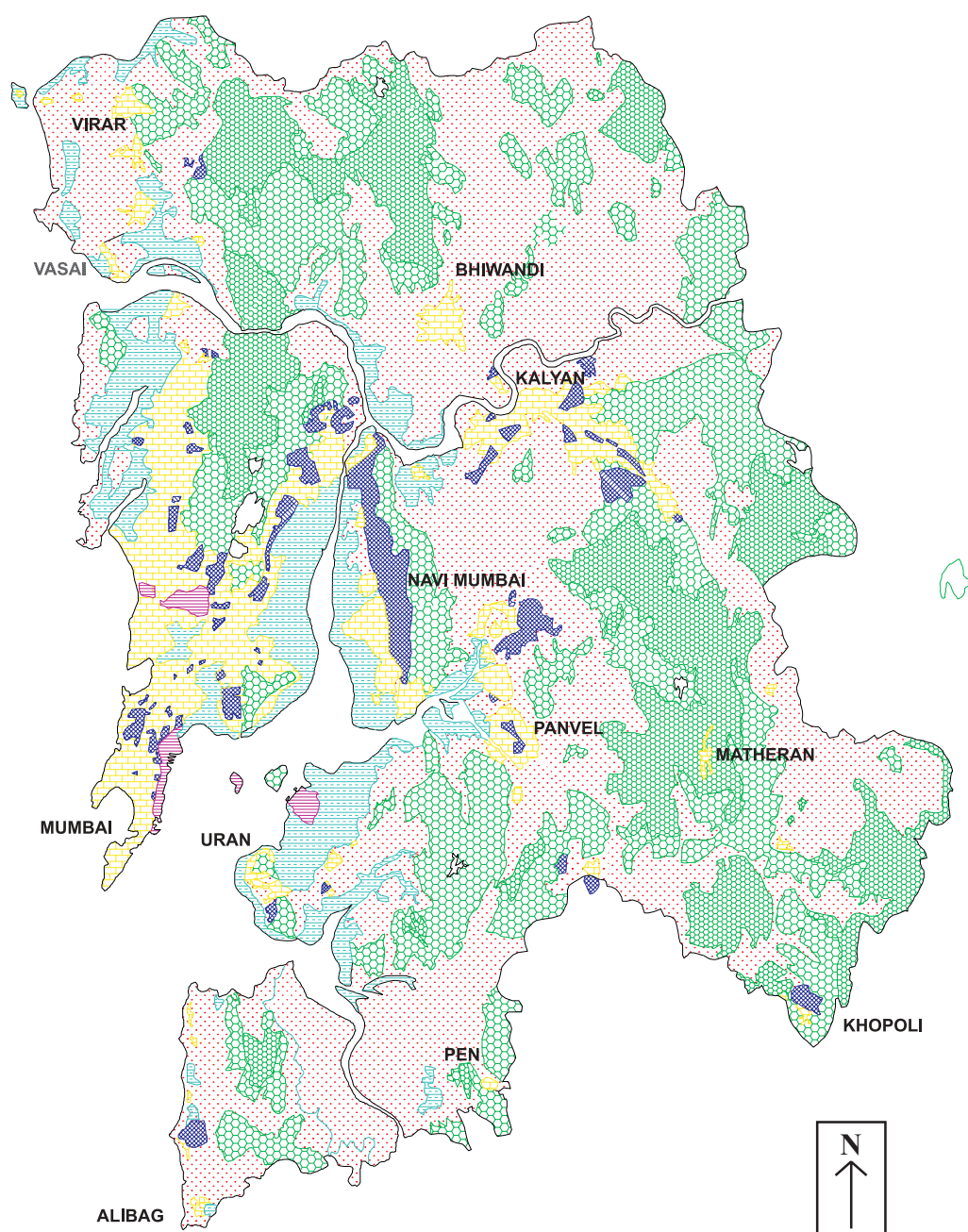


Figure - 2.9

(in Sq. Km.)

