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PROJECT REPORT
ON
REPETITIVE WATER LOGGING
IN THANE CITY
ENGINEERING SOLUTIONS
AND
ENVIRONMENTAL MANAGEMENT PLAN

(SPONSORED BY THE MMR ENVIRONMENT IMPROVEMENT SOCIETY)

(FINAL REPORT)
(ANNEXURES)

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ANNEXURE : I

Annex.-I-01 LETTER OF APPROVAL OF THE PROPOSAL BY MMRE

MMR
ENVIRONMENT
IMPROVEMENT
SOCIETY

No.:MMR-EIS/SOC/3-2005/ 251 /2006 . 27th March, 2006

To

Shri Punam Singavi,
President, 'Hariyali'
5/702, Flower Valley,
Eastern Express Highway,
Thane – 400 601.

Sub : Project proposal regarding "Environmental Management Plan and Engineering Solution".

Sir,

The Board of Governors of the MMR-Environment Improvement Society (MMR-EIS) is pleased to approve your project proposal regarding "Environmental Management Plan and Engineering Solution" and decided to give financial support to the extent of Rs. 7.49 lakhs (Rupees Seven lakhs and Forty Nine thousand only) The duration for completion of the project is 9 months. The grant fund should be utilised for the purpose for which it is sanctioned.

2. You are, therefore, requested kindly send the "Letter of Agreement" duly typed on a Hundred Rupees Non-Judicial Stamp Paper, in duplicate (one copy on plain paper) duly signed in the enclosed format.

3. You are also requested to give a 'Bank Guarantee' of Rs.74,900/- (ie 10% of the approved cost) of any Nationalized/Scheduled Bank in the format enclosed herewith.

4. The grant will be released in four instalments as under :

(i) 20% of the approved project cost as an advance on execution of the "Letter of Agreement" and production of 'Bank Guarantee' in the prescribed formats.

(ii) 30% of the approved project cost after completion of first stage work to the satisfaction of the Society and on verification of statement of expenditure duly supported by vouchers bills etc. for the amount released.

(P.T.O)

MUMBAI METROPOLITAN REGION - ENVIRONMENT IMPROVEMENT SOCIETY
MMRDA BUILDING, BANDRA - KURLA COMPLEX, BANDRA (EAST), MUMBAI - 400 051. TEL : 2659 1267 • FAX : 91-022-2659 1264 • E-MAIL : mmrda@giasbm01.vsnl.net.in

(iii) 30% of the approved cost after completion of second stage work to the satisfaction of the Society and on verification of statement of expenditure duly supported by vouchers bills etc. for the amount released.

(iv) 20% of the approved project cost after completion of the project and submission of the final report to the satisfaction of the Society and on verification of the statement of expenditure supported by vouchers, bills etc. for the amount released.

5. The amount of each instalment will be released after deducting TDS as per the provisions of Income Tax Act, 1961, unless exemption certificate under relevant Section of the Income Tax Act is produced by you.

6. You are, therefore, requested kindly to confirm and do the needful at the earliest.

Thanking you,

Yours faithfully,

Encl: As above.

(N.V.Kulkarni)
Secretary
MMR-Environment Improvement Society

****

Annex.-I-02 FORWARDING LETTER FOR SUPPLEMENTARY REPORT.

HARIYALI
हरियाली
राष्ट्रस्य अलङ्कार: वनम्

5/702, Flower Valley,
Eastern Express Highway, Thane - 400 601.
5/702, फ्लावर व्हॅली,
ईस्टर्न एक्सप्रेस हायवे, ठाणे - 400 601.
Admn. Off.: 26, Dadoji Konddeo Stadium,
Khartan Road, Thane - 400 601.

Mobile : 93232-91890 Telefax : 022-25474119, 022-25408661 E-mail : punamsingavi@vsnl.com Web : hariyalithane.com

The Secretary
MMR Environment Management Society
MMRDA Building, 7th Floor
Bandra- Kurla Complex
Bandra East
Mumbai, 400 051

Dear Sir

Ref :- Your letter No. MMR-Env/SOC/SUB/MTG/39/155/2006 dated 31-10-06.

Sub:- Hariyali's Project Report on Repetitive Water logging in Thane City - Environmental Management Plan and Engineering Solutions - Supplement to Part II Report

This has a reference to our presentation of Part II of the above Project Report before the Committee of the MMR Environment Management Society on 11 Sept 2006 and your letter dated 31st October 2006 regarding our Supplementary Presentation before the meeting of the Sub-Committee scheduled for 11th November 2006.

Attached please find eight copies of our Supplementary Report to Part II Report along with a comprehensive map identifying each water logging spot. We would also like to draw your attention to the contents of the Part II Report and the discussion about the same at our last presentation before the Sub-committee on 11th September 2006 as follows: -

i) Identification of repetitive water logging spots
ii) Causes of water logging-localitywise-based on primary survey
iii) Multi-dimensional nature of localities of repetitive water logging
iv) Assessment of Impact of water logging based on secondary survey
v) List of aspects covered for assessing the impact
vi) Five maps including base map of Thane Municipal Corporation area prepared by 'Hariyali
vii) Matrix for Environmental Management Plan (EMP) and Matrix for Engineering Solutions (ES)

During the discussions, the Members of the Committee felt that the impact assessment and the identification of EMP matrix has been successfully done by 'Hariyali' based on the perception of the people during two surveys. Nevertheless, it was felt that with a view to identifying specific EMP and ES for each water logging spot, 'Hariyali' may study in detail all such spots. While doing so, 'Hariyali' may take help of the concerned engineers of Thane Municipal Corporation to get their perception as well as support for site visits to each such water logging spot. Also, decisions required at Macro level and micro level and nature of ES and EMP for each such water logging spot may be identified and all such findings may be presented before the Committee in the **Supplementary Report**.

Contd...

We are now pleased to submit 8 copies of the 'Supplementary Report' together with a detailed map as desired by the Committee.

We would also like to submit the utilization statement of the first installment received in March/April 2006 before the meeting scheduled for 9th November 2006 and have to request you to release the second installment to enable us to prepare and submit the 'Draft of Final Report' of the above Project.

Thanking you and wishing you a happy new year.

Thane, 1st November 2006.

Yours faithfully
-SD-
Punam Singavi
(President, Hariyali)

****

Annex.-I-03 LETTER FROM TMC COMMISSIONER.

No. TMC/COMMR/CR/971/05

Thane Municipal Corporation
Mahapalika Bhavan,
Panchpakhadi, Chandanwadi,
Thane - 400 602.
Tel. : 2533 6523 / 2533 6529

19/11/05

Commissioner

The President Secretary,
MMR Environment Society,
MMRDA Bldg.,
Bandra-Kuira Complex.
Bandra (East). Mumbai - 400 051.

Dear Sir,

Subject :- **Support from the Thane Municipal Corporation, Thane.**

Reference :- Hariyali's project of "Survey of Deluge in Thane City - Nature, Causes, Effects & Preventive Measures".

We understand that Hariyali has made application to you for Environmental Grant to meet the cost of its project for suggesting preventive measures of flooding of Thane on the basis of its survey of the nature, causes and effects of Deluge of July 2005 in Thane City.

We have discussed the subject matter of the project with the representatives of Hariyali and have given our consent for Shri K.D.Lalla to be a part of the Experts Committee set up by Hariyali for this purpose.

In our opinion, the project undertaken by Hariyali is keeping in line with our national policy of "Peoples Participation" in tackling all our environmental, social and economic problems in a constructive manner. We also expect the outcome of the project to be of immense use and importance from the point of view of safeguarding environment of Thane, environmental management policy for the future, as also, in drafting town planning scheme and providing civic amenities to the residents of Thane and are looking

T.M.C.

Continuation Sheet.....

forward to completion of the same. From that point of view, Thane Municipal Corporation would like to lend its full support to Hariyali, without any monetary commitment from TMC and would like to assure of our best possible co-operation in implementation of the same.

As such, we commend the project for your scrutiny and appropriate action.

Yours faithfully,

Sanjay Sethi

(Sanjay Sethi),
Commissioner,
Thane Municipal Corporation, Thane.

****

Annex.-I-04 MINUTES OF THE MEETING WITH CWPRS.

Date : 17th April, 2006.

To,

Sarvashri :- Mr.Punam Singavi
Mr.S.N.Patankar
Mr.H.M.Oswal
Mr.Madhukar Date
Mr.Vasantrao Kelkar
Mr.Doiphode
Mr.Gole
Mr.Shinde
Prof. Oak

Sub :- Environmental Management Plan & Engineering Solutions -- Storm water flooding ---- Thane city ---- Preparation of project report.

Ref :- Visit to CWPRS on 13th April, 2006.

Dear Sirs,

Please find enclosed minutes of discussion held at CWPRS. Arising out of this you may kindly forward comments regarding further actions Hariyali can take up in respects of mathematical modeling and involvement of CWPRS in near future.

Thanking you, regards.

S.N.Patankar
Chairman Experts Committee, Hariyali.

Minutes of meeting with CWPRS officials by Hariyali & TMC's representatives on 13th April, 2006 at 9.30 a.m. at Pune. Following were present.

CWPRS Representatives :

Dr. V. Bendre	- Director.
Mr.Purandare	- Deputy Director.
Mr.Kapileshwar	- Scientist.
Mr.Deshmukh	- Scientist.

Hariyali Representatives :

Mr.Punam Singavi	- Chairman.
Prof. Oak	- Trustee.
Mr.S.N.Patankar	- Member.

Thane Municipal Corporation Representatives :

Mr. Doiphode - Deputy Engineer.

Mr. Shinde - Jr. Engineer.

- At the outset Mr.Singavi & Mr.Patankar informed CWPRS about Hariyali's work in respect of plantation, conservation of water, involvement of students in various project, social commitment, support by MMR Environment society in respect of preparation of project report for Thane city, environmental management plan with particular reference to flooding in Thane city, possible engineering solutions, and mitigation aspects, in respect of flooding in Thane city.
- The involvement of Thane Municipal Corporation with Hariyali for preparation of the project report was explained.
- Director CWPRS expressed satisfaction for such a work being taken up by a group involving public private institutions e. g. Thane Municipal Corporation and Hariyali together to help the social cause in Thane city.
- CWPRS officials explained the physical model of Bombay Harbor Port, the history of the model, the usefulness of model etc.
- While exchanging thoughts on possible work for Thane city, rain fall runoff and estuarine mechanism, it was felt that the exercise would be complex and different than Mithi River, Poisar River, and Dahisar River etc. in the region. This is mainly because Thane creek connected to Bombay Harbor, Ulhas estuary connected to Ulhas River and also to Vasai creek and further to Arabian Sea would be hydraulically complex phenomenon. For any type of study for these water bodies it is necessary to first decide boundary conditions as well as obtain cross sectional and other details of the water bodies. The CWPRS officials informed that they have capability to develop mathematical model for these water bodies subject to availing of the data.
- The CWPRS officials there after explained the work of mathematical model recently carried out by them in respect of Mithi river of Mumbai city at the instance of MMRDA.
- It was also felt that a combined program of study of water bodies by TMC, KDMC, Ulhasnagar Corporation, NNMC and Virar Bhayandar Corporation may be taken up.

The discussions ended with a vote of thanks by Hariyali for nice arrangements and support given by CWPRS officials.

S. N. Patankar
Chairman, Experts Committee, Hariyali.

****

Annex.-I-05 OBJECTIVE AND SCOPE OF THE REPORT.

1. **To identify different localities** under the jurisdiction of Thane Municipal Corporation, where water logging takes place repeatedly.
2. **To identify the causes** of repetitive water logging.
3. **To identify and co-ordinate the causes of repetitive water logging, locality wise.**
4. **To assess the impact of such water logging** on several aspects of the life and activities of citizens, including socio-economic, environmental and other aspects of urban life.
5. **To Make a locality wise graphical presentation of the causes of and impact** of repetitive water logging.
6. **To prepare and present a Base Map of Thane** City (covered by the jurisdiction of Thane Municipal Corporation).
7. **To identify major water courses passing through/**located in the jurisdiction of Thane Municipal Corporation on the Base Map for the ascertainment and identification of relationship between the causes and impact of water logging.
8. **To lay down the Matrix for the presentation of 3rd and Final Report involving proposition of Engineering** Solutions for the Prevention of Repetitive Water Logging of Thane City.
9. **To lay down the Matrix for the preparation and presentation of the Environmental Management Plan for Thane City.**

(**Note : -** Scope and objective of the assessment of impact and preparation of EMP (Environmental Management Plan) is restricted only to the Repetitive Water logging of Thane City, as per the basic condition of the Project Proposal).

*****

Annex.-I-06 COMPOSITION OF THE EXPERTS COMMITTEE.

Sr. No.	Name	Designation	Telephone Number
01	Shri. Patankar S. N. (Convener)	Retired City Engineer, BMC	(M) 93222-72777 (R) 022-25679245
02	Shri. Oswal S. M.	Retired S.E., P.W.D. & City Engineer Kalyan-Dombivali M.C.	(R) 0251-2203877
03	Shri. Deshmukh S. V.	Architect & Engineer	(M) 98211-41982 (O) 022-25333191 (R) 022-25360036
04	Shri. Lala K. D.	City Engineer, TMC	(M) 98211-52112 (O) 022-25347714 (R) 022-25450767
05	Shri. Date Madhukar V.	Retd. General Manager, RBI	(R) 022-25473627
06	Shri. Kelkar Vasant (Kaka)	Retired Engineer, MHADA & Social Worker, thane	(M) 98204-50152 (R) 022-25422906
07	Shri. Bhole L. S.	Retired Principal, Mulund College of Commerce	(M) 99690-83506 (R) 022-32966689
08	Shri. Singavi Punam Ex Officio Chairman	Chartered Accountant President, Hariyali	(M) 93232-91890 (R) 022-25474119

*****

Annex.-I-07 LIST OF PERSONS INTERVIEWED FROM MULTIPLE-DISCIPLINE AND CROSS SECTION OF THE SOCIETY DURING SECONDARY SURVEY

Sr. No.	Names	Designation	Organisation
01.	Mrs. Sulakshana Mahajan	Architect and Independent Professional	Environmentalist
02.	Dr. Sunil Sawant	Doctor of Medicine	Municipal Hospital, Kalwa.
03.	Dr. W.G.Chaure	Doctor of Medicine	Health Officers, TMC.
04.	Dr. Bhanushali	Renowned Surgeon	Founder & Director of Kaushalya Hospital.
05.	Mr. Girish Mehendale	Dy. City Engineer	Thane Municipal Corpn.
06.	Mr. N. Y. Nachane	Traffic Inspector	Maharashtra State Transport Corpn.
07.	Mr. Prakash Gholap	Officer	Thane Municipal Transport Corpn.
08.	Mr. Girish Shinde	Secretary	Thane Vahatuk Sangh
09.	Mr. R. V. Burud	Ex. Enginner	M.S.E.B.
10.	Prof. V. Walavalkar	Environmentalist	Founder Secretary, Enviro-Vigil, Thane.
11.	Mrs. Palkar	Dy. Pollution Control Officer	Thane Municipal Corpn.
12.	Mr. Deepak Bhagwat	Officer, Slum Development Deptt.	Thane Municipal Corpn.
13.	Mr Sanjay More	Education Officer	Thane Municipal Corpn.
14.	Mr K. A. Pendhare	Dy. Gen Manager	MTNL, Wagle Estate, Thane.
15.	Mr. Satishan	Section Engineer	Central Rly., Thane
16.	Mr. Bapusaheb Patil	Industrialist	Chairman, BSP Industries Pvt. Ltd.
17.	Mr. M. R. Khambete	Industrialist	Founder & Chairman of Thane Small Scale Ind. Association
18.	Mr. M. P. Patil	Ex. Enginner	Khar Land Div., Kalawa, Thane.
19.	Mr. Vijayraghavan	Social Worker	Secretary of a CHS in the Vrindavan Complex.

*****

Annex.-I-08 LIST OF PERSONS CONDUCTING THE INTERVIEWS

Sr. No.	Name of the Person	Qualification / Designation / Authority
1.	Shri. Patankar S. N.	Retired City Engineer, BMC and Renowned Water Expert.
2.	Shri. Madhukar Date	Retired General Manager, RBI and a Writer on Economic Issues.
3.	Prof. (Dr.) Kusum Gokhale	Retired Head of Department of Zoology Bandodkar College of Science, an Environmentalist and an Authority on Thane Creek & Ulhas River Estuary
4.	Miss Mugdha Todkari	A Post-Graduate student of Environmental Science
5.	Shri. Saurabh Thackekar	Under-Graduate Student of Science

*****

Annex.-I-09 SPECIAL FEATURES AND THE METHODS APPLIED.

1. The Report is prepared after taking into consideration the suggestions made and the **guidelines given by MMREMS** during the course of Presentation of the 1st Report.
2. Based on and prepared after an **extensive research and processing of data** collected and interviews conducted over a period of four months and is being presented in continuation of Part I of the Report presented earlier on 25th April 2006.
3. **Data collected from the records of Thane Municipal Corporation and Reports of several studies and projects available with TMC, MMR Environment Management Society and MMRDA.**
4. **As many as 19 (Ninteen) eminent personalities** residing/working within the Jurisdiction of Thane Municipal Corporation (TMC), belonging to several disciplines with long-standing experience and expertise, as also, holding academic qualifications, **interviewed**.
5. **The Team of Interviewers headed by the Convener of the Experts Committee**, Shri S.N. Patankar himself, comprised of a zoologist and environmentalist, economist and students of environmental sciences, whose names are given separately at the end of the Report.
6. **Extensive Physical visits** to the localities affected by repetitive water logging and the watercourses were undertaken to verify the observations made by the persons interviewed and the data collected from the available records.
7. **Consolidated Base Map of Thane City**, incorporating therein the extended suburban region of Mumbra, Kalva, Kharegaon, etc (North and East of Thane Creek) prepared by **Hariyali** with the help of experts from the field.
8. **Several other maps** identifying the localities normally affected by repetitive water logging, impact of such water logging on such localities and different civic services, establishing a co-relationship between the same, etc, also prepared for the first time.
9. **Impact of Water Logging** on several civic services and different aspects of urban life ascertained and presented in a scientific manner for the first time.

10. **Observations made in the First Report about the causes, nature and effects of Deluge vindicated by the instant study of repetitive water logging, as well.**

11. **Matrix for the Possible Environmental management Plan (EMP)** defined and identified to serve as the basis for the preparation and submission of Part III as the Final Report.

12. **Matrix for the Possible Alternative Engineering Solutions (ES),** Mandatory, as also, Optional, also identified and defined to serve as the basis for the preparation of the Part III as the Final Report.

****

Annex.-I-10 DETAILS OF REPETITIVE WATER LOGGING.

TABLE SHOWING THE MULTI-DIMENSIONAL CHARACTER OF LOCALITIES INFLUENCED BY REPETITIVE WATER LOGGING (BASED ON THE RESULTS OF SECONDARY SURVEY)

Legend:

I. Creek Vicinity.
II. Nalla Vicinity.
III. Low lying area.
IV. Forest Boundary.
V. Slum Area.
VI. Others, including High-rise buildings.

Sr. Nos.		Low	Slums	High Rise Bldgs.
(I)	CREEK VICINITY	III	V	VI
1.	Shreerang Society	✓	X	✓
2.	Vrindavan Society	✓	X	✓
4.	Chendani Koliwada	✓	✓	X
5.	Khartan Road	X	✓	X
8.	Kharegaon	✓	✓	✓
9.	Shastrinagar, Kalwa	X	X	✓
10.	Mumbra, Koliwada	✓	✓	X
11.	Anand Koliwada	✓	✓	X
15.	Saket	X	X	✓
19	Sewarage Pumping Stations	X	X	X
20.	K. Villa	X	✓	X
21.	Rabodi Koliwada	✓	✓	X
22.	Majiwada	X	✓	✓
26.	Mumbra Station Area	X	✓	✓
52.	Balkum Pipe Line	X	X	✓

Sr. Nos.		Slums	High Rise Bldgs.	Forest
(II)	NALLA VICINITY	V	VI	IV
6.	Ram Maruti Road	X	✓	X
7.	Manish Nagar	✓	✓	X
13.	Vandana Talkies	X	✓	X
14.	Vitava Bridge	X	✓	X
16.	Anandashram, Naupada	X	✓	X

Sr. Nos.		Slums	High Rise Bldgs.	Forest
(II)	NALLA VICINITY	V	VI	IV
17.	Naupada	X	✓	X
18.	Amargyan	✓	✓	X
23.	Opp. Anand Talkies	✓	X	X
24.	Downside Kopri	✓	X	X
25.	Near Kalwa Platform	✓	✓	X
27.	Brahman Society	X	✓	X
28.	Bradura Company	X	✓	✓
29.	Road No. 21	X	✓	✓
30.	Road No. 34	X	✓	✓
32.	Majiwada Paper Product	✓	✓	X
33.	Teen Hath Naka to Mental Hospital	✓	✓	X
34.	Raghunath Nagar	X	✓	X
35.	Road No. 22	X	✓	✓
36.	Near SBS Circle	✓	✓	X
37.	Morarji Sundarji Rasta	✓	✓	X
38.	Road No. 2	X	✓	✓
39.	Near Vandana Theatre	X	✓	X
40.	Near Civil Hospital	X	✓	X
41.	Panch Pakhadi	✓	✓	X
3.	Thanekar Wadi	✓	✓	X
54.	Patlipada (North)	✓	✓	X
55.	Dongari Pada (North)	✓	X	X

Sr. Nos.		Slums	High Rise Bldgs.
(III)	LOW LYING AREA	V	VI
74	Vitava Bridge	✓	✓
65	Sambhaji Nagar	✓	✓

Sr. Nos.		Slums	High Rise Bldgs.
(IV)	**FOREST BOUNDARY**	**V**	**VI**
48.	Ramnagar	✓	X
45.	Mahatma Phule Nagar	✓	X
46.	Karvalo Nagar	✓	✓
31.	TMT Depot to hills	✓	✓
47.	Hanuman Nagar	✓	X
53.	Manpada (South)	✓	✓
56.	Wadvali	✓	✓
57.	Anand Nagar	✓	X
58.	Owala	X	X
59.	Bhaindar Pada	X	X
60.	Kaju Pada	X	X

Sr. Nos.		Forest	Creek Vicinity	Low Lying Area	Nalla Vicinity
(V)	**SLUM AREA**	**IV**	**I**	**III**	**II**
49.	Bhimnagar	X	X	✓	✓
50.	Ambedkar Nagar	X	X	X	✓
42.	Indira Nagar	✓	X	X	✓
43.	Sathe Nagar	✓	X	X	✓

Sr. Nos.		Forest	Creek Vicinity	Low Lying Area	Nalla Vicinity
(VI)	**HIGH RISE BUILDINGS**	**IV**	**I**	**III**	**II**
44.	Rupadevi Pada	✓	X	X	✓

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Annex.-I-11 ASPECT COVERED FOR ASSESSING THE IMPACT OF WATER LOGGING..

