8. ISSUES & CHALLENGES AND RECOMMENDATIONS

8.1 Introduction

Drainage management plan aims at discharging storm water within a minimum time, control of floods, maintaining the drainage networks and improvement of environment in and around drainage networks. Analysis of existing drainage network in terms of their design, construction and maintenance and various problems and issues related to encroachment, discharging of sewage into the drains, dumping of solid wastes and pollution are required for formulation of recommendations for Drainage Functional Plan. In this Chapter various problems have been discussed, issues & challenges identified and recommendations made for the development of drainage system in the NCR.

8.2 Drainage System in NCR Issues and Challenges

NCR being inter-state region, its drainage systems are planned, designed, constructed and maintained by various Departments/Agencies /ULBs of four NCR participating states. The problems being faced regarding planning, design, construction and maintenance of drainage system are discussed below:

8.2.1 Piecemeal Approach for Designing Drainage System

The development/expansion of existing urban area takes place outward from the City Centre. Normally, high level lands are developed followed by low lying lands. The drainage systems are also developed along with the development of the areas. The invert level of the drains developed in this area are kept with a view to drain out the storm water from the developed land, which is relatively high-level land. In the event of low lying land developed subsequently, the water from low-lying areas cannot be drained out under gravity through the drains constructed for draining out the storm water from higher level due to difference in the invert levels. In addition to above, during flooding of the areas the back flow of sewer creates serious problem.

There is a need to plan and design the drainage system of the city based on catchment area and taking into consideration, topography, slope, rainfall intensity and future expansions of the urban areas in an integrated manner. Holistic approach of drainage of planning and development is important instead of piecemeal approach.

8.2.2 Area Specific Rainfall Analysis

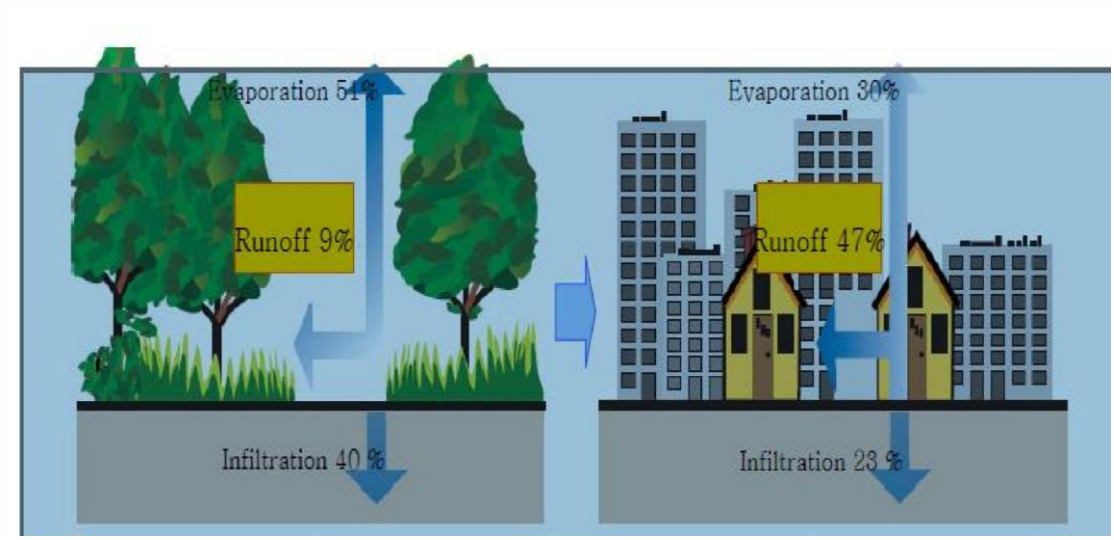
Among the important cities of India, the average annual rainfall varies from 2,932 mm in Goa and 2,401 mm in Mumbai on the higher side, to 669 mm in Jaipur on the lower side. The rainfall pattern and temporal duration is almost similar, which receive the maximum rainfall from the southwest monsoons. The average rainfall for the month of July in Mumbai is 868 mm and this far exceeds the annual average rainfall of 611 mm in London. Hence standard rainfall intensity cannot be adopted all over India/States.

Rainfall is the main driver of runoff process and intensity of rainfall is most important factor for designing the drainage system. It is often observed that the storm water drainage systems are designed for rainfall intensity of 12 - 20 mm/hr. which are easily overwhelmed whenever rainfall of higher intensity has been experienced. It has been observed that there is a variation of rainfall in the cities and the rainfall is expected to increase in the urban areas due to "urban heat island effect" discussed in Chapter 7 para 7.4.3. There is a need for area specific rainfall data and analysis for designing the Urban Drainage System.

8.2.3 Increase in Imperviousness in Urban Areas

The rainwater received on the land surface completes the water cycle by a combination of infiltration, evaporation (includes transpiration) and surface run off. With the urbanization, the built-up area increases and this reduces the scope for infiltration. Similarly in urban areas,

Figure 8-1 Run off before and after development



The tree and plantation cover decreases resulting in decrease in evaporation. Increase in built-up area and decrease in evaporation result in more surface run off. The comparison of run off before and after development indicates (Fig. 8.1) that after development surface run off has increased to 47 % from 9 % whereas infiltration has reduced from 40 % to23 % and evaporation reduced from 51% to 30 % which results in flooding. (Fig 8.1). There is a need to plan the developments in such a way that infiltration is not reduced and at the same time the surface run off is also not increased. There is a need to adopt the traditional approach to revive water bodies and also to increase the depleting water table.

8.2.4 Encroachment on Natural Drainage Channels in Urban Areas

Natural streams and watercourses have formed over thousands of years due to the forces of flowing water in the respective watersheds. Habitations started growing into towns and cities alongside rivers and watercourses. As a result of this, the flow of water has increased in proportion to the urbanization of the watersheds. Ideally, the natural drains should have been

widened (similar to road widening for increased traffic) to accommodate the higher flows of storm water. But on the contrary, there have been large scale encroachments on the natural drains and the river flood plains. Consequently the capacity of the natural drains has decreased, resulting in flooding.