Region/Sub Regionwise Existing Landuse Distribution For MMR

Region / Sub Region	Buildup	Industry	Airport/ Harbour	Beach/ Groynes	Agriculture	Plantation	Dense Forest	Sparse Forest	Scrub Land	Rocky Outcrop	Coast Wetland	Water Body	Total Area
1. Greater Mumbai	190.73	22.14	13.09	7.71	25.86	8.58	28.61	37.25	21.33	4.81	98.90	8.80	467.81
1.1 Island City	49.86	6.01	6.51	4.42							5.66		72.46
1.2 Western Suburb	84.55	5.10	6.31	3.29	24.28	7.15	22.64	18.23	8.28	2.30	43.28	1.45	226.86
1.3 Eastern Suburb	56.32	11.03	0.27		1.58	1.43	5.97	19.02	13.05	2.51	49.96	7.35	168.49
2. Western Region	32.18	2.38			185.55	41.65	103.74	44.29	37.38	2.49	67.77	3.75	521.18
2.1 Mira-Bhayander Sub Region	5.64	0.68			24.88	2.76	18.30	2.15	3.86	1.51	24.95	0.65	85.38
2.2 Vasai-Navaghar Sub Region	8.11				26.77	5.88	13.35		2.06		14.81	1.12	72.10
2.3 Nallasopara Sub Region	2.76	1.48			18.08	3.54	10.48		3.06	0.98		0.25	39.65
2.4 Virar Sub Region	4.09				24.18	2.64			12.09		9.01	0.39	53.38
2.5 VVNA Coast Sub Region	8.75				18.66	26.83			15.17		18.15	0.89	73.28
2.6 VVNA Rural Sub Region	1.02	0.22			41.84		37.44	14.05			0.38	0.45	110.57
2.7 Outside VVNA Sub Region	1.81				31.14		24.17	28.09	1.14		0.47		86.82
3. North East Sub Region	88.64	29.93			694.96	50.00	153.52	211.75	139.03	22.09	43.52	29.24	1462.68
3.1 TMC Sub Region	16.11	12.15			28.69		9.75	20.12	18.01	2.26	18.04	2.37	127.50
3.2 KMC Sub Region	19.89	5.71			65.47	8.97			1.88	1.33	0.49	1.75	105.49
3.3 Ulhasnagar Sub Region	11.53	3.32			3.05	0.12		1.15	5.20			1.05	25.42
3.4 Ambemath Sub Region	14.68	7.55			5.07		1.68	0.09	7.72	0.12		0.41	37.20
3.5 Badlapur Sub Region	4.45	0.80			14.06		1.35	7.22	5.25	0.84		0.89	34.14
3.6 Bhiwandi Sub region	13.55	0.40			108.71	6.58	7.04	7.91	7.46	0.84	22.51	3.71	178.71
3.7 Bhiwandi Rural Sub Region	4.39				280.08	12.61	88.34	81.69	20.33	12.29	2.37	6.64	508.74
3.8 South Kalyan Ulhas Sub Region	2.04				131.16		45.36	30.32	23.77	5.25	0.11	8.79	246.80
3.9 North Kalyan Tehsil Sub Region	2.00				58.67	21.72		63.25	49.41			3.63	198.68
4. Navi Mumbai	53.10	39.66	3.36		117.58	5.34		53.52	9.01		104.35	2.81	388.73
4.1 NMMC (Excl. 15 Villages)	24.43	27.93			10.77			18.30	0.62		25.35	0.09	107.49
4.2 NMMC (15 Villages)	0.21	0.15			19.45			6.09				0.20	26.10
4.3 Panvel Sub Region	19.94	10.33			53.78	0.40		18.88	7.42		31.99	2.52	145.26
4.4 Uran Sub Region	8.52	1.25	3.36		33.58	4.94		10.25	0.97		47.01		109.88
5. Neral-Karjat Region	7.97	3.51			187.47		153.20	67.16	44.08	6.30		11.20	480.89
5.1 Karjat Sub Region	4.76				146.81		89.49	21.91	36.06	1.98		7.87	308.88
5.2 Khalapur Sub Region	3.21	3.51			40.66		63.71	45.25	8.02	4.32		3.33	172.01
6. Panvel-Uran Sub region (Outside NM)	7.33	3.92			232.61		81.36	146.27	36.78	2.42	11.24	10.93	532.86
6.1 Rasayani-Panvel Sub Region	4.62	1.65			86.12		15.41	46.37	12.01			3.10	169.28
6.2 Rest Panvel sub Region	0.64	2.27			98.56		61.83	30.29	19.16	2.42		5.24	220.41
6.3 Khopta Sub Region	0.85				31.87		2.05	28.22	0.29		10.22	0.29	73.79
6.4 Rest Uran Sub region	0.85				4.11			21.27	2.17		0.42	1.18	30.00
6.5 Kamala Sub region	0.37				11.95		2.07	20.12	3.15		0.60	1.12	39.38
7. Pen region	3.06				98.87		1.57	29.64	0.17		11.65	7.78	152.74
8. Alibag region	19.01	3.13			134.62	7.95	8.90	24.43	14.68	0.37	12.79	3.43	229.31
Total Area	402.02 9.49%	104.67 2.47%	16.45 0.39%	7.71 0.18%	1677.52 39.60%	113.52 2.68%	530.90 12.53%	614.31 14.50%	302.46 7.14%	38.48 0.91%	350.22 8.27%	77.94 1.84%	4236.20 100.00%