(For undertaking Secondary Survey)

1. **Roads:** Roads and other related infrastructure services.
2. **Health:** Diseases, epidemic, hospitals, dispensaries, clinics, medicines, survey of affected area, additional monetary burden on health services.
3. **Water supply:** contamination, portability.
4. **Road transport:** State transport depots, loss of revenue, mileage covered, damage to vehicles, additional maintenance and operation cost, traffic jams, fuel, time lost.
5. **Electricity supply:** Substations, pillars, cables, revenue.
6. **Pollution:** Biomedical waste, treatment of wastewater, ground water.
7. **Slums:** Water logging, landsides, sinking structures.
8. **Education**: Absenteeism, damage, repairs, maintenance.
9. **Communication:** Short circuits, jamming of services, maintenance, reduction in revenue, installations, etc.
10. **Railways:** Tracks, culverts, rehabilitation, inconvenience to passengers.
11. **Industries:** shutdowns, production loss, maintenance, psychological, losses, machinery, compound walls, buildings, stilts, etc.

Town planning & development: Slums, high tides, development levels, utilities, solid waste, structures, plinth levels, shops, integrated Nalla developments, dumping ground, land use, commercial area, review of development plan, etc.

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Annex.-I-12 ASSESSMENT OF IMPACT OF WATER LOGGING.

A] ROADS.

1. Water logging occurs on roads of newly developed area due to wrong formation levels of existing and proposed roads.
2. Stagnation of floodwaters & damage to the sub-grade & sub-soil in flooded areas.
3. Accidents occur because of damage to roads.

B] HEALTH.

1. Residential areas at Mumbra, Kausa & Kalwa are affected due to water logging resulting in-two fold increase in patients being admitted in the nearby hospitals.
2. Spread of epidemics such as, Dengue, Lepto, Gastro, Malaria occurred due to flooding in 2005 & 1998 in localities such as Konkanipada, etc.
3. The TMC is required to spend about Rs.3.5 to 4 crores annually to control and prevent spreading of diseases in flood prone area.
4. Blood banks are put under severe stress to provide blood in adequate quantity for transfusions.
5. TMC is also required to conduct house-to-house survey in flood affected residential areas to treat patients, take preventive measures and to conduct free medical checkup.
6. Daily wage earners are more affected. As such, the economic impact is felt more on slum areas.
7. Burden on General Medical Practitioners - particularly in flood prone areas - results in giving more prescriptions of standard and curative medicines by the Doctors. This leads to generation of shortage of such medicines in the affected localities.
8. Increase in medical expenses by the people.

C] WATER SUPPLY

1. Contamination of water increases because of intermittent water supply and crossing of sewage lines.
2. Shock loads of turbidity and contamination of water results into non-potable water supply.

D] TRANSPORT

1. Reduction in the mileage-cover per day by State Transport buses in Thane from 40,000 km to 36000 km a day.
2. Revenue loss to S.T. Buses in Thane amount to Rs. 1 lakh per day.

3. Operation & maintenance cost of S.T. Buses in Thane increases by about Rs.2 crores per year.
4. Damaged roads and potholes on the roads affect tyres, suspension springs and break liners of vehicles.
5. TMT has to incur additional maintenance cost of about Rs. 1.5 crores per year.
6. Traffic Jams result in loss of time in transit & loss of fuel.
7. Loss of Rs. 1 crore is estimated for additional fuel for about 3000 trucks in Thane City.

E] ELECTRIC SUPPLY

1. Substation of electric supply and equipments like transformers, etc. get affected in areas like Saket, Vrindavan, Anandashram, Naupada, Amargian, K.Villa, Rabodi, Koliwada, Majiwada, etc.
2. Pillars and cables of electric supply get punctured due to short-circuiting.
3. Repairs and maintenance losses of Rs.10 lakhs per year by MSEB in Thane city.
4. Revenue loss to MSEB due to interruption in power supply.

F] BIO-MEDICAL WASTE

Bio-medical waste generated in private clinics comes in contact with floodwater causing pollution of floodwaters.

G] WATER BODIES

Overflowing ETPs cause mixing of untreated wastewater with water bodies. This also contaminates groundwater.

H] WATER SUPPLY

1. Contamination of water increases because of intermittent water supply and crossing of sewage lines.
2. Shock loads of turbidity and contamination of water results into non-potable water supply.

I] TRANSPORT

1. Reduction in the mileage-cover per day by State Transport buses in Thane from 40,000 km to 36000 km a day.
2. Revenue loss to S.T. Buses in Thane amount to Rs. 1 lakh per day.
3. Operation & maintenance cost of S.T. Buses in Thane increases by about Rs.2 crores per year.
4. Damaged roads and potholes on the roads affect tyres, suspension springs and break liners of vehicles.

5. TMT has to incur additional maintenance cost of about Rs. 1.5 crores per year.
6. Traffic Jams result in loss of time in transit & loss of fuel.
7. Loss of Rs. 1 crore is estimated for additional fuel for about 3000 trucks in Thane City.

J] ELECTRIC SUPPLY

1. Substation of electric supply and equipments like transformers, etc. get affected in areas like Saket, Vrindavan, Anandashram, Naupada, Amargian, K.Villa, Rabodi, Koliwada, Majiwada, etc.
2. Pillars and cables of electric supply get punctured due to short-circuiting.
3. Repairs and maintenance losses of Rs.10 lakhs per year by MSEB in Thane city.
4. Revenue loss to MSEB due to interruption in power supply.

K] BIO-MEDICAL WASTE

Bio-medical waste generated in private clinics comes in contact with floodwater causing pollution of floodwaters.

L] WATER BODIES

1. Overflowing ETPs cause mixing of untreated wastewater with water bodies. This also contaminates groundwater.
2. Industrial waste gets mixed up with floodwater increasing water pollution. This also contaminates ground water.

M] SLUMS

Landslides, water logging and sinking of buildings occur in slum areas in Kalwa, Mumbra and Kausa due to deficiencies in construction.

N] EDUCATION

Educational institutes in low-lying areas get affected due to damage to the furniture and loss of school hours.

O] COMMUNICATION SERVICES

1. Cables get damaged due to short circuits, joints go faulty due to water leakages.
2. Mobile services get jammed.
3. Additional maintenance cost of Rs.1.5 lakhs is required to be incurred by MTNL in Waggle Estate.
4. Loss in revenue to MTNL because of interruption in service.
5. Leakages in MTNL installations and buildings.

P] RAILWAYS

1. Six culverts below railway tracks at Mumbra, Kalwa and Thane unable to carry runoff even during normal flooding.
2. Water logging occurs on Railway tracks at Mumbra, Kalwa and Kopri
3. Railways have to spend about Rs.65 lakhs per year for rehabilitation of tracks within TMC area.

Q] INDUSTRIES

1. Loss in production of small-scale industries is about Rs.10 crores per annum.
2. Loss in maintenance of submerged machinery in industries is about Rs.2 crores per annum.
3. Removal of silt in industrial installation takes about 8 days resulting in loss of Rs. 4 crores per year.
4. Additional cost is required to be incurred on maintenance of buildings and compound walls.

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Annex.-I-13 MAJOR OBSERVATIONS OF THE EXPERT COMMITTEE. ON THE RESULTS OF SURVEY AND THE IMPACT OF REPETITIVE WATER LOGGING

1. **Few usual water logging areas are quite near to the Thane Creek.** The reasons are:
   a) Filling levels are equal to less than highest high tide level (1.9 GTS).
   b) They get affected due to back water levels in the watercourses joining the creek (2.9 GTS).
   c) Inadequate carrying capacity of the watercourses.
2. **Certain areas which are not in the vicinity of creek and are at a higher altitude of above 3.9 GTS are also being affected by repetitive water logging mainly because of :**
   a) Obstruction due to utilities.
   b) Obstruction due to structures.
   c) Inadequate hydraulic carrying capacity.
3. **The areas like Majiwada, Central Jail, V. P. Polytechnique, Vishwakarma Nagar, Shastri Nagar, and Jai Bhim Nagar are abutting Thane Creek. These portions of Thane Creek receive tidal water of Arabian Sea through Bombay Harbor, as also, the tidal water of Ulhas Creek from Arabian Sea through Ghodbandar, Bhaindar areas.**
4. **This portion of Thane creek is also affected due to high run off from the Mountainous Region on the West side of Thane City.**
5. **In addition, the run off from Ulhas River during unusual rainfall finds way into Ulhas creek and ultimately into Thane Creek. This situation is extremely peculiar for the above localities and also for part of Kalwa and Mumbra.**
6. **Thus the hydraulics in this part of TMC area is extremely complicated, needing multidisciplinary research and deliberations between the Authorities of several Municipal Corporations adjoining each other across the Creek seeking effective and long-term solutions.**
7. **The so called number of major 'Nallas', in fact, are small rivulets originating from the nearby mountainous region having a large catchment area with an average rainfall of not more than 2500 mm. p.a. and a run off of not less than Six K.M.**
8. **Lack of civic discipline on the part of citizens on one hand and laxity in implementation of the accepted policy of and relevant statues for the development and maintenance of services on the part of the concerned**

administrative machinery on the other hand appear to be as important and responsible factors as natural causes like heavy rainfall for the repetitive water logging at most of the spots.

9. **As such, evolution of effective methods of educating masses from cross section of the society belonging to all age groups would demand an equal degree of consideration while evolving any ES and EMP.**

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Annex.-I-14 POSSIBLE MATRIX FOR EMP.

POSSIBLE MATRIX FOR ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR THE PREVENTION OFAND MITIGATION OF HARDSHIPS CAUSED BY REPETITIVE WATER LOGGING (To be detailed in Part III of the Final Report)

A] ROADS :

1. Identify and design formation levels for all roads in the City.
2. Give due regard to HFL of all surrounding water bodies instead of local watercourse in front.
3. Continue the efforts to maximize the concrete roads.
4. For the tar roads, utilize new technologies for longer durability, even in flood prone areas.
5. Use rainwater harvesting technique in roadside drains to minimize runoff going to the watercourses.
6. Prepare plan for prompt attending to the potholes even during the monsoon, irrespective of its temporary nature and utility.

B] HEALTH :

1. Develop 'capacity building' programs to take preventive measures to control epidemics, utilizing outside medical health facilities, testing of samples, house to house survey & free medical checkup.
2. Strengthen the rat control program well before the commencement of monsoon..
3. Implement plan for shifting of cattle sheds out of towns before monsoon.
4. Plan properly for safe storage of food grains.
5. Prepare plan for increasing the number of primary health centers in monsoon.
6. Implement awareness programs for boiling drinking water.
7. Prepare plan for shifting of affected people during flooding.

C] WATER SUPPLY :

1. Prepare plan to locate leakages/stop the leaks from water mains and distribution systems.
2. Prepare plan for replacement / rectification of rusted pipes in the distribution system.

3. Identify locations of frequent contamination in the distribution system & immediately take preventive measures before monsoon.

D] TRANSPORT :

1. Plan high level of efficiency of vehicles before & during monsoon.
2. Use modern technologies to minimize damages to the tyres, suspension springs, break liners, etc. during flooding.

E] ELECTRIC SUPPLY :

1. Plan to revise the levels of sub-stations in flood prone areas by 1 to 1.5 metre.
2. Use modern technology, minimize damage to pillars, cables, joints, etc. due to floods.

F] BIO-MEDICAL WASTE :

1. Plan opening of collection centers for bio-medical waste for private clinics, nursing homes & public at large.
2. Prepare programs to make public aware of the hazards of bio-medical waste.
3. Appropriate arrangements are made for collection of data regarding generation and disposal of bio-medical waste.

G] WATER BODIES :

1. Probe the possibility of interlinking all lakes in Thane city for flood assimilation' as well as, improvement in groundwater level.
2. Study of dilution due to runoff for all the water bodies including lakes should be done.
3. Study of the extent of pollution, dilution, advection, convection, in case of estuaries and dilution during runoff in lakes should be carried out.
4. The status report of the sewage treatment plants and wastewater treatment plants of industries should be prepared to enable taking corrective action during monsoon, particularly to avoid overloading of plants during flooding hours.

H] SLUMS :

1. Redevelopment of structures & slum areas should be planned to minimize losses of lives & structures due to floods and land slides.
2. Create rehabilitation centers to accommodate people in the flood prone areas before and during occurrence of flooding.

I] EDUCATIONAL INSTITUTIONS :

Prepare plans to locate record rooms, computer labs, libraries, etc on upper floors.

J] COMMUNICATION SERVICES :

1. Prepare time -bound programmes to raise height of pillars above HFL.
2. Prepare programs for checking of cable joints well before monsoon.
3. Complete the plan for replacement of copper cables by Jelly-fed cables to minimize disruption in services.
4. Prepare plans for technological upgradation of cable joints to avoid leakages.

K] RAILWAYS :

1. Prepare time-bound programmes to increase carrying capacity of all the six railway culverts in TMC areas by establishing co-ordination at all levels between railway & TMC.
2. Maintenance of the culverts should be done well before monsoon.

L] INDUSTRIES :

Effective steps are taken to remove the encroachments adjoining the compound walls of all industrial units/estates.

M] STORM WATER MANAGEMENT PLAN :

1. Continue with the desalting of all Nallas up to invert level before monsoon. This programmes, should preferably be carried out thrice in a year, in the month of November, March and June.
2. Continue vigorously with the program of shifting of utilities in all the watercourses.
3. Execute the programmes of training of Nallas for improved carrying capacity for frequency of 1 in 10 years with suitable concentration time & duration.
4. The roadside drains may be designed for higher intensity and less duration.
5. Continue the program of repairs to the collapses on different Nallas.
6. Emphasize the need to implement the master plan for storm water drainage at all the levels.
7. A complete storm-water drain inventory with analysis should be maintained for monitoring and revision of the system.
8. The forecast of rains should be continuously monitored with meteorological department.
9. With the help of technical studies, expected quantum of flood in relation to run off, high tides in different locations of TMC be prepared and published regularly.

10. If required, the use of radar for data transmission may be planned for real flood forecast.
11. Due importance and emphasis be given for maintenance of storm water drainage system while making budgetary provisions.
12. A storm water drainage project specifically for TMC should be prepared and implemented in next five years.
13. Effective steps are taken for facilitating the movement of 'Nalla cleaning machinery' and equipment, including removal and demolition of structures on Nallas.

N] SEWERAGE PLAN :

Plans are made for methodical construction of sewage lines so as to totally avoid body connection in sewer lines.

1. A time-bound and effective program to stop leakages from joints and minimize infiltration in sewers be drafted and implemented.
2. To prepare sewerage plan for the entire City an effective system to avoid entry of sewage in open Nallas.
3. Proper and effective plans for the treatment and disposal of entire sewage quantity with due consideration to the assimilative capacities of water bodies and treatment standards of MRCB be made.
4. A Plan for improvement in efficiency of pumping stations be prepared and implemented.

O] DEVELOPMENT PLAN :

1. Any new development in TMC area should be 2' above HFL in relation to surrounding water bodies.
2. Any new development in TMC falling in the area of HFL for once in 10 years design and once in 100 years design, should be provided with stilt arrangement.
3. In case of existing structures affected by backwater due to once in 100 years intensity converts the ground floor into stilt portion.
4. Reclamation of new area is permitted/undertaken only after evolving a development plan, instead of resorting to piecemeal reclamation.
5. Prepare plan for TMC showing minimum level of reclamation.
6. Modify land usage for open spaces to act as holding capacities for abnormal storm Runoff and ingress of seawater.

7. Survey and utilize wetlands for conservation of mangroves to use as buffers and for hydraulic assimilation.
8. Growth of unauthorized habitats in violation of civic regulations is strictly arrested.
9. In case of existing slums, redevelopment and rehabilitation programmes be taken up and implemented on priority.
10. Appropriate steps be taken for identifying and acquisition of land for dumping and disposal of civic garbage taking into consideration the needs of at least next ten years.

P] SOLID WASTE MANAGEMENT :

1. The TMC should enforce vehemently and scrupulously the segregation of solid waste - bio-degradable & recyclable.
2. Provision for penal rules for non-compliance with civic regulations for the disposal of solid waste at household, commercial and industrial level.
3. Provision of adequate number of litter bins for at prominent and crowded public places, markets, etc.
4. Provision for making appropriate arrangement for segregation of solid waste.
5. Provision for the replacement of present dustbins made of cement pipes, metal rings construction in a phased manner by a mobile closed container for temporary storage of waste for onward transportation in a cost effective manner.
6. The frequency of transportation of container should be such that dustbin sites are cleared before they start overflowing.
7. All organic / biodegradable waste is first composted by following suitable methods.
8. Domestic hazardous waste, such as, used batteries, containers for chemicals and pesticides, etc is disposed of by scientific land filling or any other suitable method.

Q] RISK AND INSURANCE :

1. The reduction in the flood losses and introduction of flood insurance is thought of.
2. Compilation of data pertaining to structures at risk due to water logging be promoted and enforced.
3. Evolution of a risk management plan to reduce the rate of growth in such structures is considered.

4. Study of risk assessment factors, such as, hazards identification, hazards analysis, consequence analysis, risk determination, risk evaluation is carried out.
5. Thereafter a plan is made by the Civic Authorities for to minimize the risk losses.

R] ECONOMIC :

1. Economic analysis for reduction in number of water logging events and its cost effectiveness carried out.
2. While doing so cost of engineering solutions, benefit to the society, increase and decrease in diseases, sickness, deaths, property damages, travel disruption, business productivity, social implications, etc be considered at length and with added details.
3. The Environmental Management Plan coupled with Engineering Solutions is considered as the cost of improving economic returns.

S] SOCIAL :

1. Public campaign for not using site drains, as well, as water courses for dumping solid waste should be vigorously carried out by the Civic Administration.
2. Similarly, people should be trained to segregate solid waste in to basically two categories bio-degradable & recyclable waste.
3. People should also be trained about hazards of bio-medical waste and its disposal technique.
4. Efforts to generate public awareness regarding using boiled water during monsoon period are made with added vigor by the civic authorities, as also, NGOs working in the field.
5. All such, public training and public awareness programmes be launched in the educational institutions.
6. The concept of formation of Area Locality committees for generating public awareness be introduced and implemented earnestly.

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Annex.-I-15 MATRIX FOR POSSIBLE ALTERNATIVES IN ES.

MATRIX FOR POSSIBLE ALTERNATIVES IN ENGINEERING SOLUTIONS (ES) -- MANDATORY AND OPTIONAL –

(To be detailed in Part III of the Final Report)

1. Design of cross sections of Nallas and working out width of Nallas for intensities – twice in a year, once a year, once in 10 years and once in 100 years.
2. Deciding the constructional aspects for training of Nallas for width of once in 10 years.
3. Design for storm water detention ponds and retention facilities with due considerations to inflow hydrographs, outflow
4. Removal of silt from the watercourses and roadside drains to be designed and implemented with the help of suitable machinery.
5. Designing interceptors in hilly areas at suitable contours to divert the run off at a suitable level and take it directly to the water body and avoid entry into the residential and other areas.
6. Design suitable embankment at the banks of the creeks and estuaries to avoid entry of high tide during maximum runoff.
7. To consider the option of construction of deep tunnel with a reservoir and using storm water for dilution of sewage.

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Annex.-I-16 OBSERVATIONS DURING FIELD VISITS.

OBSERVATIONS DURING FIELD VISITS TO WATER LOGGING SPOTS IN TMC AREA.