Generally the drains and linear patch of land on either side of the drain are neglected due to foul smell and filthy look due to drain. Because of this reason the land value along drain is lower compared to other lands in the city. Local authorities also neglect the nallah land and its surroundings because this land does not provide any source of income to them. The negligence by local authorities provides an opportunity for the encroachers to carry out construction activities on the lands along the nallahs. The encroachment also reduces the effective width of the drain, which further aggravates the problem in monsoon.

i) Construction Activity in Urban Area

On account of construction activity in urban area the water channels get blocked and sometimes the blockage is due to temporary use i.e. storage of construction material, dumping of malba and sometimes the blockage is permanent due to either land filling or construction on drain. While constructing the roads and railway lines, sometimes the drains are blocked and even if the provision is made for water channels beneath the railway line of roads, the width is reduced which affect the carrying capacity of the water channels leading to flooding of the area.

ii) High Land Value in Urban Area

In urban area the width of drains are reduced due to high land value. The adequate width required to drain the area is not provided due to scarcity of land. In monsoon water spreads over low-lying area. And during non-monsoon period the area of water spread gets reduced and the economic activity takes place in such land which becomes available during non-monsoon. In fact, some construction also take place to raise the level to avoid flooding. The land is not reverted back to its original level and it is not available for spread of rainwater in monsoon. It results in flooding the low-lying area adjoining drains.

iii) Construction of Bridges over Drainage Network

Increasing road networks for the urbanization and increase in urban population has resulted in construction of a large number of flyovers and bridges. It has been observed that due to shortage of land, the piers of roads and railway bridges constructed in major storm water drains and rivers in the cities. These may cause back water effects and flooding of the upstream catchments. There is a need to design all the roads and railway bridges in the cities crossing drains in such a way that they do not block flows resulting in back water effects.

iv) Covering of Drains/Construction over the Drainage Channels

A new phenomenon has been observed that in urban areas drains and natural nallahs are covered for urban activities use mainly for transportation and commercial activities due to scarcity of land in the cities. The covering of drains poses difficulty in cleaning and leads to reduction in the carrying capacity of the drains. To ease the traffic the covering of drain for construction of additional road space has been noticed in several cases as discussed below:

a) The drains have also been utilized for providing connectivity by constructing flyover or bridge upon nallahs. A flyover was constructed over the Barapula Drain for providing fast connectivity of the Commonwealth Games Village with Jawahar Lal Nehru Stadium in Delhi. In the case of flyover constructions the pillars/columns are constructed on the bed of the drains which hinders the cleaning process of the drain, as the cleaning machines cannot move in the drain bed and also partially block the storm water flow. This type of construction for flyovers, roads and market places should be avoided as far as possible.

b) The drains have been covered to construct roads over the drains. This gives temporary relief to the traffic as additional road space becomes available for flow of traffic. However, the cleaning of the drains becomes very difficult. Even if a shaft is provided in the center of the drains the machine cleaning the drain do not get to access the full base and as a result only the central part of the drain bed is cleaned leading to reduction in the capacity and results in flooding. In Seoul, capital of South Korea, Cheonggyecheon stream running through the centre of the City was covered and a six km long and 50-80 m wide road was created at existing drain. Subsequently, an elevated highway was constructed in 1976. Subsequently, it was demolished and reverted back to restoring the stream on environmental consideration. The details of the Chenoggyecheon Restoration Project is given in Box 8.1.

Box 8.1 Cheonggyecheon Restoration Project

Cheonggyecheon Restoration Project

Cheonggyecheon was a stream running from west to east through the center of Seoul city in South Korea. Its waters flowed down from Mt. Bugaksan and Mt. Inwangsang to the north, Mt. Naksan to the east, and Mt. Namsan to the south. The 600-year history of Seoul began when King Taejo, the founder of the Joseon Dynasty, moved the capital to Hanyang (today's Seoul) in 1394. Ever since, the Cheonggyecheon has been inextricably linked to Seoul's history.

The stream overflowed whenever there was heavy rain, and it was usually so polluted at all other times due to lack of flow that there was already talk of covering Cheonggyecheon during the early Joseon period.

Plan to cover Cheonggyecheon was formulated in 1926 but it was dismissed. The process of covering Cheonggyecheon started in 1937. The work was stopped once due to lack of fund and social unrest. The Cheonggyecheon road was created by covering Cheonggyecheon stream, which is 50-80m wide and 6 km long. The construction of Cheonggye Elevated Highway started in 1967 and was completed in 1976. It was four-lane two-way highway. Before the highway was dismantled, daily traffic volume was 168556 vehicles, with 65,810 on Cheonggye Road and remaining 102,747 on Cheonggye Elevated Highway. The structural components of Cheonggye Elevated Highway needed repair. Due to pollution in the stream even after the repair, the long-term stability of the structures could not be ensured. It was one of the reasons for Cheonggyecheon Restoration Project. The basic reasons for restoration project are to transform Seoul into a human-oriented and environment friendly city. The restoration project recovered artifacts of historic heritage and restored the pride of Korean people in their 600-year-old city.

The Cheonggyecheon Restoration Project started in 2003 with the demolition of Cheonggye Elevated Highway and structures covering the Cheonggyecheon stream. A total of 680,000 tonnes of waste were generated during the demolition work. Of this 100% of the scrap iron was recycled and 640,000 tonnes or 95% of the waste concrete and waste asphalt was reused.

The Cheonggyecheon was restored as an "urban stream in nature", a human oriented, environment friendly urban space with a waterfront and walks along the bank. It is most desirable for stream to receive water from its upper reaches. However, Cheonggyecheon is an intermittent stream i.e. it is normally dry and therefore requires additional flow to maintain certain depth of water throughout the year. The water for the restored Cheonggyecheon came from the Han River. The waterfront is planted with wide plants that grow well along bodies of water to create natural scenery. At the downstream section where Cheonggyecheon and Jungnangcheon streams join, a swamp and habitat for fish and birds are created so that nature and city can co-exist.

c) Individual property owners cover the roadside drains for access from the approach road. This phenomenon is more common in commercial areas where the land value is higher and the shopkeepers encroach upon drains for keeping the items of sale outside of their shop. This is the most common type of covering of drain. This can be permitted by allowing the covering of drain only in front of the entrance for access/approach to the road but the drain should not be covered all along the plot boundary.

v) Growth of plants in Drains

During non-monsoon period the drains have little or no water. However it has more moisture and also retains it for longer duration due to more organic content in the soil of drain. Further, even during small showers the nallah bed gets some water. It retains the moisture and this makes suitable conditions for growth of plants and vegetation. (Fig. 8.2 & 8.3). The grass and plants need to be regularly removed to maintain the carrying

Figure 8-2 Growth of grass in drain

vi) Silting of Drains

During the rain the velocity of water is high. This high speed flowing water washes the earth and carries with it soil, leaves, wood logs, dead bodies etc. The soil carrying capacity of water decreases with the reduction in velocity of water. After reduction in velocity of water, floodwater leaves behind this material in the drain. This reduces the carrying capacity of Drain. And to carry the same quantity of water wider drain is required. Otherwise the water spread

(flooding) takes place. To maintain the same carrying capacity in a limited width, the drain need to be cleaned periodically.