Table-2.10

Development Areas in various Urban Centres and Residential Areas in MMR						
Sr. No.	Urban Centre	Total Area of Development Plan in Ha.	Development Area Proposed in Ha.	Developed Area Existing in Ha.	Area Zoned for Residential in Ha.	Existing Residential Area in Ha.
1	Greater Mumbai	46634.95	27326.80	22693.46	20554.95	7463.99
2	Thane Municipal Corporation	12823.00	4602.00	2459.79	3073.00	917.28
3	Kalyan Complex Notified Area (KCNA)					
	a) Old Kalyan Municipal Corporation	764.00	722.89	434.97	425.80	139.08
	b) Old Dombivali Municipal Council	233.04	233.00	216.13	144.50	152.44
	c) Old Ambernath Municipal Council	1515.00	1195.56	227.86	697.00	89.90
	d) Ulhasnagar Municipal Council	1299.16	1105.75	596.43	497.79	331.00
	e) Rest of KCNA	34267.80	6752.16	2668.37	4811.00	727.21
4	Navi Mumbai	34370.00	30360.00	7590.00	5195.00	291.00
	a) Panvel Municipal Council	519.81	304.62	198.00	500.35	70.15
	b) Uran Municipal Council	229.10	138.67	93.85	54.99	33.34
5	Bhiwandi-Nizampur Municipal Council	2635.93	2124.23	631.14	1220.76	210.09
6	Mira-Bhayander Municipal Council	7940.56	2112.75	592.67	1133.78	275.28
7	Vasai Virar Notified Area (VVNA)					
	a) Vasai Municipal Council	776.21	343.02	167.16	217.58	115.79
	b) Rest of VVNA	37224.00	9000.00	N.A.	1585.43	N.A.
8	Khopoli Municipal Council	3022.50	1060.83	371.81	497.89	71.05
9	Pen Municipal Council	468.00	413.77	133.37	234.34	47.24
10	Alibag Municipal Council	181.00	160.09	95.90	68.56	35.78
11	Matheran Municipal Council	723.67	419.34	255.52	269.54	162.44
12	Karjat	460.00	190.92	77.40	108.00	34.70
13	Neral Zone Plan	512.00	512.00	N.A.	234.00	N.A.
14	Wangani Zone Plan	412.00	412.00	N.A.	282.60	N.A.
15	Rasayani Zone Plan	908.00	908.00	N.A.	333.65	N.A.
	TOTAL	187919.73	83683.65	39503.83	41006.73	11167.76

Source : 1. Report on the Development Plan of respective cities/towns.

Table-2.11

2. Report on Structure Plan for Kalyan Complex Notified Area (1981-2001)

Industrial Areas in MMR			(Areas in Ha.)	
Sr. No.	Location	Name of Industrial Area	Area Zoned for Industry	Area under Existing Industry
1	Greater Mumbai	MIDC (Marol)	129.96	126.19
		Others	5248.04	4585.6
	Sub Total (1)		5378.00	4711.79
2	TMC	MIDC (Wagle)	285.86	210.23
		Private (Balkum Kavesar)	571.14	369.67
		Private (Kalwa)	130.00	130.00
		Private (Mumbra)	16.00	16.00
		MIDC (Kalwa) Part	251.00	251.00
	Sub Total (2)		1254.00	976.90
3	KCNA			
	i) KMC			
	a) Old Kalyan Municipal Corporation	Private	20.08	5.48
	b) Old Ambernath Municipal Council	MIDC (Ambernath)	229.45	225.62
		Others	2.35	N.A.
	c) Old Dombivali Municipal Council	Private	1.26	0.70
	d) Rest of KMC	MIDC (Dombivali)	363.40	283.25
		MIDC (Additional Ambernath)	507.79	19.06
		Private (Dombivali)	160.00	160.00
		Private (Netavali,Tis,Pisavali)	25.00	25.00
		Private (Atale Shahad)	580.00	580.00
		Ordinance Factory	200.00	200.00
	Sub Total (i) KMC		2089.33	1499.11
	ii) Ulhasnagar Municipal Council	Private	141.97	123.20
	iii) Rest of KCNA	MIDC (Badlapur)	104.41	79.96
Sub Total (3)		2335.71	1702.27	

Table - 2.12 Contd....