Sr. No.	IDENTIFICATION OF SPOTS			OBSERVATIONS
	NO	PRABHAG	LOCATION	
1.		RAILADEVI AND WAGALE ESTATE	❖ ROAD NO. 22 AMBEWADI MARKET ❖ LOKMANYA NAGAR NO. 3 ❖ AMBEDKAR CHOWK ❖ SHASTRI NAGAR. ❖ VARTAK NAGAR AND SHASTRI NAGAR JUNCTION. ❖ PHULE NAGAR NALLA. ❖ KAMGAR HOSPITAL ❖ BRADMA ❖ ROAD NO. 28, ITI NALLA. ❖ SHRINAGAR ❖ LAKDI POOL NALLA.	⏩ Though steep gradients are available with good carrying capacity, the silt including boulders and solid waste dumped, was to the extent of 6 ft i.e. about 50% depth of Nalla. ⏩ Due to slums there was no approach road available for Nalla cleaning. ⏩ Defunct water pipes and utilities obstructing the flow is a common feature. ⏩ Inadequate capacity pipe culverts were observed instead of adequate box type culvert. ⏩ At many places Gr. + 4 structures with reva projections on bank of Nalla were found constructed on the retaining walls of Nallas. The situation is extremely serious resulting into irreversible and indeterminate for any solutions to maintaining the water course. This is due to negligence by local authority few years back. ⏩ At few places structures were found constructed in the Nalla itself reducing cross sectional area. ⏩ A major Nalla was found covered with RCC slab making it totally inaccessible for cleaning the water course. ⏩ Proper diversion and division of runoff could have avoided the water logging at low lying area near Bradma company. ⏩ At Road No. 28 junction (ITI Nalla) a

Sr. No.	IDENTIFICATION OF SPOTS			OBSERVATIONS
	NO	PRABHAG	LOCATION	
				wall of 18 pipes and utilities were found obstructing the flow. This obstructions in the steep portion of Nalla endangers the life of pedestrians during heavy rains every year ▸▸ Two water supply pipes, from over head reservoirs going through Nalla are obstructing flow of Nalla at Shrinagar. ▸▸ In these two Prabhags there is a severe problem of solid waste dumping in the water courses by slum dwellers and few others.
2.		MAJIWADA	❖ Bhayandar Pada ❖ Anand Nagar ❖ Ovala	▸▸ On the upstream, there is no obstruction and blockage of WC 15 up to Anantabaug (about 1 km.). However thereafter, there are structures of permanent nature constructed on Takarda Road, West side which have blocked totally the water course WC 15. ▸▸ This is a typical case wherein the local body has failed to maintain the water course in a developing area. This has affected the natural hydraulics of the WC 15 up to Ghodbundar Road. ▸▸ While the dimensions of WC 15 at Ghodbundar Road are about 15 ft width and 5 ft depth the box type culvert provided at the cross-drainage at Ghodbundar Road is about 10 ft wide and 5 ft deep, which is inadequate. ▸▸ This results in heavy water logging on Takarda Road. ▸▸ On the downstream of Ghodbundar Road, WC 15 travels and empties into

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

Sr. No.	IDENTIFICATION OF SPOTS			OBSERVATIONS
	NO	PRABHAG	LOCATION	
				open shrubs. ▸▸ The sullage from the developed areas on the upstream finds way in to Nalla and shrubs affecting the cultivable land and health of the people on the downstream, particularly because of the mosquito menace. ▸▸ The people residing downstream construct bunds to arrest the flow of water course containing sullage into their fields, thereby aggravating the problem of stagnated water and mosquito menace. ▸▸ This should be taken as an early warning for any future development, including fixing of development levels.
3.		MAJIWADA	❖ WADAVLI ❖ PATLIPADA NORTH	▸▸ WC 14 flows in the vicinity of these locations. ▸▸ On the upstream , near Suraj Water Park the slurry and dung from the cattle shed is let out in the Nalla (WC 14). ▸▸ While the Nalla is 20 ft wide, the cross-drainage is only 12 ft wide, which is very inadequate. ▸▸ The cross-drainage constructed perpendicular to the Ghodbundar Road, takes 90 degree turn on the downstream for further alignment which is incorrect. A skewed cross drainage alignment should have been thought of. ▸▸ On the downstream, WC 14 and WC 15 merge and are let out in the open shrub. There are no structures and development in this area as yet.

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

Sr. No.	IDENTIFICATION OF SPOTS			OBSERVATIONS
	NO	PRABHAG	LOCATION	
				▸▸ Pipe culvert with inadequate capacity across Ghodbundar Road near Hiranandani Estate Road resulting into water logging of 1 ft. or more on Ghodbundar Road as well as on Hiranandani Estate Road which is on the lower level. ▸▸ This flow is also affected due to utilities crossing the Nalla and hutment constructed within the Nalla itself. ▸▸ Beyond Hiranandani Estate, the water course has been let out in the open shrubs.

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Annex.-I-17 STUDY OF IDENTIFIED WATER-LOGGING SPOTS.

STUDY OF IDENTIFIED WATER - LOGGING SPOTS IN THANE MUNICIPAL CORPORATION AREA

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
1.	I (15)	UTHALSAR PRABHAG SAKET	1. Development levels of this area are mostly less than 3.5 mt., G.T.S. 2. Water logging of 6" during high tide & heavy rainfall. 3. The runoff from road side is let out in pipe drain at an invert lower than highest high tide.	1. Removal of silt. 2. Construction of embankment detention pond and gates.	1. Mangroves surrounding the site should be retained. 2. Proper design and implementation of development levels.	Policy for implemen-tation of stiputlated development levels.	Implem-enting program for disil-tation	Yes	No
2.	I (2)	UTHALSAR PRABHAG VRINDAVAN SOCIETY	1. Total area is below the highest high tide. 2. The developmental levels are extremely on lower side.	Construction of embankment detention pond and gates.	The mangroves have been destroyed during develop-ment. These should be restored.	-Do-	Nil	Yes	No

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
3.	I (1)	UTHALSAR PRABHAG SHRIRANG SOCIETY	**1.** Low lying area & extreme negligence by developer to bring development levels above high tide. **2.** Surrounded by two Nallas subjected to tidal back water during heavy rainfall.	**1.** Training of Nallas. **2.** Construction of embank-ment detention pond and gates	**1.** During develop-ment, mangroves have been totally destroyed which should be restored by plantation. **2.** Spreading aware-ness in the locality for proper disposal of solid waste.	-Do-	Nil	Yes	No
4.	I (20)	UTHALSAR PRABHAG K. VILLA	**1.** Inadequate cross section of near by Nalla **2.** Encroachment by slums in the water course.	**1.** Design and construction of Nalla. **2.** Rehabilitation of slums with new development levels.	Spreading awareness in the locality for proper disposal of solid waste.	Consider application of SRA / SRD	Implem-enting program for frequent disilting.	Yes	No

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
5.	I (21)	UTHALSAR PRABHAG RABODI, KOLIWADA & KRANTI NAGAR	**1.** Back water of high tide during rainfall. **2.** Low lying area & encroachment by slums. **3.** The compound wall of central jail has reduced cross section of Nalla. **4.** During high tide due to less carrying capacity & skew alignment, water spills out.	**1.** Straightening of Nalla. **2.** Redesign & training of Nalla. **3.** Rehabilitation of the entire slum area of Krantinagar.	Awareness in the locality for proper disposal of solid waste.	-Do-	Nil	No	Yes Entire low lying area with slums should be rehabilitated with new development levels. This appears to be very difficult.
6.	I (22)	UTHALSAR PRABHAG MAJIWADA VILLAGE	Same as Sr. No. 1, Identification No.I (15), SAKET.						

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
7.	II (6)	NAUPADA PRABHAG RAM MARUTI ROAD.	1. Saucer type low lying area with higher level of roads. 2. Low carrying capacity of Nalla 3. Encroachment by Hotel & school building. 4. Desilting becomes difficult because of encroachment 5. Water logging occurs for about 2 to 4 hours.	1. Re-alignment of Nalla along Ram Maruti Road. 2. Well designed submersible pumps may be installed for pumping.	Buildings to be converted into stilt on ground floor should be identified.	Suitable change in the development Rules & development plans should be made.	Frequent mannuald esilting.	Yes	No
8.	II (27)	NAUPADA PRABHAG BRAHMAN SOCIETY.	1. Proximity to railway tracks with inadequate capacity of railway culvert. 2. Desilting of culvert is not properly done. 3. 1 to 2 hours water logging occur.	1. Redesign & reconstruction of railway culvert. 2. Methodical desilting of railway culvert.	Nil	Imme-diate co-ordination at different levels with Railway authorities for implementtion	Nil	Yes	No.

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
9.	I (5)	NAUPADA PRABHAG KHARTAN ROAD	1. Subjected to high tide. 2. Cross drainage culvert inadequate. 3. Less carrying capacity of cross drainage & Nalla. 4. Encroachment hampering flow conditions.	1. Re-designing & reconstruction of cross drains. 2. Reconstruction and training of Nalla.	(1) Spreading awareness in the location for proper disposal of solid waste.	(1)Removal and rehabili-tation of encroa-chments.	Nil	Yes	No
10.	II (24)	NAUPADA PRABHAG KOPARI, DOWN SIDE	Inadequate capacity of railway culvert.	1. Well designed reconstruction of railway culvert. 2. Proper & methodical desilting of culvert.	Nil	Immediate co-ordination between TMC and Railway authorities at different levels for implement-tion.	Nil	Yes	No

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
11.	I (11)	KOPARI PRABHAG Koliwada, Thane (East), (Chendani)	1. Low level area. 2. Affected by back water of creek. 3. Water from railway tracks leading to Hariyali tank spreads in low lying area.	1. Training & widening of Nalla. 2. Straightening of Nalla from culvert to creek. 3. Possible pumping arrangement from tank.	No	No	No	Yes	No
12.	II (23)	KOPARI PRABHAG ANAND TALKIES.	1. Inadequate capacity of culvert. 2. Affected by water course WC 1 & WC 2. 3. Inadequate carrying capacity of Nalla. 4. Skewed alignment of Railway culvert & TMC Nalla.	Training & widening of Nalla with proper realignment.	1. Training people for not dumping solid waste into Nalla. 2. Readjustment of structure for enabling machine cleaning.	Co-ordination with Railway authorities should be improved.	Frequent cleaning to be resorted to	Yes	No

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
13.	II (61)	KOPARI PRABHAG ANAND NAGAR	**1.** Improper level of highway culvert. **2.** Affected by WC 1 & WC 2 with inadequate carrying capacity. **3.** Encroachment by slums	Training & widening and redesigning of culvert of BMC.	**1.** Training people for not using to water course for dumping of solid waste. **2.** Avoiding plastic menace.	Proper coordination with BMC.	-Do-	Yes	No
14.	II (29)	RAILADEVI PRABHAG ROAD NO. 21	The road side drains are not provided & designed.	Proper design with revised norms for roadside drains & implementation.	No	No	No	Yes	No
15.	II (30)	RAILADEVI PRABHAG ROAD NO. 34	**1.** Due to slums Nalla has been diverted. **2.** Inadequate carrying.	Training and straightening of Nalla	Training people not to use Nalla for dumping solid waste.	Consider application of SRA & SRD.	Frequen Manual cleaning of Nalla to be done.	Yes	No
16.	IV (31)	RAILADEVI PRABHAG TMT DEPOT.	SAME AS SR NO. 15.	-Do-	-Do-	-Do-	-Do-	Yes	No

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
17.	VI(44)	RAILADEVI PRABHAG RUPALI PADA.	1. Low lying area. 2. The drop between invert level of Nalla & incoming drain is not adequate. 3. Encroachment and utilities have reduced carrying capacity of Nalla. 4. Silting due to eroded material from hills.	Deepening of Nalla is necessary.	1. To avoid siltation & erosion grass cultivation in forest area is necessary. 2. The utilities affecting the flow should be suitable shifted.	1. Co-ordination with Forest Department 2. Co-ordination with utility organiztion.	Frequent manual removal of silt during monsoon	Yes	No
18.	II (40)	RAILADEVI PRABHAG CIVIL HOSPITAL & KAMGAR HOSPITAL	1. Proper cross drainage in the form of culvert is not constructed. 2. Pipe culvert wrongly provided improper invert level compared to Nalla invert level.	1. Design and implementation of crossdrainage system. 2. Redesign of pipe culvert with proper invert level and if required deepening of Nalla.	No	No	No	Yes	No

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
19.	V(42)	RAILADEVI PRABHAG INDIRA NAGAR.	1. Silting of Nalla due to soil erosion. 2. Solid waste is dumped by the people in the Nalla 3. Inadequate cross drainage and pipes.	Redesign and implementation of cross drainage system	1. Plantation in hilly areas to reduce erosion. 2. Awareness and training the people about proper disposal of solid waste.	1. Co-ordination with Forest authorities. 2. Consider application of SRA / SRD	Fre-quent removal of silt during monsoon	Yes	No
20.	VI (43)	RAILADEVI PRABHAG SATHE NAGAR	1. Affected due to development of slums e.g.Ajinkya Tara slums 2. The invert level of cross drainage and water course are reverse.	Deepening of Nalla is necessary.	Awareness & education to people regarding solid waste disposal.	Consider application of SRA/ SRD	Frequent manual cleaning of Nalla.	Yes	No
21.	II (28)	RAILADEVI PRABHAG BRADMA COMPANY	1. Inadequate capacity of culvert. 2. Flow affected due to utilities.	Redesign & implementation of culvert.	Utilities in the water course should be shifted.	The MSEB / MTNL etc. are not cooperating for rehabilitation of utilities, coordination and follow up	Nil	Yes	No

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
						is needed.			
22.	(67)	RAILADEVI PRABHAG AMBEWADI MARKET	**1.** Area is totally soucer like area. **2.** Difficult to remove the water.	To consider possibility of well designed pumping arrangement.	Nil	Nil	Nil	Yes	No
23.	(68)	RAILADEVI PRABHAG SAMARTH NAGAR	Inadequate capacity of culvert.	Remodification of culvert is necessary.	Nil	Nil	Frequent cleaning of culvert should be resorted to	Yes	No
24.	II (33)	WAGALE ESTATE PRABHAG TEEN HATH NAKA, MENTAL HOSPITAL	**1.** Affected due to nearness of Nalla WC 2. **2.** Road side drains are inadequate. **3.** Utilities are hampering the flow. **4.** Silting of Nalla.	Increase road side drain capacity.	Shifting of utilities.	Co-ordination with utility orgniza-tions	Frequent cleaning of road side drains and Nallas should be done.	Yes	No

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
25.	II(34)	WAGALE ESTATE PRABHAG RAGHUNATH NAGAR.	1. Low lying area. 2. Affected due to encroachment by slums. 3. Unauthorized construction has reduced carrying capacity resulting in narrowing in the Nalla 4. Affected due to water course WC 2.	Carrying capacity of Nalla is to redesigned & increased.	Educating people about solid waste disposal	Appl-ication of SRA/SRD	Frequent desilting of Nalla	Yes	No
26.	II(36)	WAGALE ESTATE PRABHAG SBI CIRCLE WITH RAOD NO. 22.	1. Affected due to water course WC 2. 2. Flow affected due to utilities. 3. Soil erosion from hills results silting.	Permanent arrangement for arresting erosion of soil & boulders should made.	1. Planting of trees on hills. 2. Removal of utilities.	1. Co-ordination with Forest Department officials 2. Coordination with utilities organization	Freq-uent desilting during monsoon	Yes	No

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
27.	IV(53)	VARTAK NAGAR PRABHAG MANPADA SOUTH	1. Inadequate capacity of culvert. 2. Nalla having narrow width on down stream result back water.	Redesign and implementation of both, culvert and Nalla	Nil	Nil	Frequent desilting during monsoon	Yes	No
28.	IV (62)	VARTAK NAGAR PRABHAG VASANT VIHAR CIRCLE	1. Inadequate width of Nalla. 2. Erosion of soil and boulders from hills affect the flow.	1. Redesign and implementation of both, culvert and Nalla 2. Consider coverage of slopes of hills by geo-fabrics to arrest flow of boulders.	Planting of trees on hills	Co-ordination with Forest Authorities.	Frequent desilting during Monsoon	Yes	No
29.	II(32)	VARTAK NAGAR PRABHAG MAJIWADA	Solid waste dumping in the Nalla by surrounding slum locality.	Nil	Educating people about solid waste disposal	Appli-cation of SRA/SRD	Frequent desilting	Yes	No

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
30.	IV(45)	VARTAK NAGAR PRABHAG MAHATMA PHULE NAGAR.	1. Low lying area. 2. Inadequate capacity due to encroachment affecting width of Nalla. 3. Slum area & solid waste disposal create problems in smooth flow.	Training & redesigning of Nalla	Training people not to dump solid waste in the Nalla.	Consi-der appli-cation ofSRA / SRD	Frequent desilting of Nalla.	Yes	No
31.	II(63)	VARTAK NAGAR PRABHAG HARIDAS NAGAR.	1. Low lying area. 2. Solid waste dumped by people in slum area.	--- Do ---	--- Do ---	--- Do ---	--- Do ---	Yes	No
32.	II(64)	VARTAK NAGAR PRABHAG RUNWAL JUNCTION	1. Improper capacity of culvert. 2. Alignment of Nalla is skew.	Redesigning of cross drainage and straightening of Nalla.	Nil	Nil	Nil	Yes	No

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
		KORAS ROAD.							
33.	III (65)	VARTAK NGR. PRABHAG SAMBHAJI NAGAR.	1. Low lying area. 2. Solid waste dumping by people in slum.	Training & redesigning of Nalla	Training people not to dump solid waste in the water course.	Appli-cation of SRA/SRD to be considered	Frequent desilting of Nalla	Yes	No
34.	II (66)	VARTAK NGR. PRABHAG NALPADA	1. Low lying area. 2. Solid waste dumping by people in slum.	-----Do----	-----Do----	-----Do----	-----Do----	Yes	No
35.	IV(59)	MAJIWADA PRABHAG BHAYANDAR PADA	1. Inadequate cross drainage. 2. Upstream of Ghodbundar road Nalla affected by structures of permanent nature on the Nalla.	1. Removal of structures in the Nalla & training of Nalla 2. On down stream redesigning & training of Nalla up to the creek even in the marshy land.	1. Since untreated sullage flowing in the Nalla & spread out in the open shrubs affected ultivable land, compel the occupants of highrise building to treat the waste water to minimum standard &/or reuse it within their compound, till regular sewerage system is provided by TMC.	Downstream of Ghodbundar Road, design development levels with conditions for layout to be enforced on the developers. This would arrest any further damage in the locality	Freq-uent desilt-ing of cross drain-age and Nalla.	Yes	No

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
					2. Removal of utilities.				
36.	IV (57)	MAJIWADA PRABHAG ANAND NAGAR	1. Inadequate cross drainage 2. Affected due to slum area 3. Eroded material cause silting. 4. Solid waste dumping by surrounding people. 5. Affected flow due to utilities. 6. Upstream affected due to permanent structures on the Nalla.	As above	1. As above. 2. As above. 3. Training people about solid waste disposal	-----Do----	-----Do----	Yes	No
37.	IV (58)	MAJIWADA PRABHAG OWALA	1. Inadequate cross drainage. 2. Upstream affected due	As above	As above	----Do---	----Do---	Yes	No

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
			to permanent structures on Nalla.						
38.	IV (56)	MAJIWADA PRABHAG VADAVALI	**1.** Inadequate side gutter on roads. **2.** Eroded material from Takardapada road block the water course & side drains. **3.** Inadequate cross drainage	**1.** Additional road side drains with increased capacity should be constructed **2.** Redesigning of cross drainage **3.** Training of Nalla up to creek .	As indicated against Sr. No.37	As above	Frequent desilting of cross drainage & Nalla	Yes	No
39.	II (54)	MAJIWADA PRABHAG PATLIPADA NORTH HIRANANDANI ROAD	**1.** Blockage of cross drainage **2.** Low lying area as compare to Ghodbundar Road. **3.** Collapse of compound wall block the drains.	As above	As above	As above	As above	Yes	No

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
			4. Silting of cross drain.						
40.	II (55)	MAJIWADA PRABHAG BOMBAY CHEMICAL, BRAHMAN COMPLEX ROAD to DEEPNAGAR	1. Low lying area. 2. No outlet for easy discharge of runoff.	Well designed pumping arrangement may be considered	Nil	Nil	Nil	Yes	Nil
41.	II (69)	MUMBRA & DIWA PRABHAG RASHID COMPOUND	1. Low lying area. 2. Developmental levels are wrong	Storm water drain under construction should be completed.	Nil	Design enforce proper development levels	Nil	Yes	No
42.	I (70)	MUMBRA & DIWA PRABHAG INSHA NAGAR	1. Low lying area. 2. Development levels are wrong. 3. Moderately subjected to high tide levels. 4. Cross drainage on by pass highway under	Rechecking & redesigning of cross drainage of by pass Highway	Nil	1. Co-ordination between PWD & TMC. 2. Enforcement of development levels	Nil	Yes	No

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
			construction is not properly designed.						
43.	I (9)	KALWA PRABHAG SHASTRI NAGAR	**1.** Subjected to high tide conditions. **2.** People from slum dumps solid waste in the Nalla.	Construction of gate with detention ponds	Training people not to dump solid waste into Nalla	Consider Application of SRA/SRD	Frequent cleaning of Nalla.	Yes	No
44.	II (7)	KALWA PRABHAG MANISHA NAGAR	**1.** Low lying area. **2.** Subjected to moderate water logging to some extent.	Well designed pumping arrangement to be considered.	Nil	Nil	Nil	Yes	No
45.	V (49)	KALWA PRABHAG BHIMNAGAR	**1.** Subjected to high tide conditions. **2.** People from slum area dump solid waste in Nalla	Consider construction of gates with detention ponds	Training people not to dump solid waste into water course	Consider SRA/SRD application.	Frequent cleaning of Nalla	Yes	No
46.	II (71)	KALWA PRABHAG NEW SHIWAJI NAGAR	**1.** Railway culvert is inadequate. **2.** Silting due to erosion	**1.** Widening of railway culvert. **2.** Consider covering slopes	Nil	**1.** Co-ordination with railway authorities. **2.** Co-ordination	Frequent cleaning of Nalla	Yes	No

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
		KALWA (EAST)	from hills.	of hills by geofabrics.		with Forest Dept.			
47.	II (72)	KALWA PRABHAG KHAREGAON BUDHAJI PATIL MARG.	**1.** Inadequate capacity of Nalla. **2.** Due to Erosion from hills silting of Nalla.	Widening & deepening of Nalla.	Planting of trees on slopes of hills	Co-ordination with Forest Dept.	Frequent cleaning of Nalla.	Yes	No
48.	II (73)	KALWA PRABHAG 'C' ROCK BUILDING	Subjected to high tide conditions.	**1.** Training of Nalla should be carried out. **2.** Construction of gates with detention pond	Nil	Nil	Nil	Yes	No
49.	III (74)	KALWA PRABHAG VITAVA BRIDGE	**1.** Low lying area. **2.** Accumulation of silt on the road. **3.** Existing bridge below high tide level appears	Construction of new bridge	Nil	Co-ordination with MSRDC	Nil	Yes	No

ANNEXURE – I : DETAILS OF SURVEYS, VISITS, INTERVIEWS AND OTHER BACKUP

SR. NO	IDENTIF-ICATION NO.	LOCATION & PRABHAG	CAUSES OF WATER LOGGING	ENGINEE-RING SOLUTION	EMP MAIN PARAMETERS FOR MITIGATION	DECISIONS REQUIRED		NATURE OF SOLUTION	
						MACRO (POLICY)	MICRO	DETERMI-NATION	NON-DETERM-INATIVE
			to be low level causeway.						
50.	I (75)	KALWA & DIWA PRABHAG DIWA PATIVALI & OTHER AREAS.	**1.** All unauthorised construction without consideration to development levels will cause flooding in this area in near future. **2.** No regards to CR2 regulations.	Nil	Nil	Enforcement of development levels & DC regulation on priority basis.	Nil	Yes	No

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Annex.-I-18 DELUGE OF JULY'05 IN THANE CITY.