Figure 8-3 Growth of grass & plant in drain

8.2.5 Pollution in Drainage System

The purpose of drains is to provide a safe passage to the water accumulated due to rainfall. The water of first few rains becomes acidic after absorbing sulphur dioxide and nitrogen oxides present in the atmosphere. Otherwise, rest of the time the rain water is pure but while being carried in drains it gets polluted due to human intervention like dumping of garbage, mixing of sewage, intrusion of industrial affluent etc. The reasons for pollution of drains are discussed subsequent paragraphs.

(i) Mixing of Sewage and Drainage

Storm water drainage is meant to carry storm water (rain water) or any other clean surface water. It is fundamentally neither suitable nor designed for carrying sewage or industrial wastewater or even septic tank effluent. Even the effluent from the sewage treatment plant cannot be discharged into drain unless it meets the norms set by the Bureau of Indian Standards (BIS) code and the Central Pollution Control Board. In urban areas it is desirable to have separate system for carrying the sewage and storm water. In accordance with this principle in

cities, the drainage and sewerage systems are provided separately. The problem arises due to blockage in sewerage system resulting the back flow in houses and in nearby areas. In order to avoid back flow and immediate relief is given by puncturing the sewerage line and diverting the sewage to nearby drains. Thus in urban areas the drains also serves as a substitute to sewerage system, for which the drains are not designed. The raw sewage mixed with storm water directly flow to the major drains and ultimately to the rivers cause serious water pollution in rivers which are the major source of drinking water of supply effects the aquatic life. There is a need to plan and construct separate sewerage and drainage system and necessary measures may be taken so that sewage are not punctured during floods and drained into the drains.

In some cases, reverse conditions have been observed where drains are connected to sewer lines and the storm water runoff which is not required to be treated by the Sewage Treatment Plants (STP) find its way to STP resulting in increase the volume of waste water for treatment. The STPs are designed for certain capacity for the treatment of sewage only but the quantity of storm water runoff mixed with sewage becomes very high leading to overflowing of the STPs.

(ii) Disposal of Untreated Sewage in Drains

In some cities Sewage Treatment Plants have been constructed to treat the sewage and to discharge the treated effluent in the drains. However, the untreated sewage finds its way into drains. During the site visit,it was observed that the sewer lines were punctured before entering into the compound of the STP and the untreated sewage was allowed to flow in the drains (Fig.8.4 & 8.5).

It was also found that the STP was constructed under the Yamuna Action Plan but was not in operational condition due to lack of funds as no provision or budgetary assistance for operation and maintenance.

The purpose of constructing the STPs for the treatment of sewage is defeated as the raw sewage is being discharged into the drain leading to Yamuna River. It is necessary that viability of operation and maintenance of STP is also evaluated at the stage of project formulation and budgetary provisions for operation and maintenance of STP may be considered at the proposal stage.

Figure 8-4 Sewage Flowing into Drain

iii) Disposal of Industrial Effluent in Drains

It has been observed that several industries divert their highly toxic effluent to the drains. The urban drains which are unfit to carry even domestic sewage are loaded with highly toxic industrial waste. These industrial wastes need special attention for treatment. The nature of the industrial wastes is different in character and a special chemical treatment is required depending upon type of the industry and the wastes.

In Panipat areas it was found that the industries store the effluent in underground tanks and dispose it off in the drains through tankers at convenient hours (Fig. 8.6), some of the industrial units inject the effluent directly into the ground, which leads to serious environmental pollution. The practice of discharging untreated industrial effluents into the drains and open ground need to be checked immediately on priority. There is an urgent need to construct Common Effluent Treatment Plant (CETP) and discharge the industrial effluents into the drains only after treatment. The treatment of the industrial waste is costly and may not be economically viable for individual industries. The cluster of industries may form an Association and carry out collection, conveyance and treatment of their industrial effluents in CETP.

Figure 8-5 Disposal of Untreated Industrial Waste in drain

iv) Dumping of Garbage and Malba

Improper disposal of solid wastes, and dumping of construction debris into the storm water also contributes significantly to reduction of capacity of the storm water drain.

This includes domestic solid waste, commercial and industrial waste, street sweepings and construction debris etc. (Fig. - 8.7). In rural area also agriculture waste, cow dung and other waste material is dumped into the drain especially during the non-monsoon period. The solid waste dumped into the drains blocks the flow of storm water and causes stagnation or flooding on the upstream side or spreading of water locally in the vicinity. Further, due to decomposition of the biodegradable material the foul smell deteriorates the environment and causes breeding of mosquitoes and water borne diseases. It has also been noticed that locally collected garbage is dumped near to cross drainage works of roads (Fig.8.8). There is an urgent need to protect the drainage system from dumping solid wastes.

Figure 8-6 Garbage dumping in Nallah

Figure 8-7 Garbage dumping - Blockage of cross drainage

v) Open Defecation, Disposal of Dead Bodies

In rural areas people do not have access to safe sanitation and in urban areas particularly in unauthorized colonies and squatter settlements people defecate along the drains in open area. In most of the cities, the removal of night soil by head loads is in practice and this finds its place directly into the nearby drains causing pollution.

In addition to above, water bodies and rivers are also used for disposal of human dead bodies, domestic and stray animals. In absence of aquatic animals who used to consume the dead bodies, the dead bodies thrown into the lakes and rivers do not get consumed and they decompose and cause more pollution.

vi) Pollution due to Vehicles

Water running off impervious motor-able surfaces tends to pick up leaked/spill over petrol or diesel, motor oil, heavy metals, and other pollutants from roadways. Roads and parking lots are major sources of polycyclic aromatic hydrocarbons (PAHs) pollution, which are created

as combustion by products of gasoline and other fossil fuels, as well as pollution of the heavy metals e.g. nickel, copper, zinc, cadmium, and lead. Auto Garages and repair stations are also the sources of this kind of pollution.

vii) Pollution due to Fertilizers and Pesticides

The storm water runoff while flowing in lawns, nurseries, parks and agricultural fields picks up fertilizers and pesticides. Fertilizer and pesticides used on residential lawns, parks and golf courses and in agricultural fields is a significant source of nitrates and phosphorus pollutants in rivers and drains.