Industrial Areas in MMR				(Areas in Ha.)
Sr. No.	Location	Name of Industrial Area	Area Zoned for Industry	Area under Existing Industry
4	Mira Bhayander Municipal Council	MIDC (Mira) Private	7.82 138.71	7.82 126.51
	Sub Total (4)		146.53	134.33
5	Bhiwandi Municipal Council	Private	98.11	70.94
6	VVNA			
	i) Vasai Municipal Council	Private	11.36	1.29
	ii) Waliv Gokhiware	Private	300.00	N.A.
	iii) Virar Municipal Council	Private	30.36	N.A.
	Sub Total (6)		341.72	1.29
7	Navi Mumbai			
	i) Panvel Municipal Council	Private	26.11	26.11
	ii) Uran Municipal Council	Private	13.72	10.50
	iii) Rest of New Bombay	MIDC (Kalwa)Part	260.00}	
		MIDC (TTC)	2051.64}	1609.60
		MIDC(Taloja)	948.93	527.34
		CIDCO (Port based Industries)	1600.00	101.66
		CIDCO (ONGC)	162.00	162.00
		Private	60.00	60.00
	Sub Total (7)		5122.40	2497.21
8	Khopoli Municipal Council	Private	367.89	248.58
9	Karjat Municipal Council	Private	7.44	2.60
10	Pen Municipal Council	Private	12.26	10.55
11	Alibag Municipal Council	Private	7.01	2.35
12	Rest of MMR	RCF Thal	330.00	330.00
		MIDC (Bhiwandi Kalyan)	48.16	48.16
		Pen-Alibag Tehsil	300.00	20.00
		Rasayani	439.00	439.00
	TOTAL (1 TO 12)		16188.23	11195.97

Table - 2.12 Concltd.

Sources 1. MIDC Annual Report 1987-88.

2. Development Plans Reports of respective Cities/Towns

3. Report on Structure Plan for Kalyan Complex Notified Area (1981-2001)

4. Existing landuse statement for TMC prepared by Special Cell Development Plan, Thane.

5. Existing landuse statement obtained for ADTP Thane.

6. Sanctioned modification to Regional Plan (Vasai Virar Sub Regional Plan).

7. *Report on Draft Development Plan for New Bombay (1973), Appendix S, para 5.14.*
8. *Derived on the basis of MIDC figures and Source 7 above.*
9. *Proposed landuse statement in supplementary report on Draft Development Plan for New Bombay.*
10. *Report of sanctioned Regional Plan for extended area of BMR (Pen-Alibag).*
11. *Report on Revised Thane Complex Plan by BMRDA, Dec.1979. (HURE Board note for 35th Meeting.)*
12. *As measured on map of Extended BMR Plan.*

Notes 1 * : *Derived by splitting the area of MIDC (Kalwa) industrial area of 511 ha.(Source 7 above, Appendix R; Table R.01). According to Source 7 above 260ha. of MIDC Kalwa is included in New Bombay. The Rest i.e. 251 ha. is assumed to be in TMC.*

1 * * : *Includes residential area of 152.40 ha. (Source 3).*

1 * * * : *Part of this area is outside old Ambernath Municipal limit.*

8 * : *Source 7 shows this area to be only 1844 ha. Source 7 however, shows Kalwa and TTC industrial area to be 2562.64 ha. The area of MIDC Kalwa ie 511 ha. is deducted to arrive at the TTC area in New Bombay. Increase from 1844 ha. to 2051.64 ha. is perhaps due to overall increase in TCC area after 1973.*

1 + : *Source 7 shows this area to be 706 ha. Latest figure according to Source 1 is 907.33 ha, which indicates increase in area over a period of time. Part of this area may be outside New Bombay. Details not available. It also includes some residential land. Detail not available.*

1 + + : *Includes some residential land; details not available.*

1 + + + : *The net area is converted into grass area by assuming 60% efficiency of the layout except in case of MIDC (Marol) and MIDC (Kalyan-Bhiwandi) areas.*

Land Use Classification System			
Sr. No	Level - I	Level-II	Level - III
1	Urban Built-up land	1.1 Residential 1.2 Industrial 1.3 Residential 1.4 Recreational 1.5 Public/Semi-public 1.6 Mixed Built-up land 1.7 Open spaces/vacant land 1.8 Others a) Quarrying/Industrial Waste b) Reclaimed land c) Slum areas	1.3.1 Roads 1.3.2 Railways (Tracks/Yards) 1.3.3 Airport 1.3.4 Harbour/Port 1.3.5 Bridges/Bearthe 1.3.6 Groynes/Break Waters/ Jettys 1.4.1 Parks/Gardens 1.4.2 Playgrounds 1.4.3 Stadium 1.4.4 Race course
2	Agricultural land	2.1 Crop land 2.2 Fallow land 2.3 Plantation	
3	Forest	3.1 Evergreen 3.2 Deciduous 3.3 Mixed Forest 3.4 Scrub/Degraded	a) Dense b) Sparse
4	Wastelands	4.1 Salt affected land 4.2 Gullied/Eroded land 4.3 Water logged areas 4.4 Undulating upland with/without scrubs 4.5 Sandy area 4.6 Rocky outcrops	
5	Coastal wetland	5.1 Tidal/Mudflats 5.2 Saltpans 5.3 Vegetated 5.4 Non-Vegetated	
6	Water bodies	6.1 Rivers/Streams/Creeks 6.2 Reservoirs/Tanks/Lakes 6.3 Canals/Drains	

Annexure - A.2.1