DELUGE OF JULY 2005 IN THANE CITY AS THE STARTING POINT

- A "Never before in the History" situation arose, not only in Thane City, but in Mumbai, as also, the entire Konkan Region.
- There was a continuous rainfall with the intensity of ____ for more than three days starting from 25th to 27th July 2005.
- This resulted in flooding and water logging almost through entire Konkan Region, more particularly throughout the catchment area of Ulhas River.
- All major towns across the banks of Ulhas River, such as, Badlapur, Ambernath, Ulhasnagar, Kalyan, Dombivali and Thane were cut off from each other and from rest of the parts of the country for a prolonged period.
- Train and road traffic was totally disrupted.
- There were a number of continuous spells of absence of power.
- Even the communication systems, such as, telephone and mobile services failed.
- Number of parts of twin cities of Thane and Mumbai were inundaneted.
- There was a huge loss of human lives, cattle, industrial production, destruction of wealth, houses, domestic articles, etc.

HARIYALI, an Organization which is active in the field of environmental protection and upgradation felt the need to undertake a Survey of the said Deluge, so as to find out peoples' perception about the nature, causes, effects and preventive measures for such situation occurring in futures, as also, for restricting the human and monetary loss arising because of the same in future.

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Annex.-I-19 PEOPLE'S PERCEPTIONS ON DELUGE OF JUL'05.

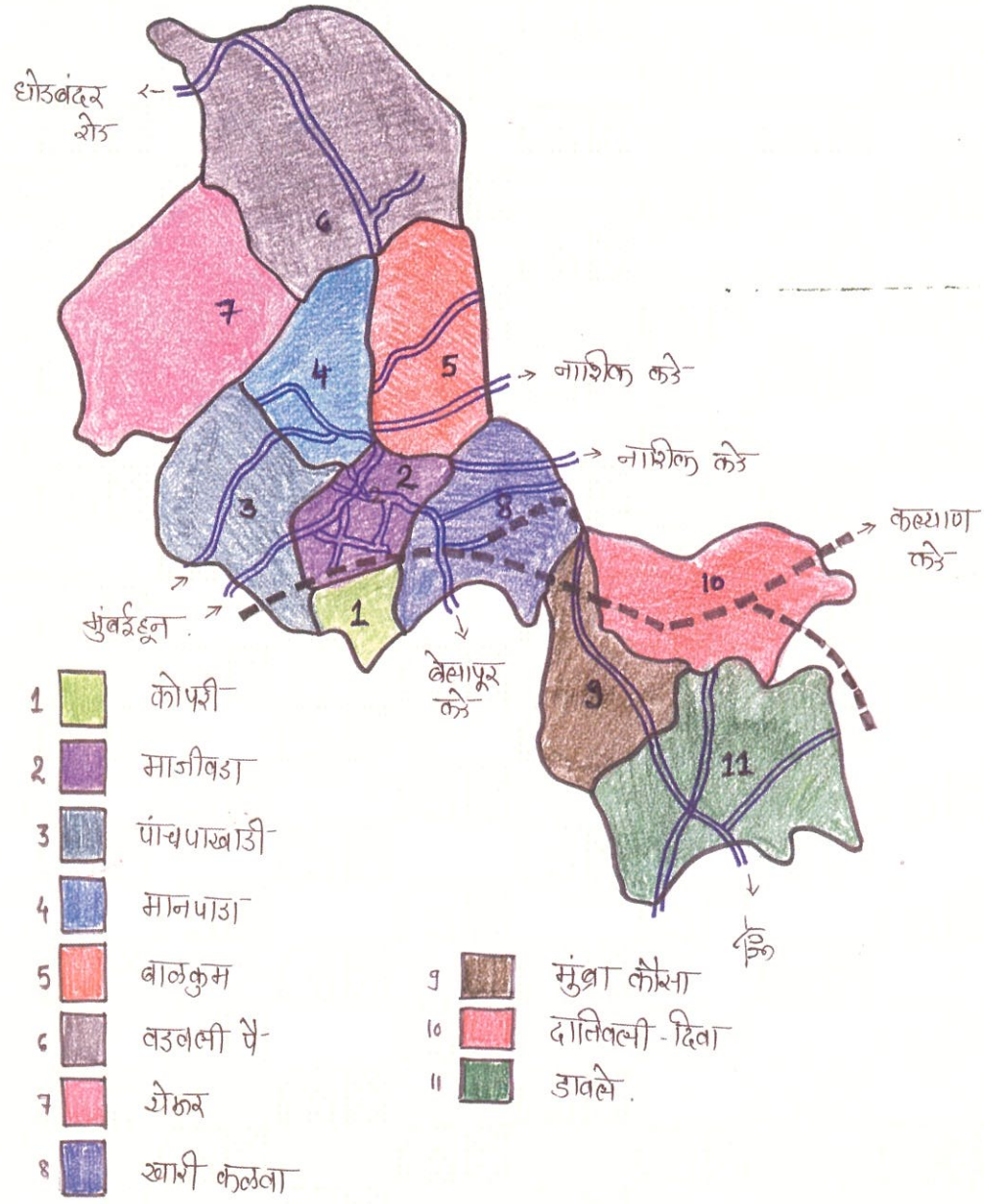
SURVEY OF DELUGE IN JULY 2005 IN THANE CITY
- HIGHLIGHTS -

- 8,274 persons (representing as many families) residing in Thane were interviewed over a period of two months of November & December 2005.
- More than 800 enumerators worked on the project.
- Most of the enumerators were volunteers from N.S.S. Units of nine participating colleges associated with Hariyali's environmental activities.
- The enumerators were sent to the field for taking interviews with necessary training and instructions.
- Work of the Enumerators was supervised by a number of Moderators who were mostly Professors in charge of the N.S.S. units of the respective participating colleges, belonging to various disciplines, and activists of Hariyali from various walks of life.
- People who were interviewed included working population, senior citizens, students, males and females coming from different walks of life and social status.
- Interviews were taken of people from the areas, which were affected, as also not affected much by the Deluge.
- Observations revealed by the Survey were cross-checked and verified by personal visits of the members of Experts Committee of Hariyali to and inspection of various water bodies and water courses comprising of a number of Nallas starting from adjoining mountain ranges and flowing through Thane City right upto the adjoining Thane and Ulhas Creeks.
- Contents of the Response Sheets collected by the Enumerators were fed to the computers for processing by a specially designed software.
- Graphical presentation of the results of the Survey comprised in a separate Report.
- The said Report entitled "Survey Report of Deluge of July 2005 in Thane City – Nature, Causes, Effects and Preventive Measures" is enclosed as Annexure I.

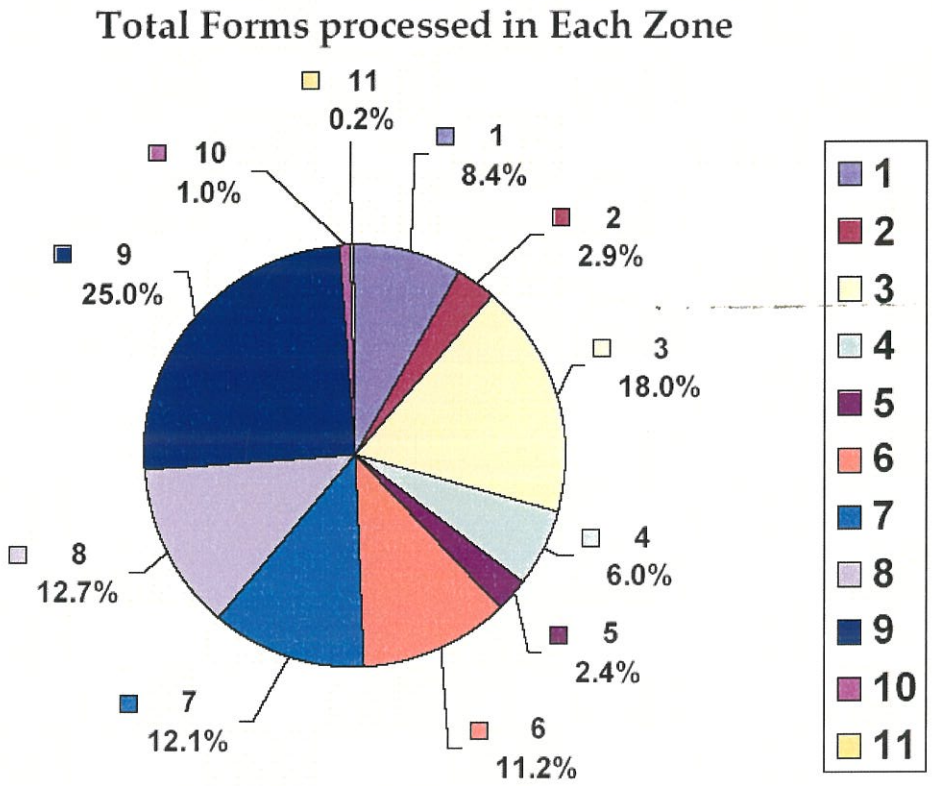
The Report is the testimony of Hariyali's "Peoples Participatory Approach" in understanding and tackling our social and environmental problems, and as such, is unique in that respect.

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Annex.-I-20 ZONAL MAP OF THANE CITY



Annex.-I-21 TOTAL FORMS PROCESSED IN EACH ZONE.



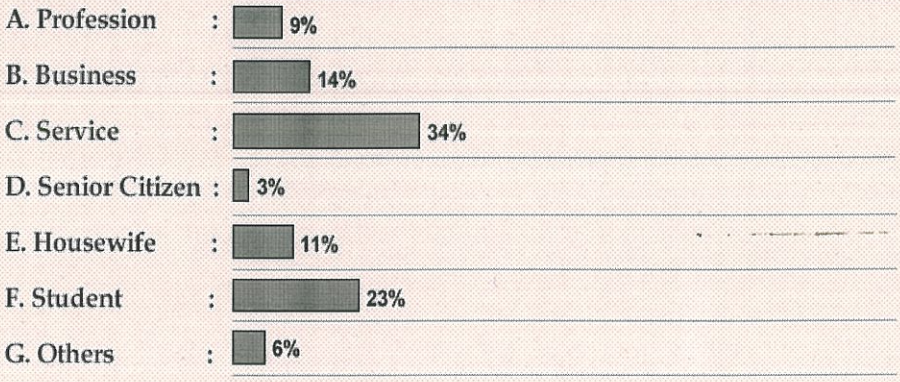
Note : 1. Total number of respondents : 8274.
2. Zonal map of Thane City and the names of participating colleges are given on page no.11 and 12 of the report.

1	Kopari	7	Yeour
2	Majiwada	8	Khari Kalawa
3	Panchapakhadi	9	Mumbra - Kausa
4	Manpada	10	Dativali - Diva
5	Blkumbh	11	Others
6	Vadvali Pai		

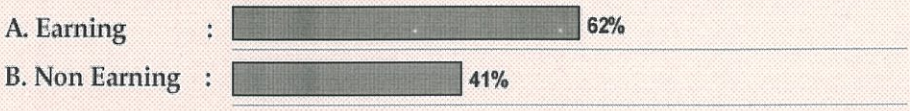
Annex.-I-22 REPORT ON SURVEY OF DELUGE OF JUL '05 IN THANE

Chapter I : Preliminary Information :

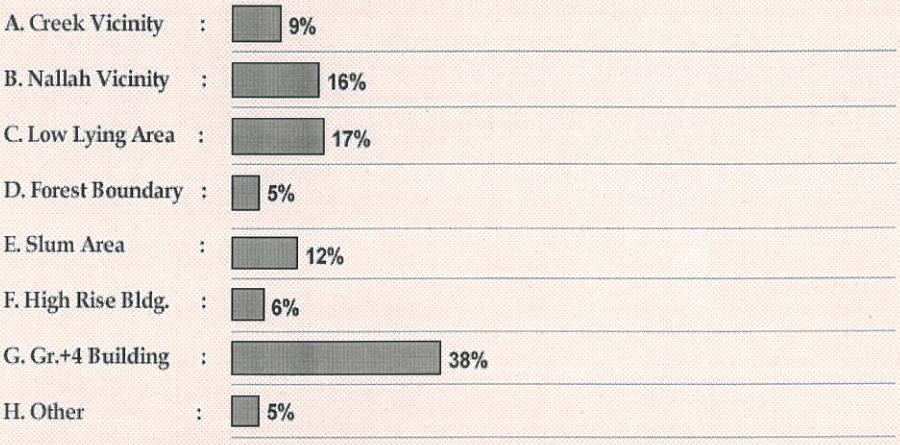
Q. 1. Occupation



Q. 2. Number of Members in the Family :

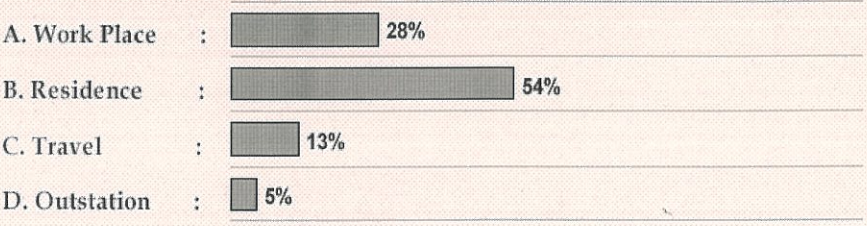


Q. 3. Status of the Residential Locality :

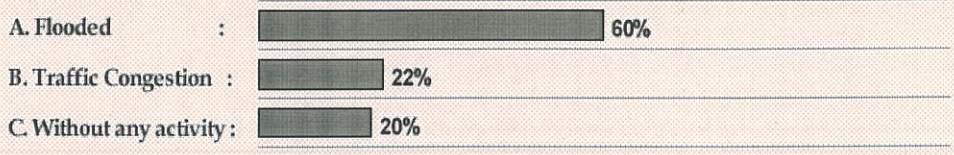


Chapter II : Nature of Deluge in your Locality

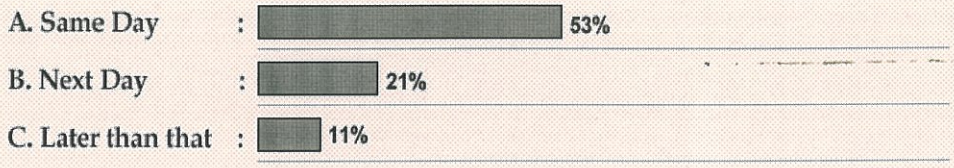
Q. 1. Where were you physically located on the day of the Deluge?



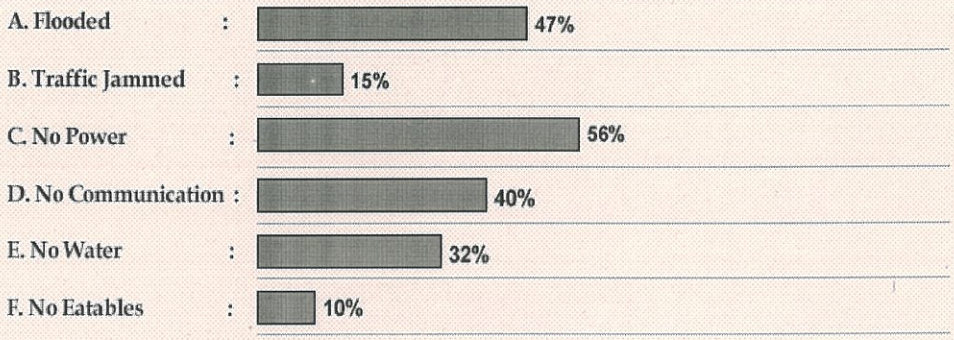
Q. 2. What was the status of the Locality of your physical presence?



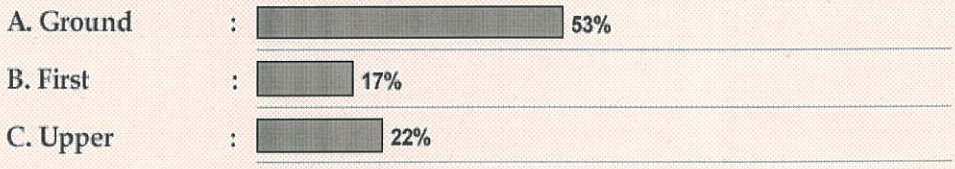
Q. 3. When could you reach your residence, if away from it ?



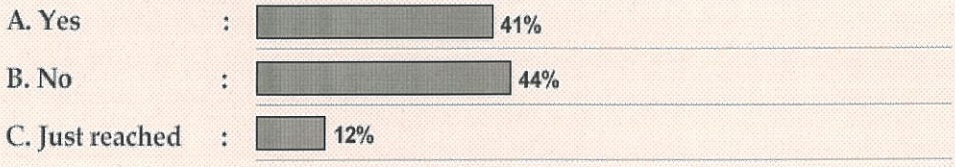
Q. 4. How was the locality of your residence affected by the Deluge ?



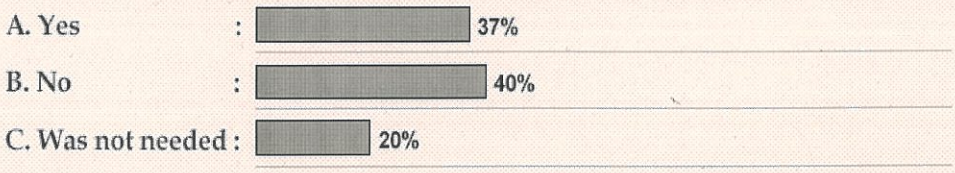
Q. 5. What Floor of the Building do you stay on ?



Q. 6. Did the water enter your residence ?

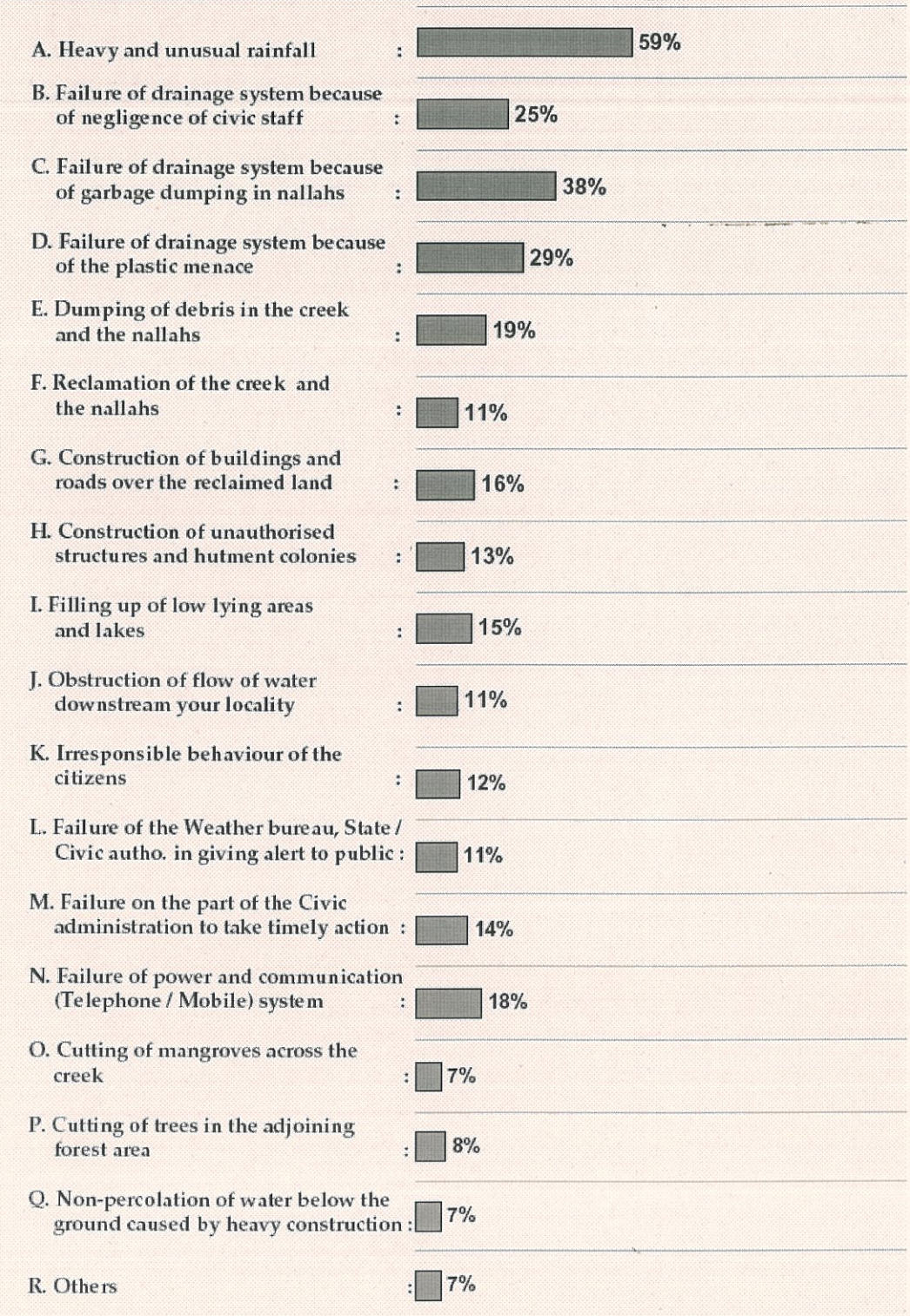


Q. 7. Was any rescue/help operation visible in the area or your residence ?



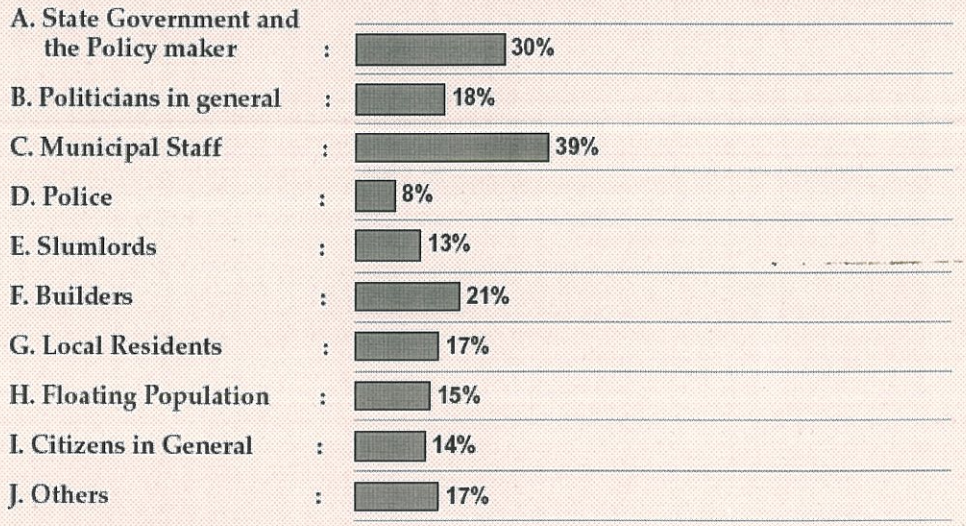
Chapter III : Causes of the Deluge :