8.2.6 Operation and Maintenance of Drains

Proper Operations and Maintenance (O&M) are crucial for any system to be functional to the designed capacity and for its durability. Most of the storm water drainage and sewerage systems suffer to a great extent due to lack of proper and regular O&M. This equally affects both the major and the minor storm water systems. This has been discussed in detail below:

i) Pre-Monsoon De-Silting

It has been generally observed pre-monsoon de-silting does not commence and get completed on time and as such even the designed capacities are not operational. As a result of this, even lower intensity of rainfall results in flooding. Major drains and nallahs were originally waterways for rainwater to flow. However, due to large-scale urbanization and lack of required sewerage systems in place, sewage started getting discharged into these drains and nallahs.

ii) Removal of Sediment

Sediment is present on all urban catchment surfaces and much of this material finds its way into the drainage system. The amount of sediments that enters into the drainage system is limited by the degree of street sweeping and the effectiveness of the inlet catch basins or gully pots and their cleaning regime. Management of such sediment is rarely carried out, by the ULBs. In developing countries with larger amounts of sediment and weaker urban management systems, the extent and magnitude of sediment in the drainage system can have a significant impact on its performance. As with solid waste, sediments also greatly reduce flows. The duration of local flooding increases proportionately, with the extent to which the cross-section of the channel was filled with sediment. In many cases, the operational practices are poor, as clearing up drains is not done from the outlet end particularly in minor drains resulting in very little net benefit.

Due to non-availability of adequate flows in the minor drainage systems, frequent deposit of sediments occurs and it ultimately results in the loss of capacity to accommodate the flows during high intensity monsoon rainfall, thus compounding the existing situation, which is far from being satisfactory.

Lack of preventive maintenance of minor drains and sewerage systems is also very commonly observed. In some cities, some underground drains are over 100 years old and are now susceptible to collapse because of age and increased burden due to traffic load.

iii) Draining Storm water through Pumping

In a developed urban area, storm water from the low level lands surrounded by high-level lands are drained through pumping. Though technically it is feasible but practically it has not been found successful due to its high maintenance cost operational problems.

Pumps are used during heavy rainfall which occurs few days in a year whereas a pump has to be maintained in working conditions throughout the year. In the event of heavy rains and flooding, failure of electricity supply is very common and pump has to be operated through electric generator. An electric generator has to be kept stand by which add to the maintenance cost. During floods due to heavy rains the accessibility to the pump site may be difficult due to submergence of the approach road.

8.2.7 Institutional Issues

The drainage was considered a phenomenon of draining the rainwater to avoid the flooding and Irrigation Departments of the State Governments were responsible for the construction and maintenance of the storm water drains. The ownership of nallah land lies with this department. Even in the initial phase of urbanization the responsibility for development, construction and maintenance of urban drainage system was also with Irrigation Department. After the emergence of local bodies the small urban drains were designed to carry the storm water runoff from residential colonies and these drains were connected to the existing natural drains. The local bodies became responsible for the drains constructed by them and also discharging the responsibility for the cleaning and garbage removal from drains falling in urban area. Even though the ownership of the drain may be with the Irrigation Department, the responsibility of maintenance and cleaning rested with local body. Subsequently, the Urban Development Authorities were created to supply the developed land for urban use/activities at a faster pace. Storm water drains were also constructed in the area developed by the Development Authorities and these drains mostly outfall in the storm water drains maintained by Local Authority / Irrigation Department. There are also industrial towns developed by agencies i.e. National Thermal Power Corporation, Nuclear Power Corporation of India Ltd., who maintain their own drainage system within their township and mostly these drains outfall into the major drains of the area. The Cantonment Boards also construct and maintain storm water drains in the Cantonment areas. Thus there are several agencies involved in the handling of drainage of a region. In urban areas the agencies responsible for design, construction, maintenance the urban drainage system vary from State to State**.** The Departments/ Local Authorities/Agencies involved in design, construction and maintenance of drainage system in NCR are discussed below:

i) Haryana Sub-Region

In Haryana Sub-Region, the ownership of urban drains is with Public Health Engineering Department (PHED) and it is responsible for construction of new drains and widening of existing storm water drains and the ULBs are responsible for maintenance of storm water drains. Further, Haryana Urban Development Authority (HUDA), a State level agency maintains drains in areas developed by them. Similarly, Haryana State Industrial & Infrastructure Development Corporation (HSIIDC) is responsible for design, construction and maintenance of drains in their respective areas.

ii) U.P. Sub-Region

In U.P. Sub-Region, in municipal area, the construction of drains is carried out by UP Jal Nigam on deposit basis due to non-availability of technical manpower in ULB and the cost of construction is borne by ULBs. After construction of the storm water drains, maintenance work is carried out by ULBs. Wherever the Urban Development Authorities exist, the storm water drains in their area are constructed and maintained by Development Authorities till the developed area is handed over to the ULB for maintenance. Further, in UP, Housing Boards also develop colonies and Drainage System in the residential colonies are constructed by Housing Board and the maintenance is carried out by ULB after handing over of the area to the ULBs.

iii) Rajasthan Sub-Region

In the Rajasthan Sub-region, originally Public Health Engineering Department undertakes the construction and maintenance of the drainage system. Presently, the local bodies i.e. Municipality in Urban Area and Panchayat in rural areas are responsible for the maintenance of drainage system. In the industrial estates developed by Rajasthan State Industrial Development & Investment Corporation Ltd. (RIICO), the drains are constructed and maintained by RIICO.

iv) NCT-Delhi

The Irrigation and Flood Control Department, Govt. of NCT Delhi is overall responsible for drainage management in Delhi. The responsibility of construction and maintenance of the large drains (natural) is with this department. However, de-silting and disposal of the silt removed from drains is the responsibility of the respective local bodies, under whose jurisdiction the drain falls. Delhi Jal Board looks after drains with more than 1,000 cusec discharge. The Public Works Department, Government of NCT Delhi is responsible for the drains in identified pockets. The three Local Bodies – Municipal Corporation of Delhi, New Delhi Municipal Council and Delhi Cantonment Board – have the mandate to look after construction and maintenance of the drains in their respective areas.