Q. What in your opinion was/were the cause/s of the Deluge ?



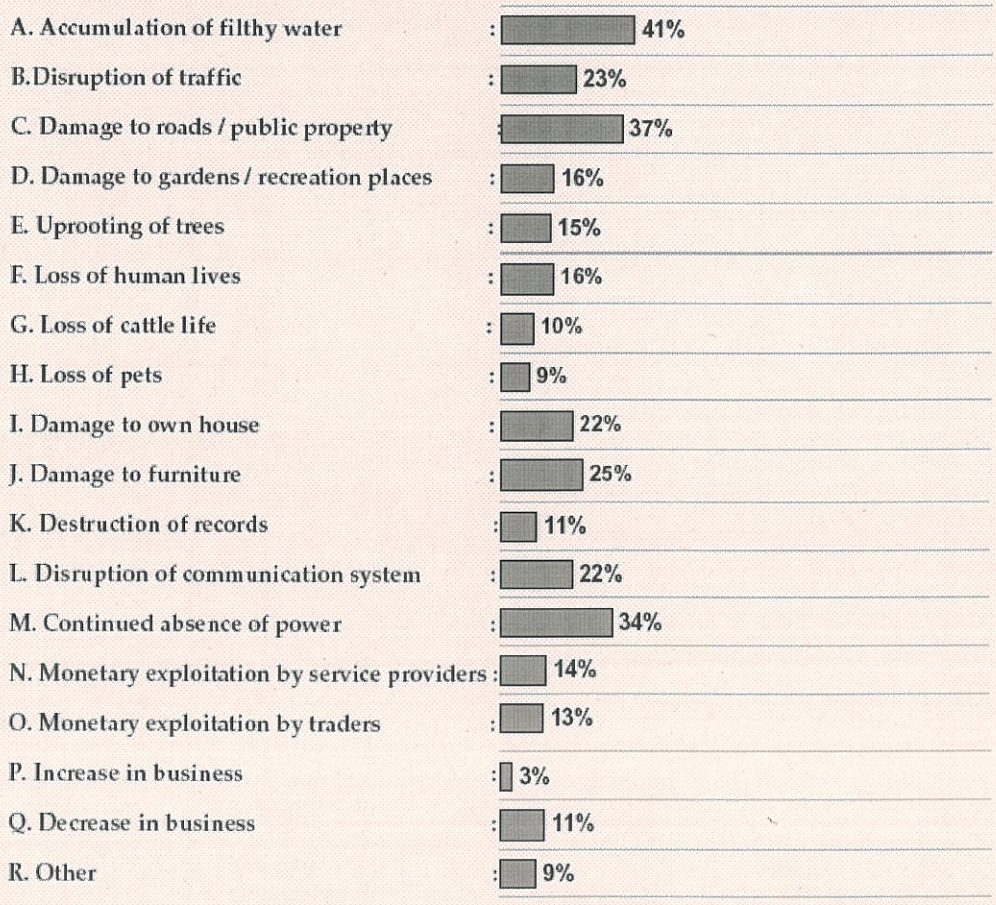
Chapter IV :

Q. Who do you think was mainly responsible for the above mentioned cause ?

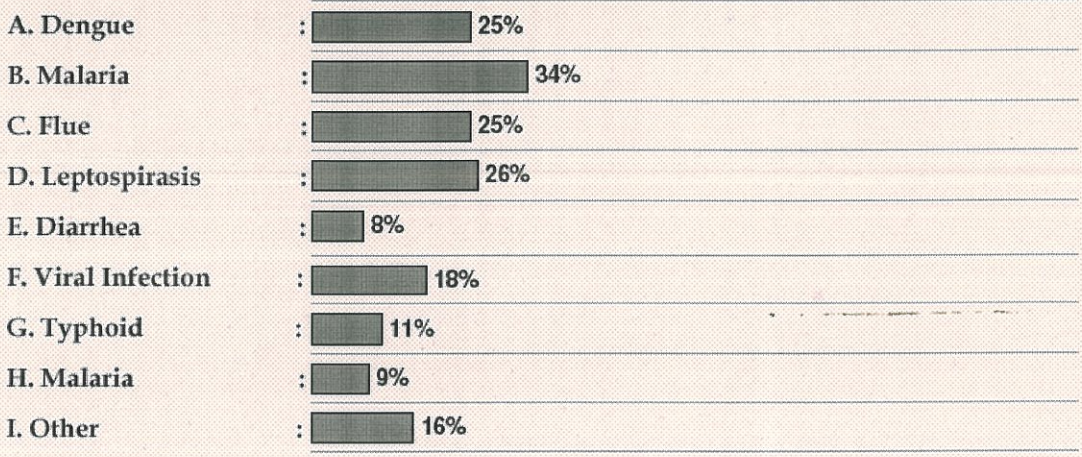


Chapter V : Effects of Deluge :

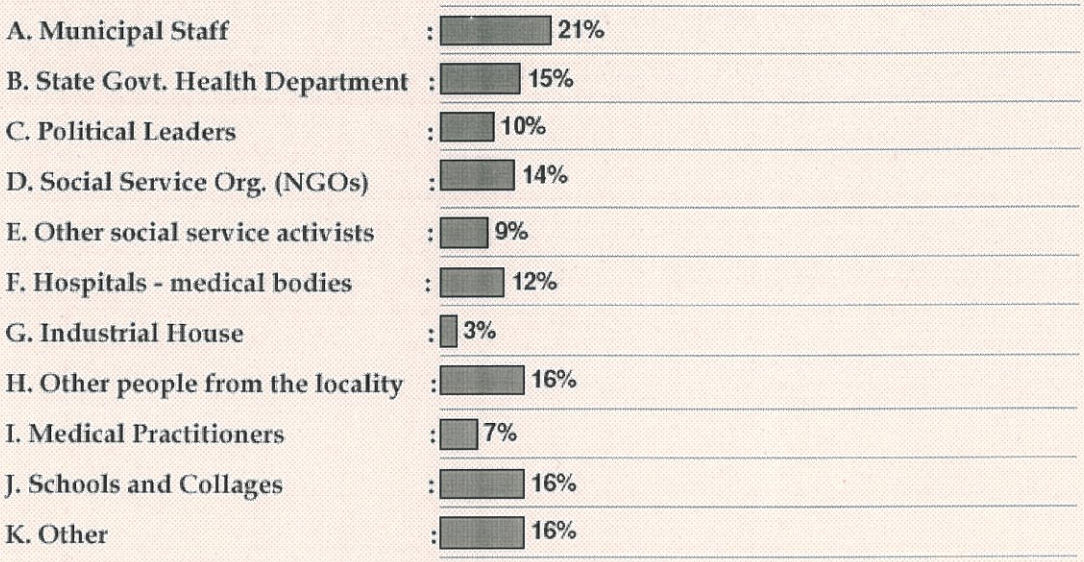
Q.1. Which of the following effects did you notice in your locality because of the Deluge?



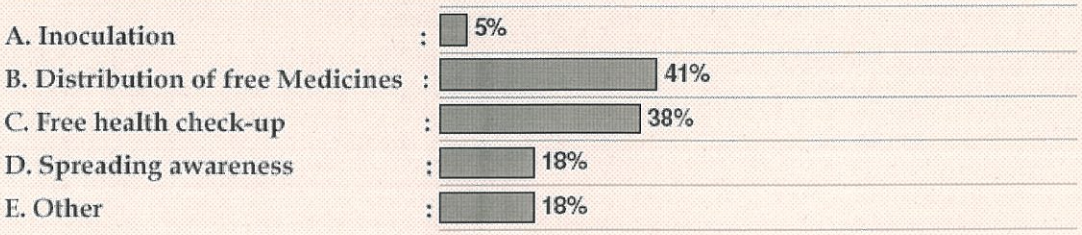
Q.2. Did you notice spreading of any epidemic diseases ?



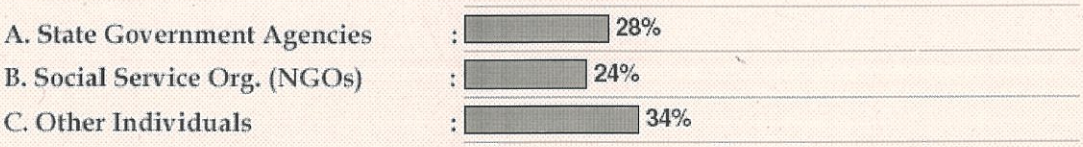
Q.3. Did you notice any medicinal help being offered by any of the following bodies to the affected people ?



Q.4. If yes, what was the nature of help ?



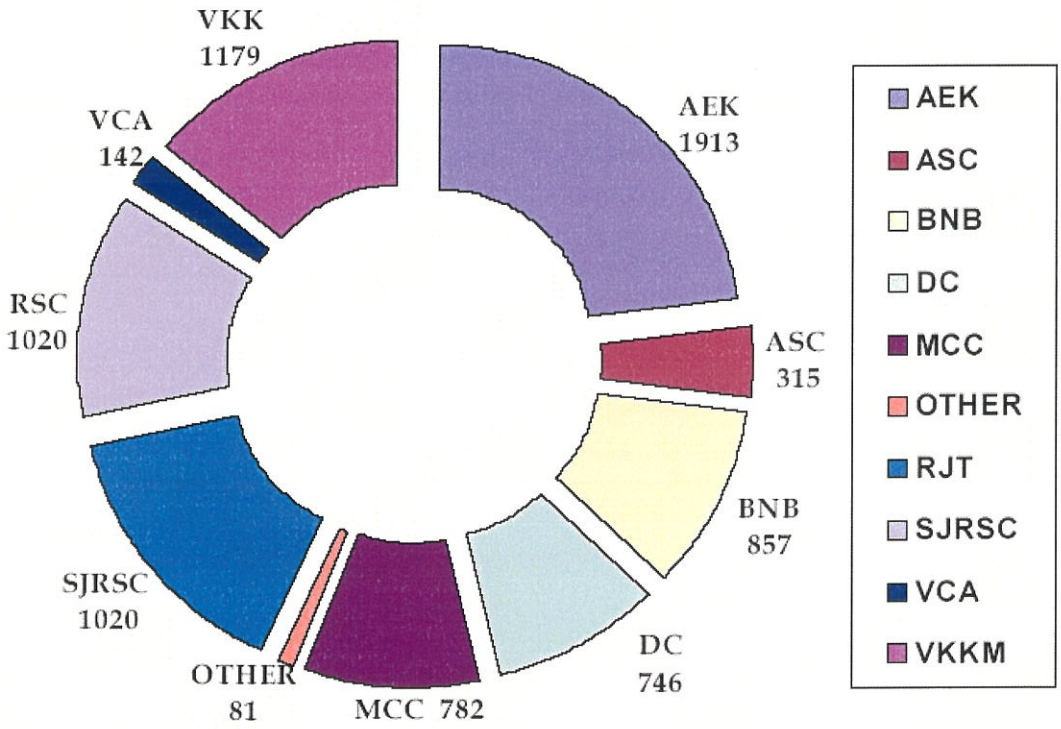
Q.5. Have you noticed monetary help being offered by ?



Annex.-I-23 CONSOLIDATED REPORT ON SURVEY OF DELUGE OF JULY '05 IN THANE CITY

CONSOLIDATED REPORT ON SURVEY OF DELUGE OF JULY 2005 IN THANE CITY

Total Forms Processed by each College

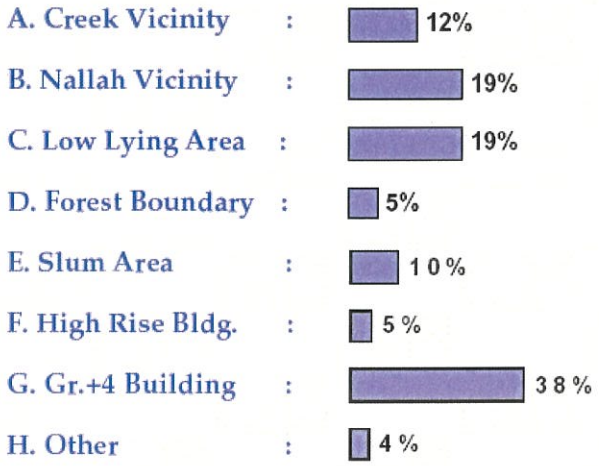


Annex.-I-24 LIST OF PARTICIPATING COLLEGES.

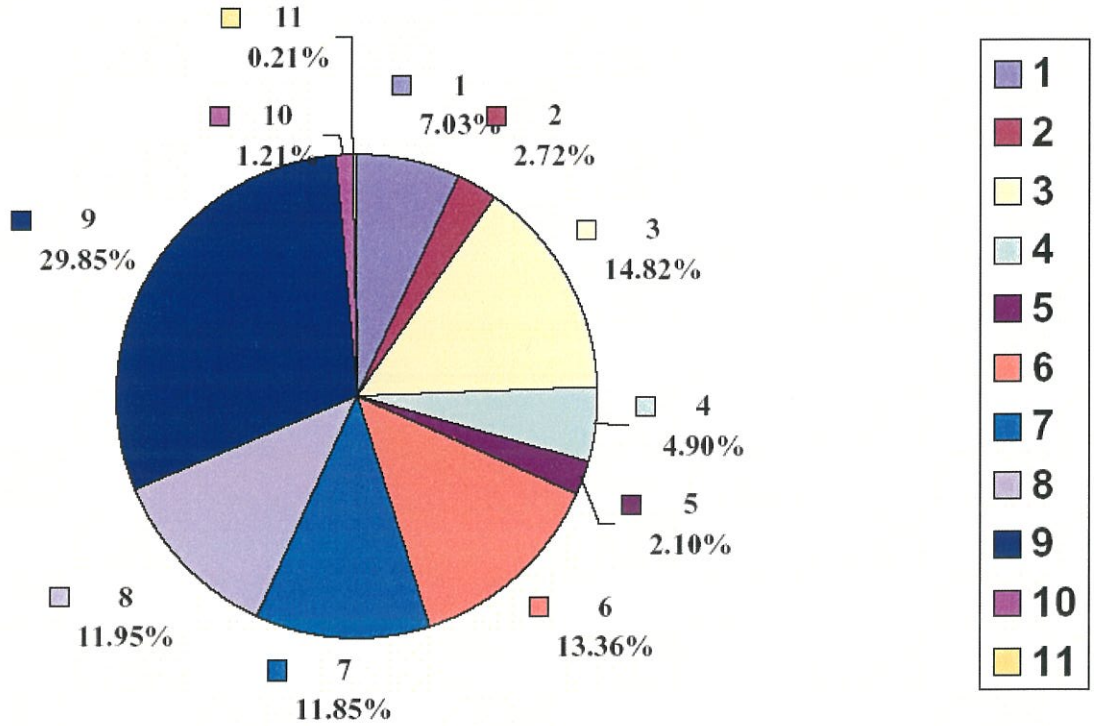
AEK	A.E. Kalsekar Degree College of Arts, Commerce & Science, Mumbra.
ASC	N.C.C. Girls Unit, Bandodkar College of Science.
BNB	B.N. Bandodkar College of Science, Mulund.
DC	Dnyansadhana College of Arts, Science & Commerce, Thane.
MCC	Mulund College of Commerce, Mulund.
RJT	R.J. Thakur College of Arts & Commerce, Thane
SJRSC	S.J.R. Salvi College of Arts, Commerce & Science, Kalwa.
VCA	V.G. Vaze College of Arts, Science & Commercem Mulund.
VKKM	V.K.K. Menon College of Arts, Science & Commerce, Bhandup
OTHER	Others.

Annex.-I-25 FLOOD SUSCEPTIBILITY LOCATIONS & ZONES.

1. Flood Susceptible Locations

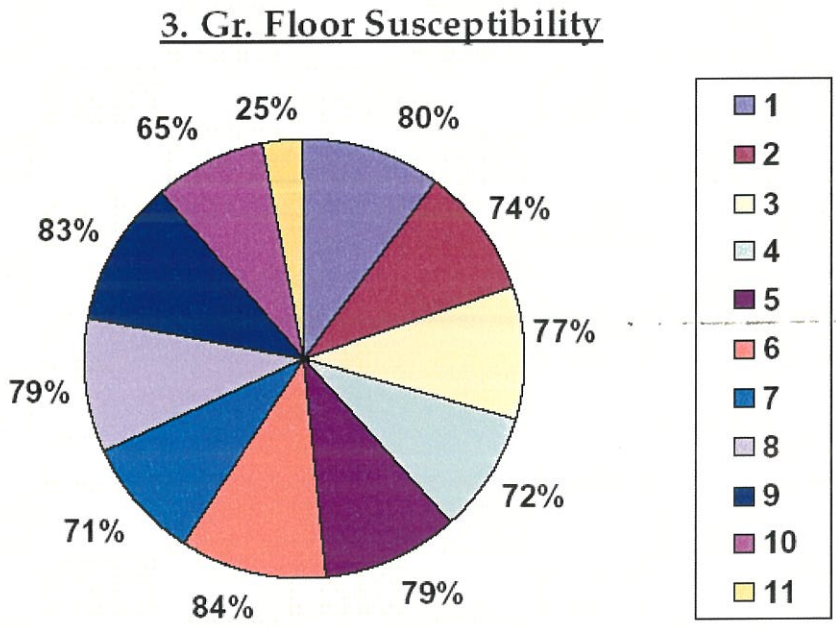


2. Flood Susceptible Zones

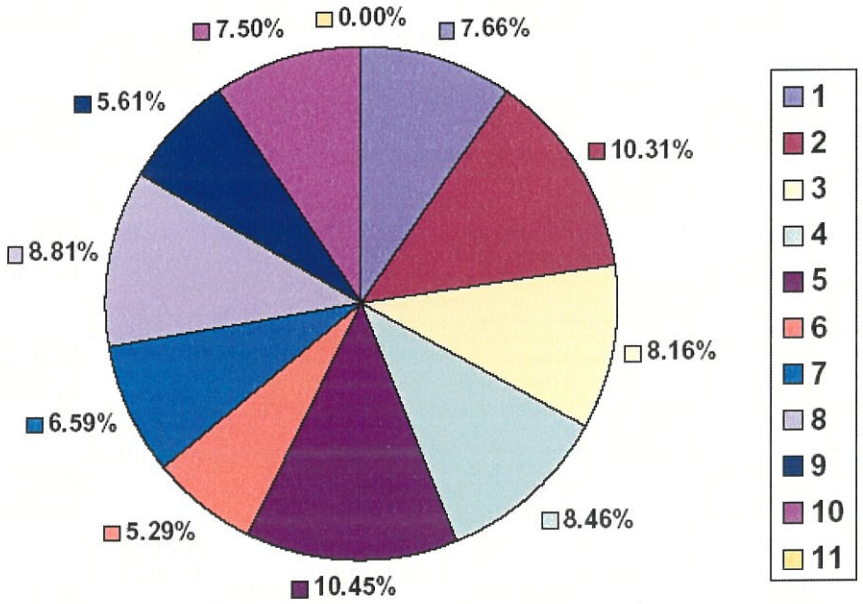


Note : Total number of respondents : 8274.

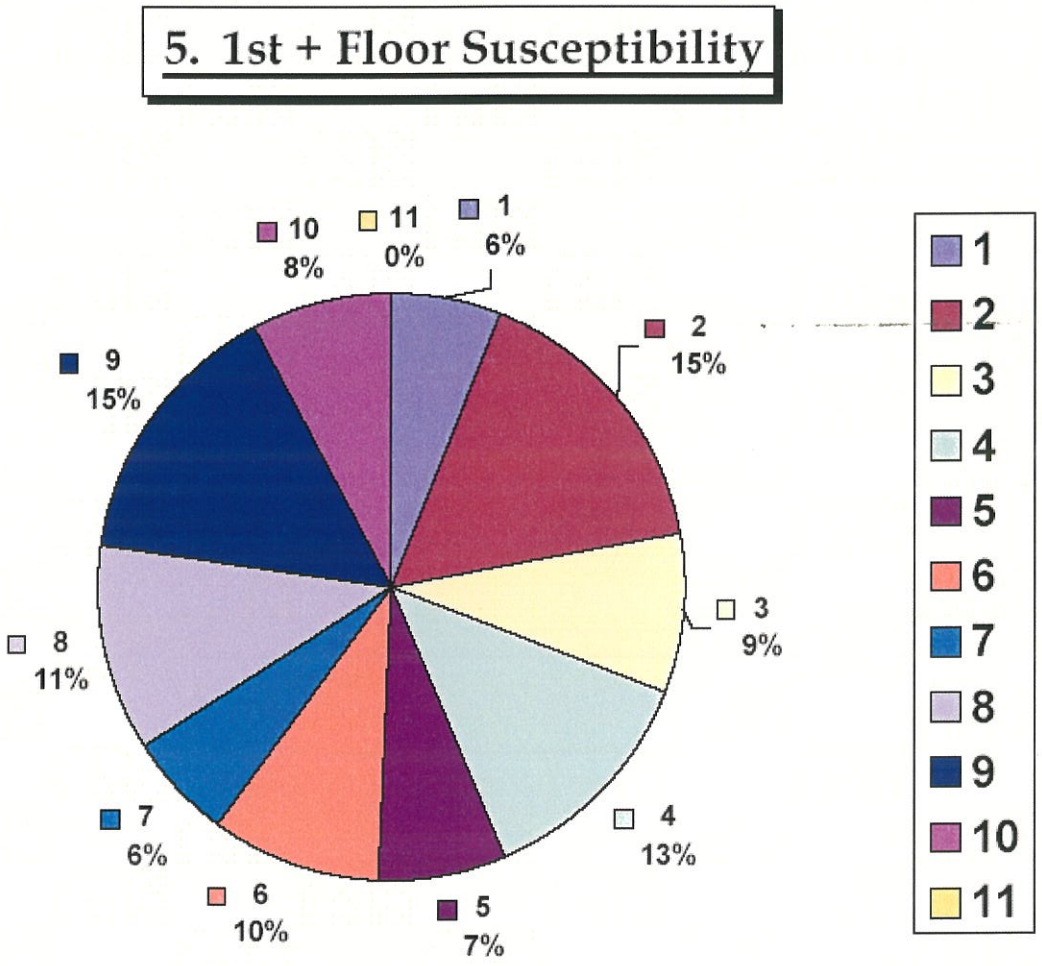
Annex.-I-26 GR. FLOOR SUSCEPTIBILITY.