It is observed that each NCR participating State has its own institutional arrangement for handling drainage system. There are multiple departments/agencies responsible for drainage management in urban areas. As there are several agencies there is lack of coordination in management in the drainage system.

v) Poor Maintenance of Drains

The drains need to be cleaned before the monsoon season to remove garbage, silt, malba and other materials, which creep into the drain during the year when there was no flow. During the no flow situation the growth of grass and plants takes place in the drain, which increases the friction co-efficient and reduces the capacity of the drain. To keep the drain in working condition regular maintenance and cleaning is required. As the heavy rain takes place in monsoon generally the cleaning of drains is completed before arrival of the monsoon to avoid flooding of the city and cramping the urban life in the first shower itself. Generally, the local body is the agency responsible for maintenance of drains and the annual cleaning has to be undertaken by them. The general observation is that the annual maintenance is not completed in time. Further the material removed from the drain is kept near the drain similarly the material removed from roadside drain is kept along roadside for several days. The foul smell and filthy look spreading in the locality makes the life miserable. After cleaning nala the removed material should be shifted to the disposal site immediately or at the most on the same day.

vi) Non Availability of Trained manpower in ULBs

The Agencies responsible (ULBs) for looking after the drains lack in trained manpower for construction and maintenance. Instead of strengthening the local bodies, the State Governments have taken different approach and the work for construction of drains are entrusted to different agencies, often due to shortage of manpower in the ULBs. For example, in Haryana, the construction of drains is done by Irrigation Department and similarly, UP Jal Nigam undertakes the work of construction of drains in UP. The responsibility of regular maintenance of drains remains with ULBs, which do not have trained manpower. This needs to be addressed.

vii) Non-Availability of Equipment

In addition to non-availability of trained manpower the ULBs, i.e. agency responsible for cleaning the drains, also do not have proper machineries and equipments to handle the work efficiently. The age-old method of manual garbage removal is adopted by the ULBs. There is a need to adopt latest mechanical method of garbage removal/cleaning to improve the maintenance of the drains.

viii) Resource Crunch in ULBs

Due to poor financial health of ULBs, the maintenance and cleaning of drainage system are seriously affected in the cities and towns. There is a need to provide adequate funds to the ULBs for regular maintenance and cleaning of drainage system in order to improve the drainage system so as to prevent loss of human life, property and agriculture land which is more than the cost of cleaning the drainage system.

8.2.8 Existing Approach

So far the efforts have been to provide a safe passage to the storm water up to nearby natural stream. In rural area whenever flooding takes place a view is taken about the carrying capacity of the existing drains and if required the widening/deepening or construction of new drains are undertaken to flush the floodwater in the river. In urban area a general engineering approach has been adopted by constructing the drains, cleaning it annually and allowing the storm water to join the natural stream/river.

The poor sanitation in Indian cities is a major hurdle in proper drainage system. Even in Delhi, the Capital of India, there are patches, where the removal of night soil is by head loads. This finds its place directly into nearby drain. And unless this problem is attended, the clean drainage system will remain as a dream. In our cities, wherever possible, the separate system has been provided. Sewer lines have been laid for disposal of sewage and surface water run-off is to be collected in drains and disposed of separately in existing natural streams. However, the problem occurs due to mixing of sewage and storm water. On noticing that Realising that rivers got polluted due to disposal of untreated sewage, in the past, several efforts have been made to treat the sewage in Sewage Treatment Plants before disposal. This centralized approach of collection, conveyance and treatment of sewage has not been successful due to various problems e.g. diversion of sewage into storm water drains, releasing of treated waste into drains where it mixes with untreated waste to finally flow into the river. An innovative approach require to be adopted to overcome this issue.

i) Inadequate Water for Dilution

Conventionally, the urban areas developed along major rivers. The city drains used to outfall in the river. Owing to the high volume of water being carried by the river, the effluent being discharged by the nallah used to get diluted and it was easily treated by the natural carrying capacity of the river water. Due to diversion of water and extensive use of water for irrigation upstream and the rivers downstream do not have adequate fresh water. For example, there are several drains in Delhi carrying untreated sewage and out falling into Yamuna River, which enters Delhi with no flow situation. In other words, Yamuna River, in the downstream of NCT Delhi carries whatever is disposed of by Delhi i.e. treated or untreated sewage. River has no fresh water for dilution of the wastewater discharged into the river. As there is no fresh water, the dilution does not take place, river's self-cleaning system is not able to cope up and the

effluent being carried by the river. This has adverse impact on the downstream side. It signifies that all the domestic sewage and industrial wastes be treated before disposal into the river.

ii) Treatment before Disposal

The approach adopted so far has been centralized treatment and then disposal. Currently the attempt is to collect the sewage in the sewerage system, convey it to the treatment plant and dispose of the treated effluent into the stream. Though this approach has inbuilt flaw but it can be applied only to a city which has 100% coverage by sewerage system. None of the Indian cities have 100% coverage by sewerage system. In absence of 100% coverage by sewerage system, the approach of treatment before disposal is not successful because the drains are also carrying sewage which outfall in the river discharging untreated sewage.

iii) Centralized Treatment of Sewage

The Sewage Treatment Plants are normally located outside the city and whole sewage of the city has to be transported to the site of STP for treatment and thereafter the treated wastewater is disposed of into the river/drains. There is a need to treat the sewage locally and use the treated water for non-drinking purposes i.e. in gardening, horticulture, A.C. plants, cooling towers of the power plants etc. Micro Sewage Treatment Plants can be constructed throughout the city to treat and use the treated water locally. This will reduce the sewage conveyance cost and also ensure recycling of water.

iv) Need for Change in Technology

The sewerage system as sewage disposal technology was developed almost two centuries ago in Europe after industrialization. The same technology is being used without much improvement in technology which needs improvement.

8.2.9 Recent Initiatives

Delhi Jal Board has come up with a proposal of Interceptor Sewer. Interceptor sewers are large sewer lines that, in a combined system, control the flow of sewage to the STP. In a storm, they allow part of the sewage to flow directly into receiving stream, thus keeping it from overflowing onto the streets. Also used in separate systems to collect the flows from main and trunk sewers and carry them to STPs. The project is under consideration for approval by Government.

The success of Interceptor sewer has to be viewed in detail. Interceptor Sewer has been conceptualized and it is under implementation in Ahmedabad by Government of Gujarat. A brief of the project is given below:

> *In Ahmedabad, Sabarmati River flows through the city. There is development on either side of the river. Also* there *are some unauthorized colonies along the river. There are several sewage carrying small drains joining the river. Government of Gujarat is*

constructing Interceptor Sewer along Sabarmati River to arrest the untreated flow. It will collect the untreated sewage and surface run off from adjoining area, which would have joined the stream otherwise. This collection will be treated before disposal into the river. In case of heavy rainfall the surface run off will be heavy and it will overflow directly into the stream. Since there is limited rainfall in Ahmedabad, the phenomenon of overflowing is likely to occur seldom and with this assumption the project has been sanctioned.

8.2.10 Service Level Benchmarks

As part of the ongoing endeavour to facilitate critical reforms in the urban sector, the Ministry of Urban Development, Govt. of India has adopted National Benchmarks in four key sectors, namely, Water Supply, Sewerage, Solid Waste Management and Storm Water Drainage. Investments in urban infrastructure have, however, not always resulted in corresponding improvements in levels of service delivery. There is, therefore, a need for a shift in focus towards service delivery. The Handbook of Service Level Benchmarking developed and published by the Ministry of Urban Development, Govt. of India provides a standardized framework for performance monitoring in respect to water supply, sewerage, solid waste management and storm water drainage, and would enable State level agencies and local level service providers to initiate a process of assessment of the existing level of service delivery, performance monitoring and evaluation against agreed targets, finally resulting in the achievement of service level benchmarks identified in the Handbook. The Ministry of Urban Development would facilitate the adoption of these benchmarks through its various schemes and would also provide appropriate support to municipalities that move towards the adoption of these benchmarks.

8.3 Recommendations

Regional Plan-2021 has proposed that different areas in NCR, which are liable to flooding in rivers of return period of 5, 10, 25, 50 and 100 years, need to be identified on map for land use zoning at regional and Sub-regional levels. Participating States should prepare detailed Contour Maps for their respective Sub-regions on a scale of 1:15,000 at a contour interval of 0.3 to 0.5 meter and mark areas that are flood prone.

8.3.1 Preparation of Master Plan of Inter-state Drainage Basins

The Study Group has identified about 11 major inter-state regional drains between Delhi & Haryana, Delhi & UP and Haryana & Rajasthan. While designing the drains, it is necessary to maintain the slope of the drains to allow continuous flow in the drains by gravity and to avoid back flow. Considering the invert level of the final disposal point and slope of the drain, intermediate invert levels are decided. In view of this, integrated planning of regional drains in the NCR has to be carried out well in advance to fix the invert levels of the drains. The concept of Master Plan for Drainage basin should be adopted. It would be important to prepare the Master Plan for Drainage for a drainage basin or sub-basin and integrate it with higher

order Drainage Basin Plans. Master Plan for Drainage for a drainage basins be prepared keeping in view the existing population, developments & land uses and also how the basin is proposed to be developed, its proposed population & land uses, The Plan should include L-section, invert levels, carrying capacity and width of the channels, cross section, land requirement and maintenance schedule. The land requirement should be made available to the Departments/Urban Development Authorities/Agencies responsible for reservation of the land (i.e. Town and Country Planning Departments in case of Haryana).

Master Plan for Inter -state Drainage Basins to be prepared jointly as a single project by the concerned State governments and their Departments/Agencies, River Basin Organization, and Scientific Institutions**.** However, construction could be taken up by the concerned State Governments/Agencies of the district/state maintaining the designed invert levels.

8.3.2 Preparation of Master Plan for Drainage for Towns/cities

Rainfall and runoff processes are natural phenomena and do not follow the administrative boundaries of states, districts /cities and ULBs and depend on watershed boundary. The outline of the drainage divide (a ridge or highland dividing two areas that are drained by different rivers or water bodies) follow the actual watershed boundary rather than administrative boundary. A watershed is a geographic region within which water drains into a stream, river or a lake. The watershed may be composed of several sub-watersheds and catchments. The catchment is the area draining surface water to a particular location or outlet point. Therefore, in order to ensure planned development of a city/town, Master Plan for Drainage should be prepared, after incorporating/addressing the aspects such as identification and delineation of watersheds, sub-watersheds and catchment areas at notified planning area level and analysis of their slope and fluvial characteristics. The following should be considered while preparing Master Plan for drainage for a city/town:

a) Master Plan for drainage of a town/city should be prepared within the framework of Master Plan for Regional Drainage within which it falls.
b) The catchment area should be the basis for planning and designing the storm water drainage system in all urban areas of NCR
c) Master Plan for Drainage should also include actionable items such as removal of encroachments; beautification of river banks, land alongside natural and man-made drains and other watercourses; banning/restrictions of undesirable activities; sewage collection, diversion, pumping, treatment, storage, transport, reuse of treated sewage and sludge etc.
d) Master Plan for Drainage should be prepared for towns and cities by the concerned State Government /Departments/ Agencies in close collaboration with Urban Local Bodies, Urban Development Authorities, River Basin Organization, and Scientific Institutions in a time bound manner. Master Plan for Drainage to be prepared for all class I towns of NCR in the first Phase.

8.3.3 Parameters for Design of Storm Water Drain

Rational Method for designing of urban drainage as given in paragraph 5.3.3 is recommended to be continued. However, the basic parameters should be as follows:

i) The basis for design of drainage system should be catchment area and not administrative boundaries.
ii) Rational method is applicable to maximum 80 ha. area only. For designing larger area, it should be divided into smaller units each having area less than 80 ha.
iii) Considering thunderstorms in NCR the rainfall intensity should not be less than 60mm/hr.
iv) Runoff coefficient should be 0.95 as suggested in National Disaster Management Guidelines prepared by NDMA, Govt. of India and which should be suitably adjusted by a reduction factor to be adopted based on local conditions and proposed land uses in the Master /Development Plans.

8.3.4 Buffer Along/Around Water Bodies

Expert Committee constituted by Ministry of Home Affairs, GOI had proposed amendments to Rules and Bylaws, relating to Layout approvals and Building Permissions, to address disaster management issues. The following recommendations of the Expert Committee relating to restrictions of building activity in the vicinity of areas may be adopted which will help in conservation of water bodies and prevent them from pollution:

The water bodies and watercourses be maintained as recreational/green buffer zone and no building activity other than recreational use be carried out within;

i) 100 m from the river edge outside Municipal Corporation /Municipal limits and 50 m within Municipal Corporation /Municipal limits. No permanent construction be permitted within the buffer zone.
ii) 50 m. from the boundary of lakes of surface area for 10 ha. and above,
iii) 30 m. from the boundary of lakes of an area of less than 10 ha/ponds/tank bed lands.
iv) 12 m. from boundary of major canal, streams nallahs, canals, etc.