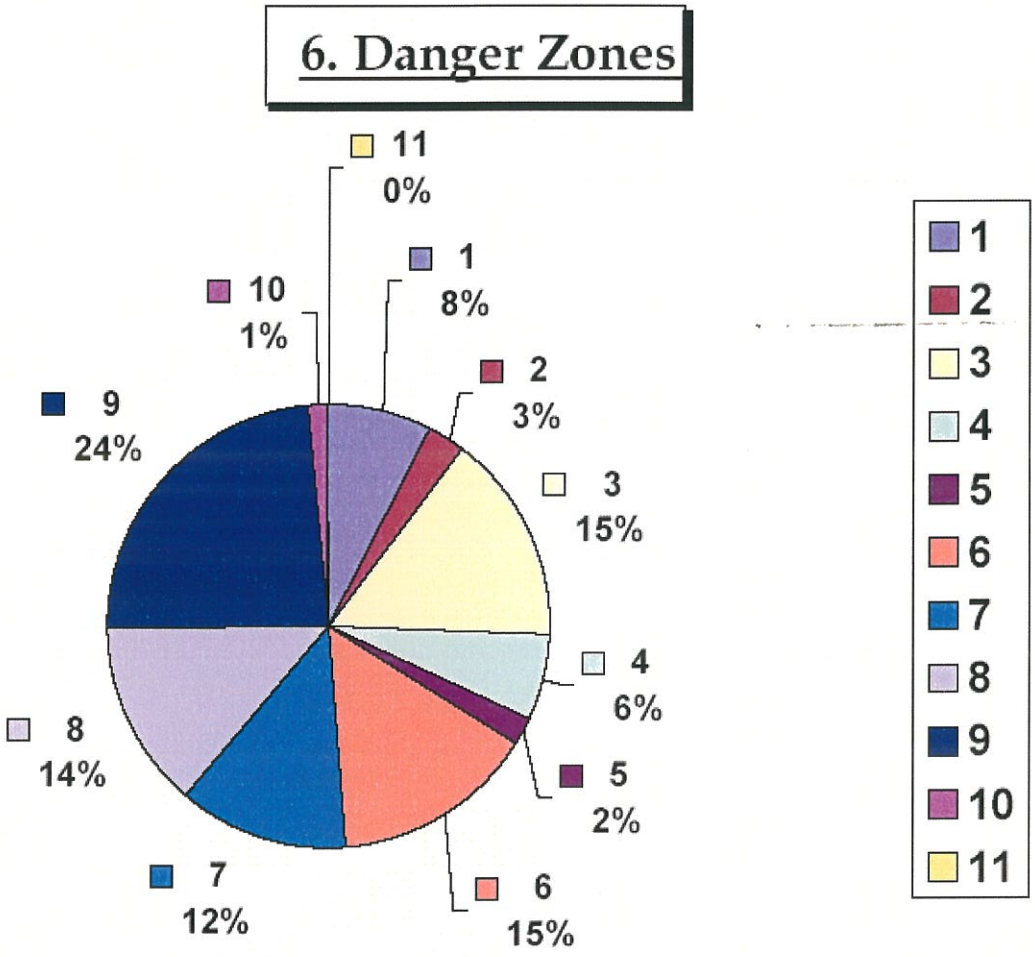
Annex.-I-27 1ST FLOOR SUSCEPTIBILITY.



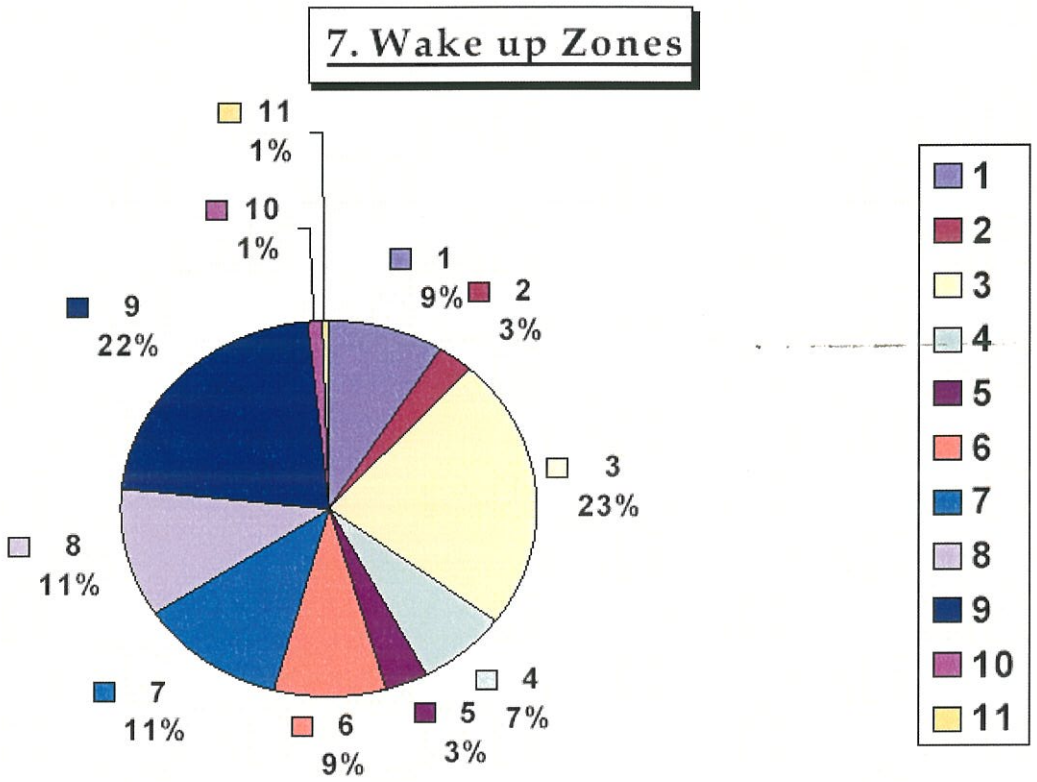
Annex.-I-28 1ST + FLOOR SUSCEPTIBILITY.



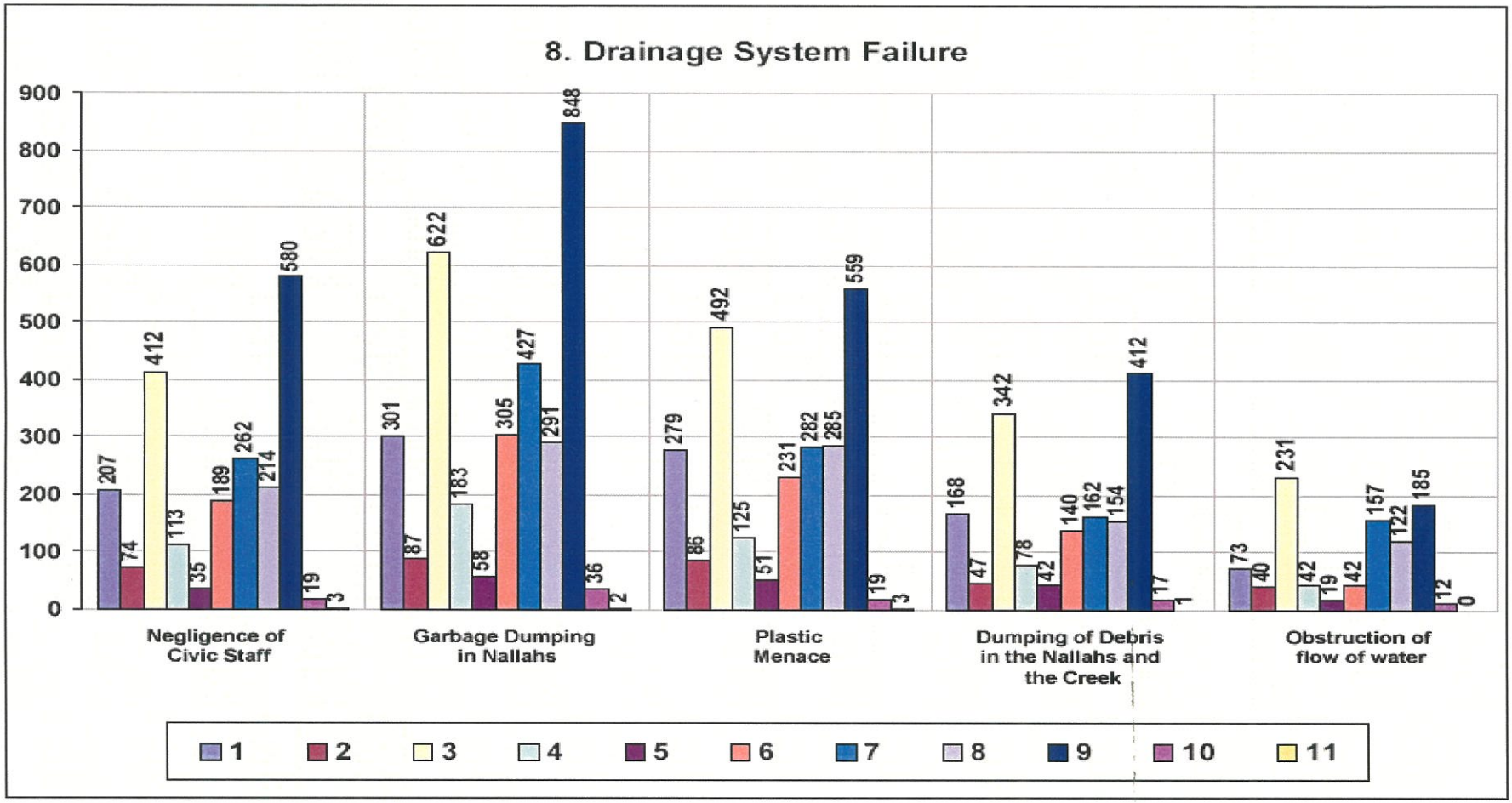
Annex.-I-29 DANGER ZONES.



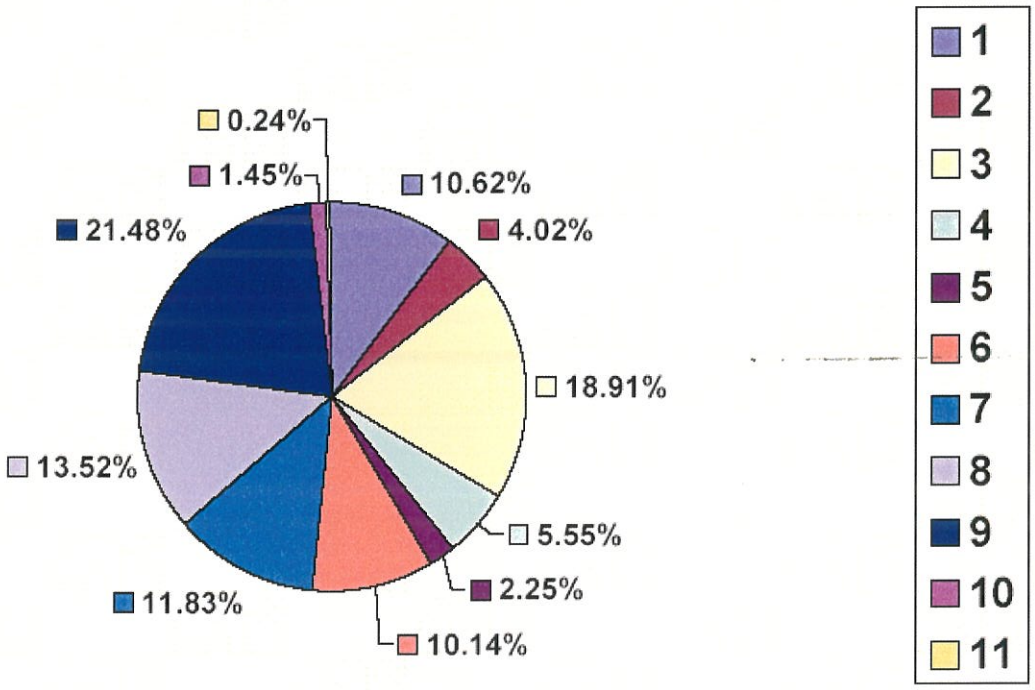
Annex.-I-30 WAKE UP ZONES.



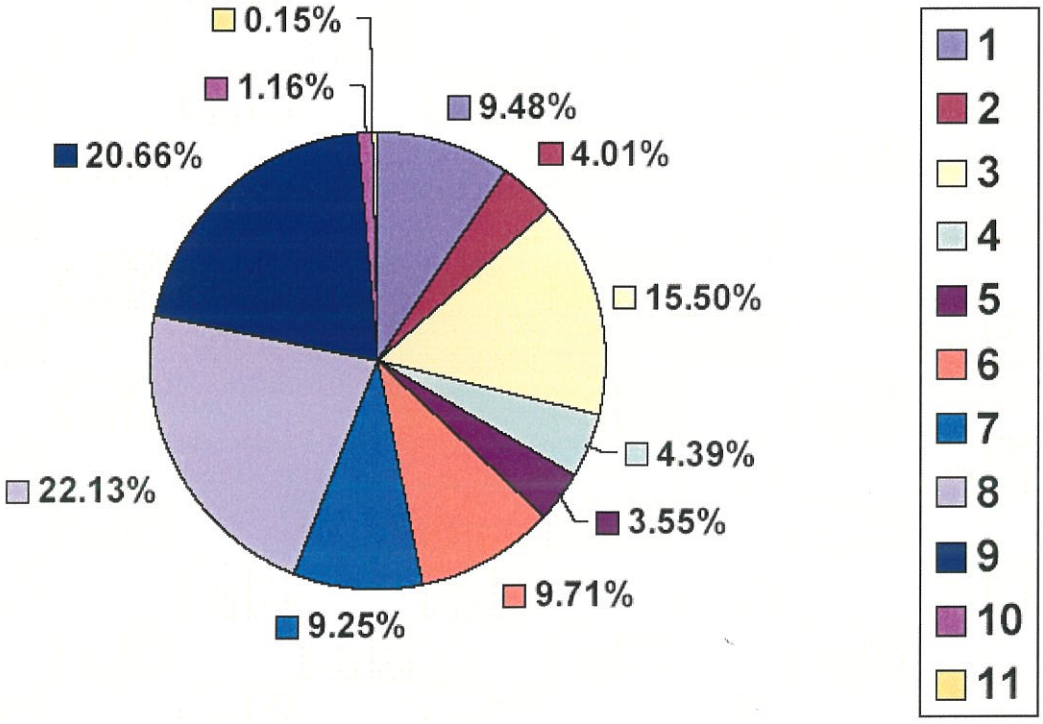
Annex.-I-31 DRAINAGE SYSTEM FAILURE



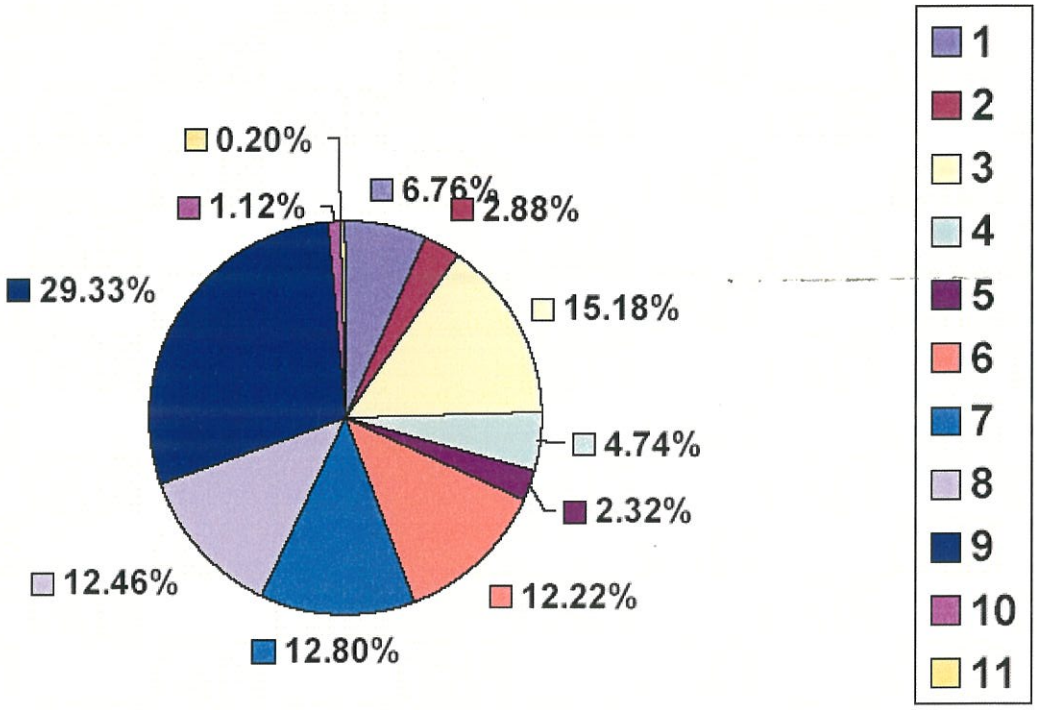
Annex.-I-32 ZONE WISE EARTH FILLING AS A CAUSE



Annex.-I-33 RECIPIENTS OF MONETARY HELP TO NEEDY PEOPLE.

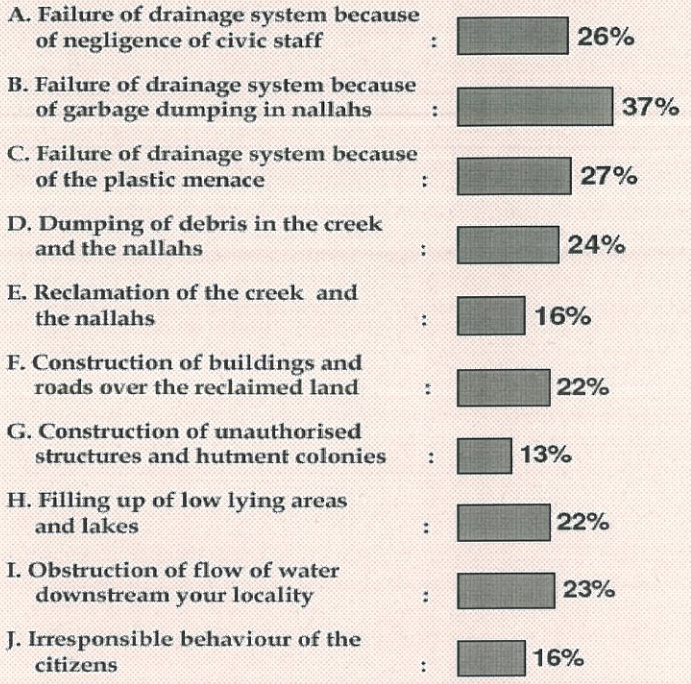


Annex.-I-34 CONSTRUCTION AS A CAUSE

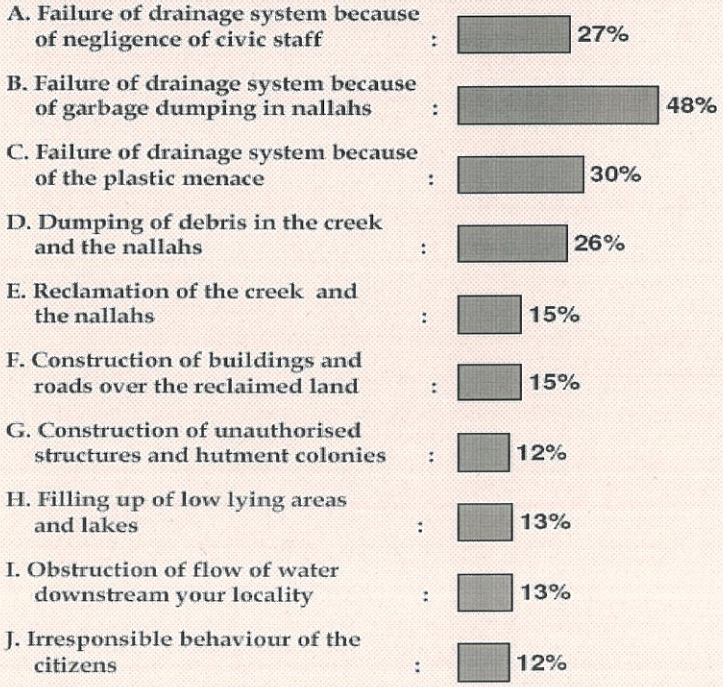


Annex.-I-35 GRAPHICAL REPRESENTATION OF LOCALITY WISE WATER LOGGING.