8.3.5 Protection of Natural Drainage System

i) The natural drainage system has evolved with span of time taking the contours of the general slope of the terrain and ultimately meeting the river / streams within the sub- basin. It should be protected from all kind of encroachments, obstructions, garbage, etc.
ii) Encroachments on nallahs/drains/watercourses be removed
iii) In order to protect the natural drainage system, the nallahs/drains/water courses/flood plains should be delineated and boundaries fixed in new developments.
iv) The Master/Development/Zonal/Area Level Plans should provide concrete measures to protect the natural drainage system by means of proposing the finished/permissible levels

of developmental activities as well as incorporating suitable regulations in these Plans and/or Building Bye Laws and Development Control Regulations for maintaining the proposed finished levels.

8.3.6 Protection of Land for Drainage System

It has been observed that in regional drains and bigger drains in the cities, the landowners on either side of the drain encroach upon the drainage land and start activities like agriculture or construct houses in urban and rural areas. This restricts the accessibility of drains for cleaning, flow in the drain and also hinders widening of drains. There is a need for strict enforcement to check encroachment.

8.3.7 Promotion of recreational use on land along nallah

The land alongside nallahs should be developed for recreational use as public open space i.e. gardens, parks, playgrounds etc. which can be used for jogging, morning walk, etc. The development of the land alongside the nallahs would prevent encroachments and misuse. The treated effluent can be used for maintenance of greenery.

8.3.8 Reservation of land for Adequate Width for Drains

Run off coefficient increases with increase in impervious surface. Development/concretisation of urban areas increases the impervious surface and hence the run off coefficient increases. The low-lying land where the water used to accumulate also gets reduced due to land filling for the urban use/construction. This effectively increases the amount of surface run off and requires increase in the section of drains/widening of drains. In addition to this, heavy machines such as JCB, bulldozers, dumper used for regular cleaning of the drains requires space near the drains. Urbanization is resulting in encroachment to such spaces and a care should be taken to ensure feasibility that this space is not encroached and accordingly necessary provisions should be incorporated in the Master/Development Plans and Zonal/Sector Plans for urban areas and in revenue records in rural areas.

8.3.9 Construction of Roads to Start from Edge

It has been observed that even if adequate right of way (ROW) is provided for proposed roads in the Development Plan, the land is not available at the time of construction/widening of roads. At the initial stage of development, road space requirement is less, therefore, construction of roads is undertaken in parts and generally it is constructed in the centre of ROW. Accordingly, the median, carriageway and drains are developed. Major part of the ROW of the road is left unused on either side of the roads. Drains and footpaths are dismantled and reconstructed at the time of widening of the roads. This increases the cost of construction and impounding of water takes place on roads when the drain is being reconstructed. Many times the land on either side of the road kept for expansion is encroached and it becomes difficult to retrieve this land. It creates congestion on the roads. This problem can be addressed by starting the construction of the road from edge and outermost part of the road is

developed first by constructing footpath, service road, drain and carriageway depending upon the requirement and land for widening of the road is left in the center merged with median. The road can be widened towards the median depending upon the requirement (Annexure 8.1). This will help in reducing the multiple expenses of constructing and re-constructing drains and footpaths along the roads on one side and appropriate slopes in the drains would be maintained as per Drainage Master Plan based on invert levels.

8.3.10 Regulation for Covering of Drain

In urban areas drains run along the roads and public is allowed to cover drains in front of their entrances for access from roads. It has been observed that the drains are covered along the property boundary especially in the commercial property. This results into covering of drains for a longer distance and cleaning becomes difficult which ultimately leads to blockage of drain and flooding on roads. A standard design for the drain for removable cover at regular interval should be incorporated in building byelaws so that the above problem can be avoided. It should be checked by the agency while granting building permission or at the time of providing occupancy certificate. A provision for recovering the demolition costs from the property owners, if any, should be integral part of Bye laws.

It is recommended that the practice of covering the drains for construction of roads should be stopped. Even the bridge/elevated road running over the drain along the alignment of the drain should also be discouraged as pillars obstruct the flow and movement of cleaning machines/ equipment's.

8.3.11 Construction of Bridge over Drains

Where it is unavoidable and when all other options are exhausted, construction of Bridges over drains should be permitted. However, efforts should be made that the construction be undertaken by the agency responsible for its maintenance, after taking into account the L - section and discharge capacity of the drain. The process of issuing No Objection Certificate (NOC) should be discouraged as the other Departments/agencies after getting NOC do not pay sufficient attention to the invert level and discharge capacity. Once the bridge is constructed it becomes difficult to rectify the fault/drawbacks. The practice of bridge construction by RCC Hume pipes should also be discouraged as it also reduces the effective cross sectional area of the drain.

8.3.12 Micro Treatment Plants (Decentralised Treatment and Reuse)

The traditional approach of conveying the sewage to a long distance and then treat it only to dispose of in the stream, does not find priority among Urban Local bodies as it hardly have any financial, economic and scenic importance to them. It is recommended that sewage is treated locally and the treated effluent is utilized for non- drinking purposes e.g. horticulture, gardening, car wash, air conditioning plants, etc. or it can be disposed of in drains.

8.3.13 Segregation of sewage and drainage

The major problem of urban drainage is mixing of sewage with storm water and discharge into the drains. The storm water drains are neither designed nor supposed to carry the sewage. The urban area should have separate sewerage and drainage network. It is recommended that separate drainage and sewerage system be planned and constructed and necessary measures to be taken so that sewage is not mixed with storm water drains during floods.

8.3.14 Treated waste water to flow in rivers, drains and water bodies

Sewage should be treated in the Sewage Treatment Plants to a desired level as specified by Central Pollution Control Board, MoEFCC, Government of India and then only treated sewage effluent should be discharged in the drains. There should be a provision of penalty for agencies discharging un-treated sewage in the rivers, drains and water bodies.

8.3.15 Cleaning of Sewerage System

It has been observed that in case of blockage or crown collapse of the sewers, sewage is diverted to nearby drains. In view of this, it is recommended that agency should clean the sewerage system using modern machines i.e. Jetting-cum-suction machines. Age-old method of using rope-cum-bucket machine for cleaning of sewerage systems should be discontinued immediately as it damages the skin of sewers, which is one of the main causes of subsidence of sewers.

8.3.16 Treatment of Industrial wastes in CETP

The characteristics of industrial wastes are very different from domestic wastes. Industrial wastes are highly toxic and acidic compared to the domestic wastes. Treatment of industrial waste requires more efforts and the technology of treatment depends upon the type of industry and its wastes.