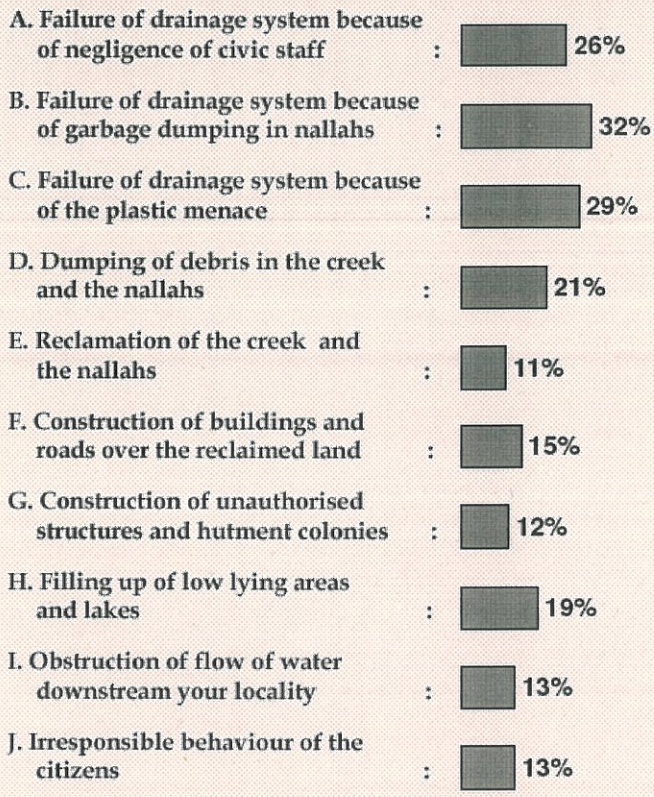
CLASSIFICATION OF CAUSES OF 'DELUGE' IN CREEK VICINITY AREA



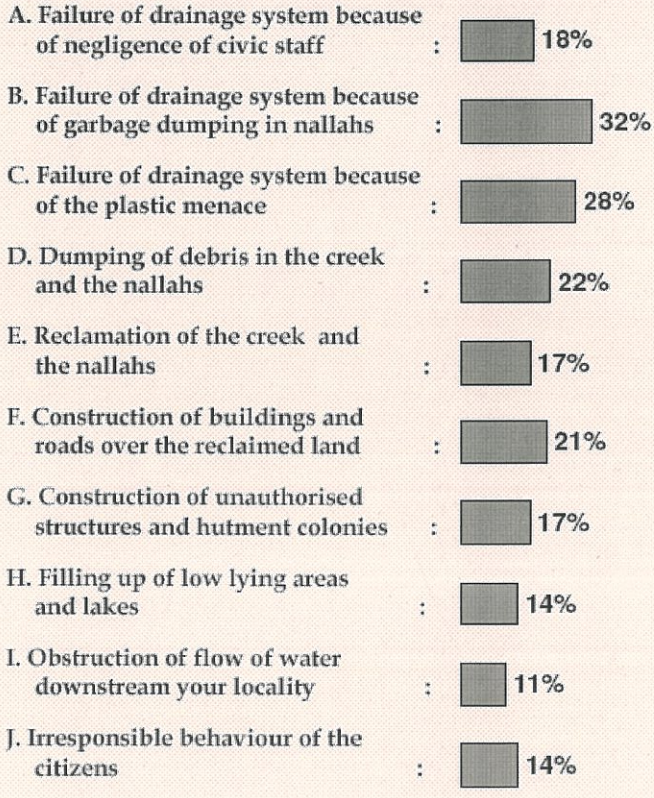
CLASSIFICATION OF CAUSES OF 'DELUGE' IN NALLAH VICINITY AREA



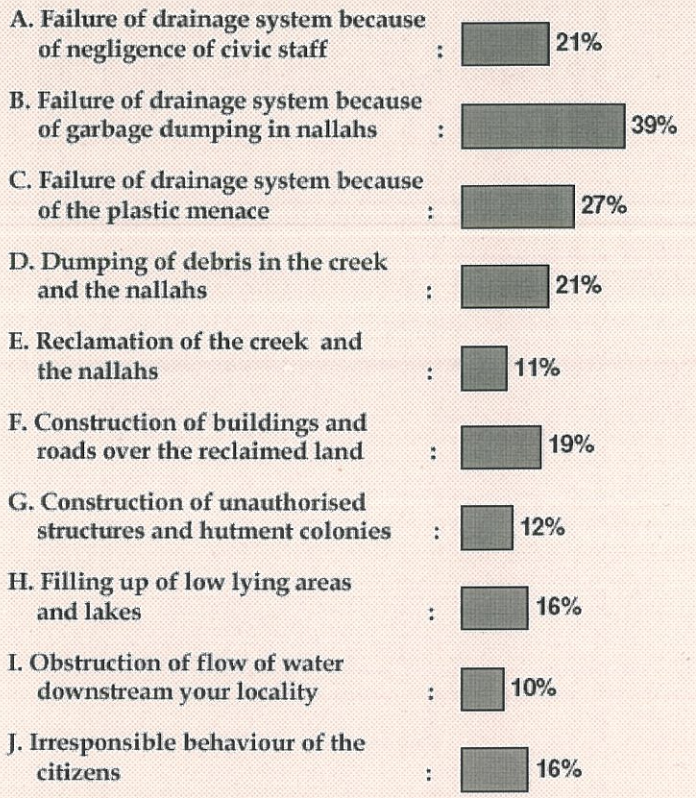
CLASSIFICATION OF CAUSES OF 'DELUGE' IN LOW LYING AREA



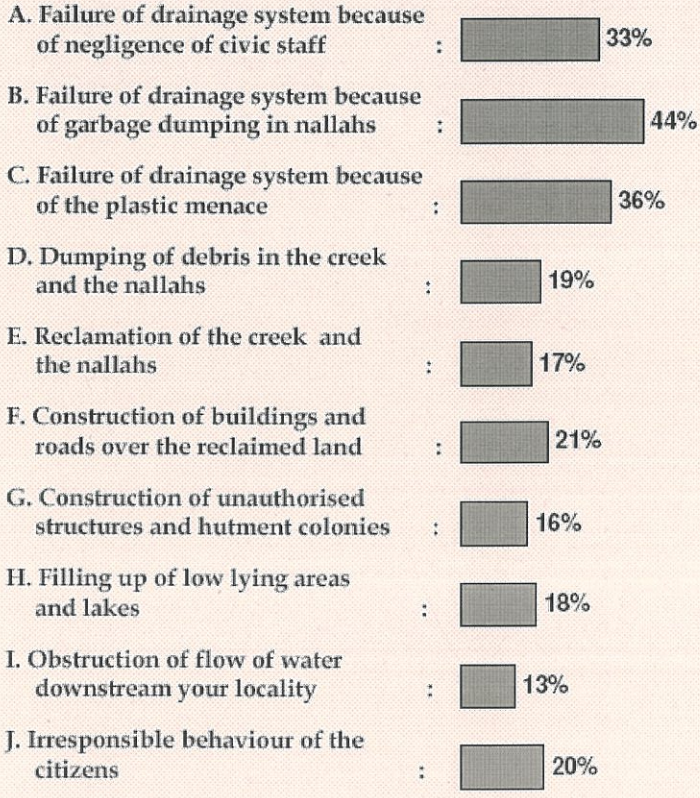
CLASSIFICATION OF CAUSES OF 'DELUGE' IN FOREST BOUNDARY AREA



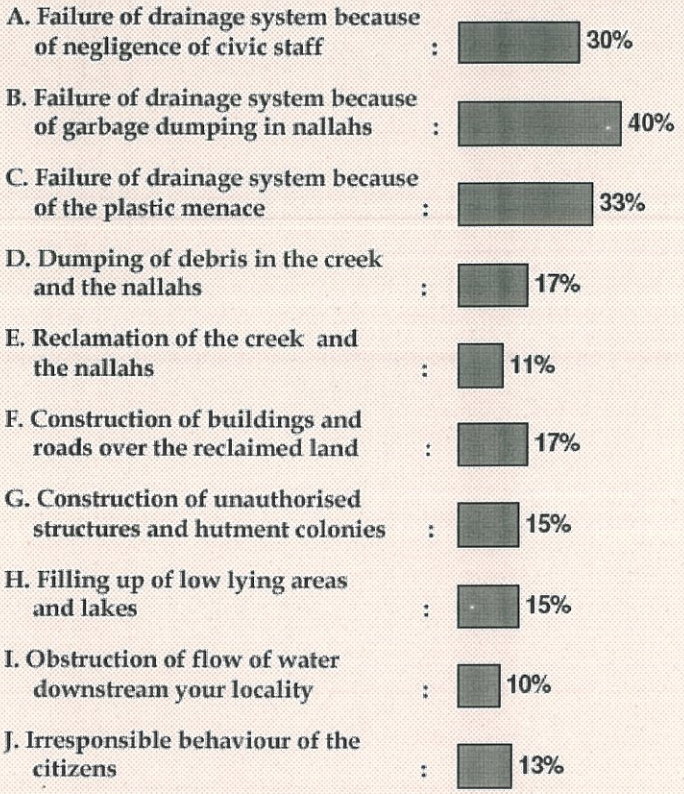
CLASSIFICATION OF CAUSES OF 'DELUGE' IN SLUM AREA



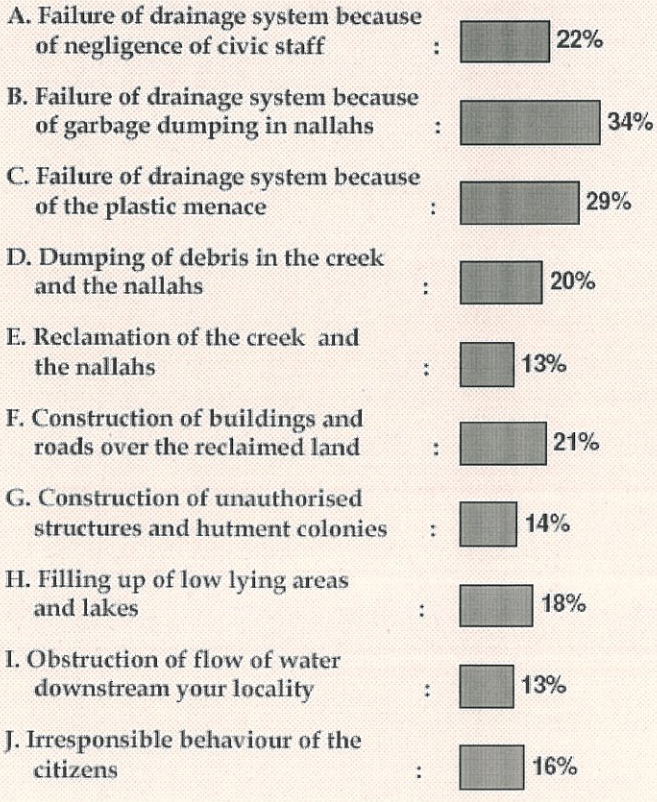
CLASSIFICATION OF CAUSES OF 'DELUGE' IN HIGH RISE BLDG. AREA



CLASSIFICATION OF CAUSES OF 'DELUGE' IN GROUND+4 BLDG. AREA



CLASSIFICATION OF CAUSES OF 'DELUGE' IN OTHER AREAS



Annex.-I-36 TABULAR PRESENTATION OF LOCALITYWISE CAUSES OF WATER LOGGING

(Based on Results of Primary Survey of the Deluge of July 2005)

Causes	Creek Vicinity	Nalla Vicinity	Low lying area	Forest Boundary	Slum area	High Rise Bldgs.	GR+4 Bldgs.
Percentage families interviewed	9%	16%	17%	5%	12%	6%	38%
Drainage system failure due to negligence	26%	27%	26%	18%	21%	33%	30%
Garbage obstruction	37%	48%	32%	32%	39%	44%	40%
Choking due to plastic	27%	30%	29%	28%	27%	36%	33%
Debris	24%	26%	21%	22%	21%	19%	17%
Reclamation	16%	15%	11%	17%	11%	17%	11%
Obstructing structures	22%	15%	15%	21%	19%	21%	17%
Filling of low lying areas & lakes	22%	13%	19%	14%	16%	18%	15%
Down stream obstruction	23%	13%	13%	11%	10%	13%	10%

Total Population: – 12 Lakhs

Comprising number of Families (estimated):- 2.4 Lakhs (2, 40,000)

Total No. of Families interviewed: – More than 8000 (Rounded to '000)

Percentage of Families Interviewed: – 3.0 %

(Based on the Published Results of the Census of 2001)

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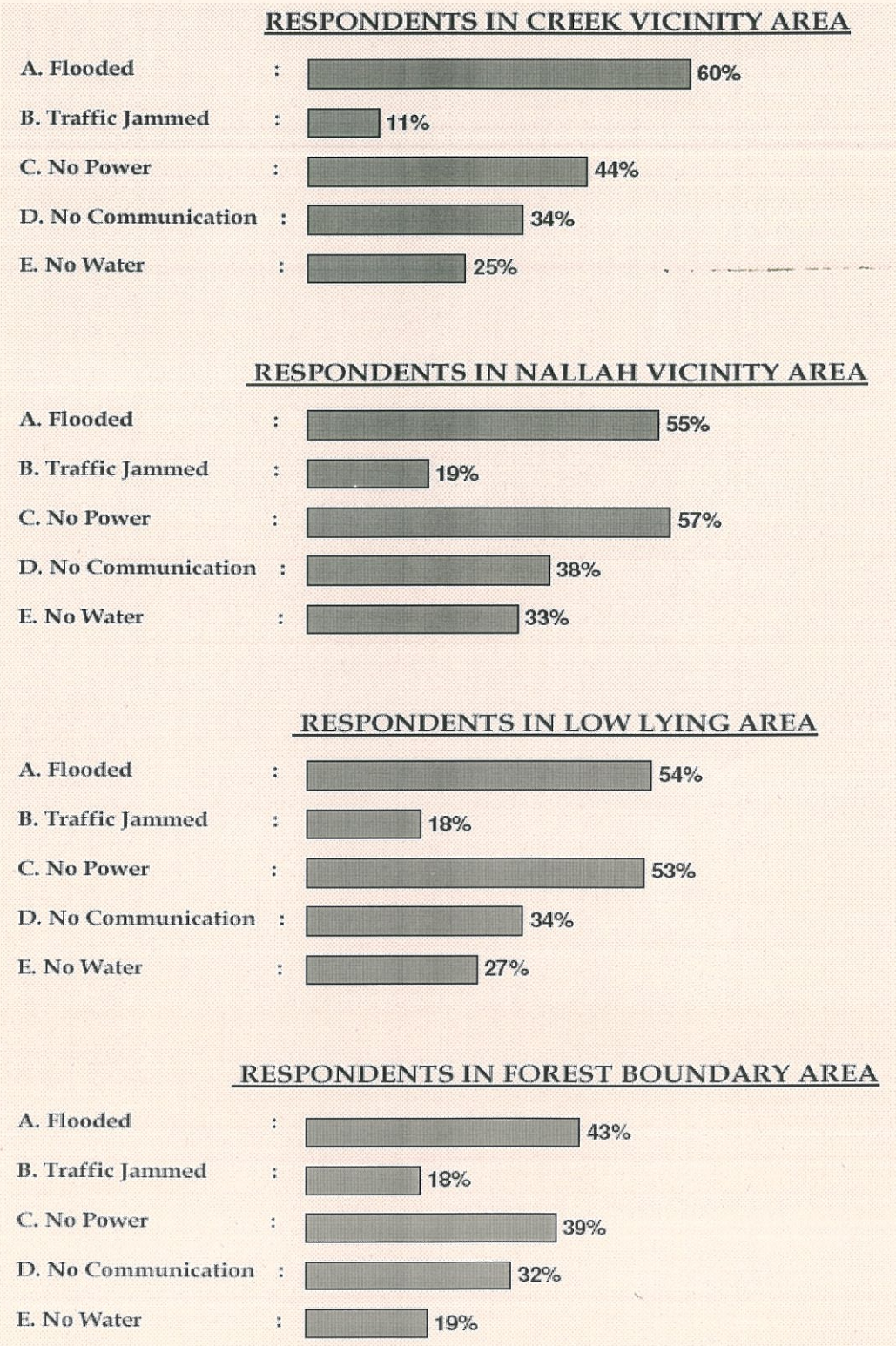
Annex.-I-37 TABULAR REPRESENTATION OF IMPACT OF WATER LOGGING.

(Based on the Primary Survey Results)

Causes	Creek Vicinity	Nalla Vicinity	Low lying area	Forest Boundary	Slum area	High Rise Bldgs.	GR+4 Bldgs.
No. of families interviwed	720	1280	1360	400	960	480	3040
Reporting flooding (3860)	60%	55%	54%	43%	40%	36%	46%
Reporting traffic jam (1200)	11%	19%	18%	18%	19%	20%	13%
Reporting no power (4500)	44%	57%	53%	39%	57%	61%	65%
Reporting no communication (3200)	34%	38%	34%	32%	41%	41%	49%
Reporting no water (2500)	25%	33%	27%	19%	37%	28%	40%

****

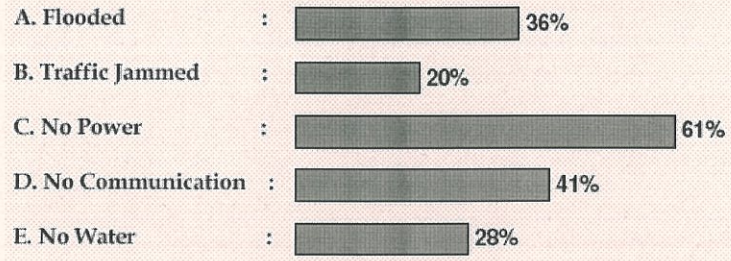
Annex.-I-38 GRAPHICAL REPRESENTATION OF IMPACT OF WATER LOGGING



RESPONDENTS IN SLUM AREA



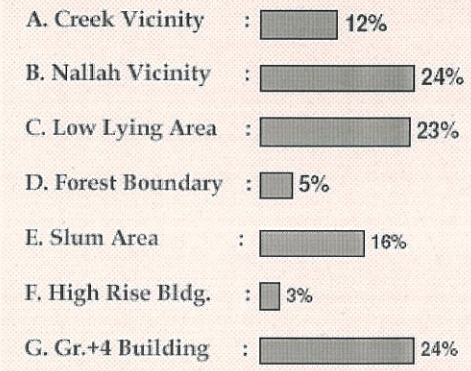
RESPONDENTS IN HIGH RISE BLDG. AREA



RESPONDENTS IN GROUND+4 BLDG. AREA



RESPONDENTS ANSWERING 'YES' TO Q. Did the water enter your residence ?



ANNEXURE : II

Annex.-II-01 STATUS OF VARIOUS WATER COURSES

PHOTOGRAPHS OF VARIOUS NALLAHS TAKEN AT SEVERAL POINTS TO INDICATE THE STATUS OF SUCH WATER COURSES

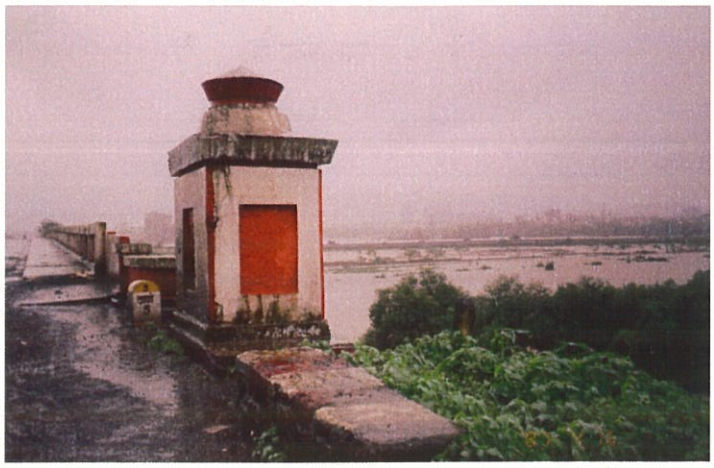
(Peoples' perception about the causes of Deluge vindicated)







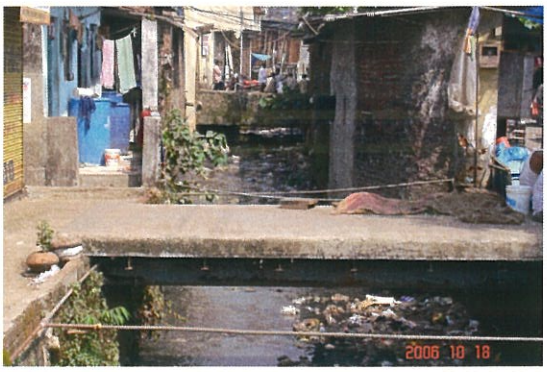
Annex.-II-02 ULHAS CREEK FROM THE BY PASS ROAD BRIDGE (DURING DELUGE JUL'05 AND IN APRIL 2006)







Annex.-II-03 TYPICAL MULTIPLE OBSTRUCTION IN NALAS













Annex.-II-04 UTILITIS PASSING THROUGH AND CREATING OBSTRCTIONS IN THE NALLAS













Annex.-II-05 NALLA IN THE VICINITY OF A TABELA ACROSS GHODBUNDER ROAD





Annex.-II-06 OBSTRUCTION OF MORIS AND FLOW SYSTEMS





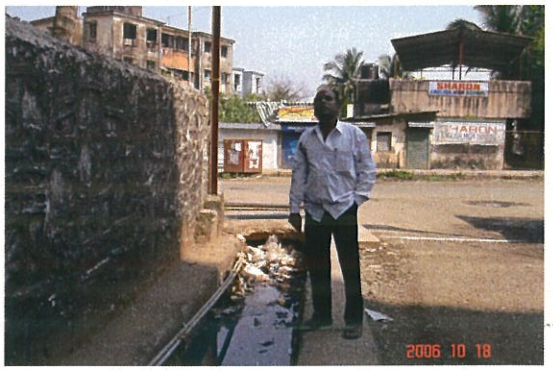
Annex.-II-07 REMOVABLE DHAPAS





Annex.-II-08 SITE VISITS ARE MUST FOR FINDING ANY SOLUTION





Annex.-II-09 MOUNTAINEOUS TERRAIN AND THE OPEN SHRUB



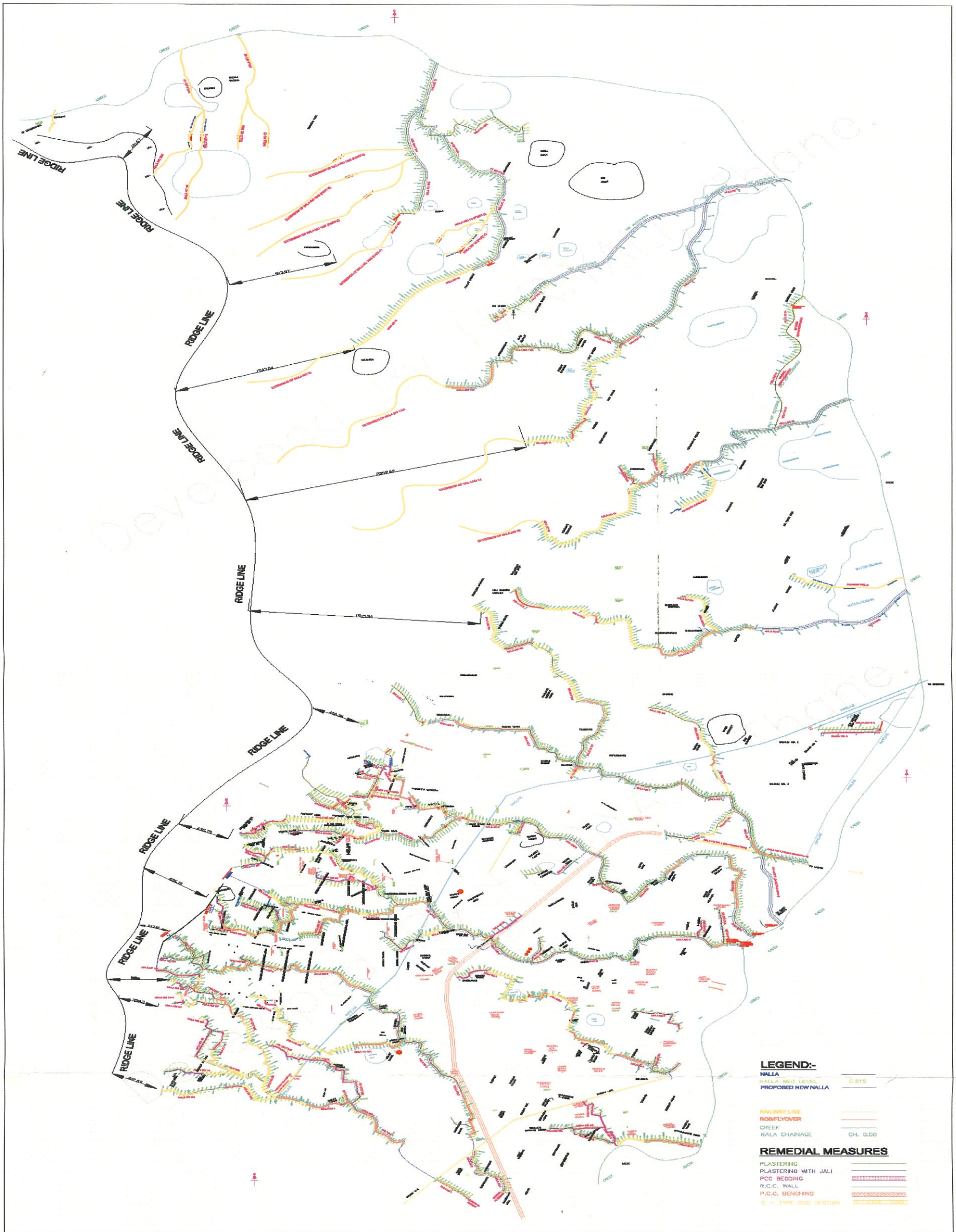






ANNEXURE - III : MAPS

Annex.-III-01 BASE MAP OF THANE CITY



HARIYALI हरियाली राष्ट्रस्य अलङ्कारः वनम्

5/702, Flower Valley, Eastern Express Highway, Thane - 400 601.
5/702, फ्लावर व्हॅली, ईस्टर्न एक्सप्रेस हायवे, ठाणे - 400 601.
Admn. Off.: 26, Dadoji Konddeo Stadium, Khartan Road, Thane - 400 601.

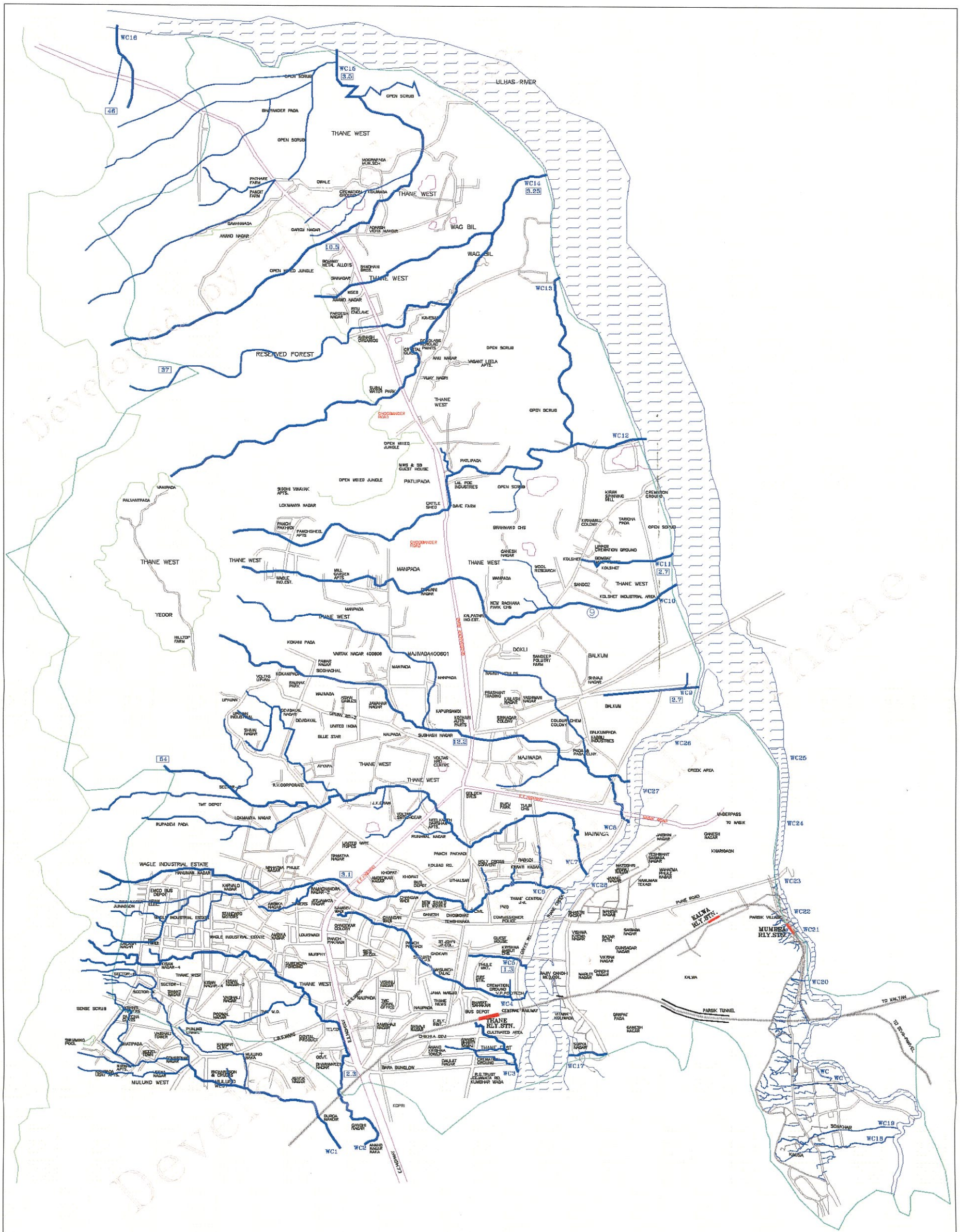
Mobile : 93232-91890 Telefax : 022-25474119, 022-25408661 E-mail : punamsingavi@vsnl.com Web : hariyalithane.org

SPONSERED BY : MMR ENVOIRMENT IMPROVEMENT SOCIETY

NOTE:- DO NOT SCALE THE DWG.

HARIYALI - THANE		
PROJECT:- EMP AND ES FOR THE PREVENTION OF REPETITIVE WATER LOGGING IN THANE CITY.		
TITLE:- BASE MAP OF THANE CITY		
DRAWN BY:- EXPERT COMMITTEE HARIYALI	SCALE:- 1 : 200	
DWG.NO.:- DRG-HRL-02	DATE:- 04.09.2006	
		REV. 0

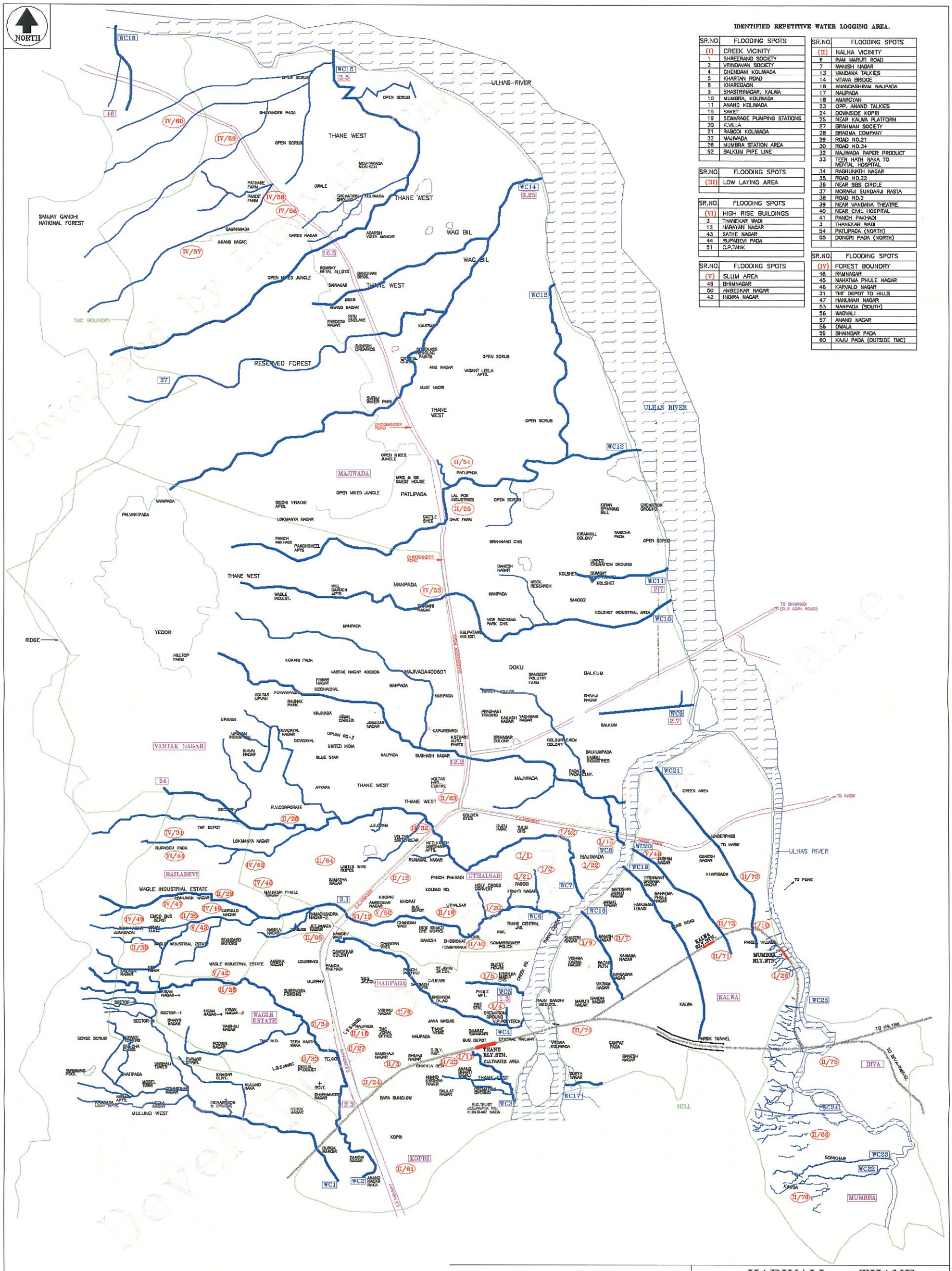
Annex.-III-02 MAP SHOWING LOCATIONS OF MAIN NALLAS & LAKES



HARIYALI हरियाली राष्ट्रस्य अलङ्कारः वनम् — 5/702, Flower Valley, Eastern Express Highway, Thane - 400 601. 5/702, फ्लावर व्हॅली, ईस्टर्न एक्सप्रेस हायवे, ठाणे - 400 601. Admn. Off.: 26, Dadoji Konddeo Stadium, Khartan Road, Thane - 400 601. Mobile : 93232-91890 Telefax : 022-25474119, 022-25408661 E-mail :		HARIYALI – THANE
SPONSERED BY : MMR ENVOIRMENT IMPROVEMENT SOCIETY	PROJECT BY : HARIYALI, THANE.	NOTE:– DO NOT SCALE THE DWG.

PROJECT:– EMP AND ES FOR THE PREVENTION OF REPETITIVE WATER LOGGING IN THANE CITY.	
TITLE:– LOCATION OF MAIN NALLAS & LAKES	
DRAWN BY:–EXPERT COMMITTEE HARIYALI	SCALE:– 1 : 200
DWG.NO.:– DRG–HRL–03	DATE:– 04.09.2005
	REV. 0

Annex.-III-03 MAP SHOWING MAIN WATERCOURSES AND WATER LOGGING SPOTS



IDENTIFIED REPETITIVE WATER LOGGING AREA.

SR.NO.	FLOODING SPOTS
(I)	CREEK VICINITY
1	SHREERANG SOCIETY
2	VRINDAVAN SOCIETY
4	CHENDANI KOLIWADA
5	KHARTAN ROAD
8	KHAREGAON
9	SHASTRINAGAR, KALWA
10	MUMBRA, KOLIWADA
11	ANAND KOLIWADA
15	SAKET
19	SEWARAGE PUMPING STATIONS
20	K.VILLA
21	RABODI KOLIWADA
22	MAJIWADA
26	MUMBRA STATION AREA
52	BALKUM PIPE LINE

SR.NO.	FLOODING SPOTS
(II)	NALHA VICINITY
6	RAM MARUTI ROAD
7	MANISH NAGAR
13	VANDANA TALKIES
14	VITAVA BRIDGE
16	ANANDASHRAM NALIPADA
17	NALIPADA
18	AMARGYAN
23	OPP. ANAND TALKIES
24	DOWNSIDE KOPRI
25	NEAR KALWA PLATFORM
27	BRAHMAN SOCIETY
28	BRADMA COMPANY
29	ROAD NO.21
30	ROAD NO.34
32	MAJIWADA PAPER PRODUCT
33	TEEN HATH NAKA TO MENTAL HOSPITAL
34	RAGHUNATH NAGAR
35	ROAD NO.22
36	NEAR SBS CIRCLE
37	MORARJI SUNDARJI RASTA
38	ROAD NO.2
39	NEAR VANDANA THEATRE
40	NEAR CIVIL HOSPITAL
41	PANCH PAKHADI
3	THANEKAR WADI
54	PATLIPADA (NORTH)
55	DONGRI PADA (NORTH)

SR.NO.	FLOODING SPOTS
(III)	LOW LAYING AREA

SR.NO.	FLOODING SPOTS
(VI)	HIGH RISE BUILDINGS
3	THANEKAR WADI
12	NARAYAN NAGAR
43	SATHE NAGAR
44	RUPADEVI PADA
51	C.P.TANK

SR.NO.	FLOODING SPOTS
(V)	SLUM AREA
48	BHIMNAGAR
50	AMBEDKAR NAGAR
42	INDIRA NAGAR

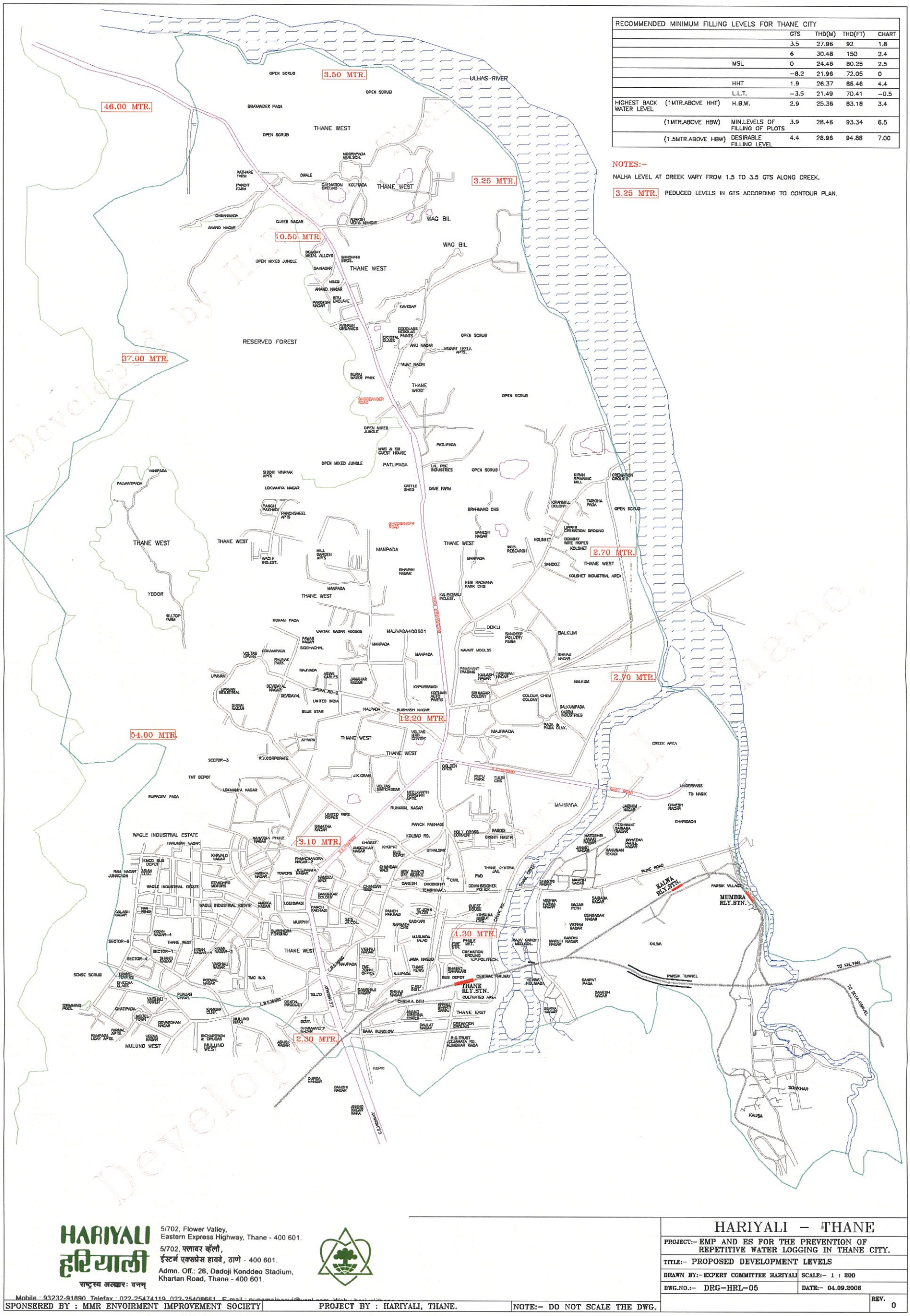
SR.NO.	FLOODING SPOTS
(IV)	FOREST BOUNDRY
48	RAMNAGAR
45	MAHATMA PHULE NAGAR
45	KARVALO NAGAR
31	TMT DEPOT TO HILLS
47	HANUMAN NAGAR
53	MANPADA (SOUTH)
56	WADVALI
57	ANAND NAGAR
58	OWALA
59	BHMINDAR PADA
60	KAJU PADA (OUTSIDE TMC)

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HARIYALI – THANE	
PROJECT:– EMP AND ES FOR THE PREVENTION OF REPETITIVE WATER LOGGING IN THANE CITY.	
TITLE:– LOCATION OF MAIN WATER COURSES & WATER LOGGING SPOTS.	
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DWG.NO.:– DRG–HRL–04	DATE:– 04.09.2006
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Annex.-III-04 MAP SHOWING PROPOSED DEVELOPMENT LEVELS



RECOMMENDED MINIMUM FILLING LEVELS FOR THANE CITY						
			GTS	THD(M)	THD(FT)	CHART
			3.5	27.96	92	1.8
			6	30.48	150	2.4
		MSL	0	24.46	80.25	2.5
			−8.2	21.96	72.05	0
		HHT	1.9	26.37	86.46	4.4
		L.L.T.	−3.5	21.49	70.41	−0.5
HIGHEST BACK WATER LEVEL	(1MTR.ABOVE HHT)	H.B.W.	2.9	25.36	83.18	3.4
	(1MTR.ABOVE HBW)	MIN.LEVELS OF FILLING OF PLOTS	3.9	28.46	93.34	6.5
	(1.5MTR.ABOVE HBW)	DESIRABLE FILLING LEVEL	4.4	28.96	94.88	7.00

NOTES:–

NALHA LEVEL AT CREEK VARY FROM 1.5 TO 3.5 GTS ALONG CREEK.

3.25 MTR. REDUCED LEVELS IN GTS ACCORDING TO CONTOUR PLAN.

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TITLE:– PROPOSED DEVELOPMENT LEVELS	
DRAWN BY:–EXPERT COMMITTEE HARIYALI	SCALE:– 1 : 200
DWG.NO.:– DRG–HRL–05	DATE:– 04.09.2006
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