It is desirable that the industrial wastes are treated separately. If there are several industries, a Common Effluent Treatment Plant (CETP) could be developed to discharge industrial effluents into the drains only after treatment.

8.3.17 Disposal of Industrial Effluent in Drains

The practice of discharging untreated industrial effluents into the drains and open ground need to be checked immediately on priority. Common Effluent Treatment Plant (CETP) may be constructed and the industrial effluents be discharged into the drains only after treatment. The cluster of industries may join together as an Association and carry out collection, conveyance and treatment of their industrial effluence in CETP.

8.3.18 Regular Maintenance (cleaning) of Drainage System

The authorities responsible for maintenance of drainage system should prepare a cleaning schedule which should be adhered to. The annual maintenance of drains being carried out before monsoon is very important and be completed before arrival of monsoon. The work should be started well in advance to ensure its completion in time. Since this work is repetitive in nature the standard tender document may be prepared and kept ready to save time. It is desirable that the following schedule is adhered to:

a) Pre-monsoon de-silting of all major drains will be completed by March end each year,
b) Besides the pre-monsoon de-silting of drains, the periodicity of cleaning drains should be worked out, based on the local conditions. The Roster of cleaning of such drains should be worked out and strictly followed,
c) All wastes removed both from the major and the minor drains should not be allowed to remain outside the drain for drying, instead the wet silt should be deposited into a seamless container and transported as soon as it is taken out from the drain. In exceptional cases, the silt may be allowed to dry for about 4 to 24 hours outside the drain before transporting the semi-solid silt for disposal,
d) Completion of work will be certified by representatives of local Residents' Welfare Associations (RWAs)/ Slum Dwellers Associations (SDAs) / Municipal Ward Committee members and Area Sabha members besides third party certification. An appropriate mechanism will be evolved to ensure this,
e) The Manual on Solid Waste brought out by the CPHEEO, MoUD, (2000) should be followed in cleaning shallow surface drains,
f) The amount of solid waste generated varies from catchment to catchment and depends on the type of locality, population, their affluence, etc. Suitable interventions in the drainage system like traps, trash racks can reduce the amount of solid waste going into the storm sewers. Due consideration should be given to internationally available technology for removal of solid waste from storm water drains.
g) De-silting of minor drains will be carried out as part of a regular preventive maintenance schedule. The catchment will be the basis for planning this, as a part of the watershed desilting master plan. Cleaning of minor drains should be taken up from the outfall to upstream side.
h) Ageing systems should be replaced on an urgent and regular basis,
i) Sewerage Master Plan should be prepared to improve the coverage of the sewerage system so that sewage is not discharged into storm water drains, and
j) Adequate budget will be provided to take care of the men, material, equipment and machinery. Special funds should be provided for the safety equipment of the personnel carrying out maintenance of underground man-entry sewers.

8.3.19 Blending of Traditional Approach with Modern Technology

The modern approach is based on the principle of draining storm water within a possible shortest time whereas the traditional approach was to maximize infiltration of rain water and storage. There is a need for blending the traditional approach with modern technology. The concept of "retain the rain water where it is received" need to be embedded in the planning and design of drainage system. With the increase in built-up areas due to urbanization/constructions, impervious areas has been increasing resulting in reduction in the rate of infiltration and consequently rapid increase in surface runoff and flooding. Attempt should be made to utilize the existing rain management facilities and retain the water wherever possible such as roadside, parking lots, houses, buildings, parks etc. A few of the examples of rain management facilities such as ponds, roof top gardens, rain gardens and grassed waterways are given in the Annexure. 8.2 and 8.3.

8.3.20 Development of Rain Gardens

Urban areas have impervious surfaces like roofs, walkways, and compacted lawn areas etc. The impervious cover in a typical city creates five times the runoff than typical vegetated area of the same size. An attempt should be made to provide pervious / porous surface around or near to impervious surfaces to enable the trapping of rainwater to reduce the surface run off. This can be achieved by providing rain gardens.

A rain garden is a porous planted depression that allows rainwater runoff from impervious surfaces to be absorbed. It provides for natural infiltration of rainwater into the soil, reduces peak storm flows, helping to prevent stream bank erosion and lowering for local flooding. (As opposed to flowing into storm drains and surface waters which causes erosion, water pollution, flooding, and diminished groundwater). Rain gardens (Fig. 8.9) can reduce the amount of pollution reaching creeks and streams by up to 30%.

Figure 8-8: Rain Garden along Pavement

The concept of Rain Gardens be incorporated in planning for public parks and on-site storm water management for larger residential areas and should form part of the Lay Out plans / Sectors/ zonal plans. Native plants are recommended for rain gardens because they generally don't require fertilizer and are more tolerant of one's local climate, soil, and water conditions. The plants - a selection of wetland edge vegetation, such as wildflowers, sedges, rushes, ferns, shrubs and small trees - take up excess water flowing into the rain garden. Water filters through soil layers. Root systems enhance infiltration, moisture redistribution, and diverse microbial populations involved in bio filtration.

8.3.21 Rain Water Harvesting

The draft Functional Plan on Water for NCR has estimated that on an average, 6112 MCM/ year of water is lost (un-used) as surface runoff from NCR and has recommended to harvest the same by increasing recharge from the basins through various techniques such as placing recharge structures over drains, recharge trenches/wells, harvesting using lakes & ponds, etc. by increasing the run off time to recharge ground water which is natural way of recharging or induced recharge through various techniques such as revival/ recharge through lakes/ ponds, roof top rain water harvesting, etc. elaborated in the. Plan. It has also proposed to amend municipal acts, building bye-laws and other relevant provisions to promote rain water harvesting by all multi-storeyed complexes, commercial buildings and group housing societies and to maintain them for efficient recharge. The proposals for Rain water harvesting should be adopted.

8.3.22 Recycling

The fresh water resources are limited and efforts are required to be made to use recycled domestic effluents for non-domestic use such as irrigation, watering of lawns, car washing, cooling in power plants, A.C. plants, etc.

8.3.23 Project formulation

NCR participating State Governments/Agencies, ULBs may formulate development programme along with phasing for drainage development/improvement for the respective Sub-regions. The NCR Participating State governments/Agencies may identify major projects for development/improvement of inter-state Regional Drainage System and Sub-Regional Level/City Level to improve the drainage system and prepare DPR for obtaining loan assistance from NCR Planning Board for their implementation.

8.3.24 Institutional Arrangement

There are multiple departments/agencies responsible for planning, design, construction and maintenance of drainage system in urban areas due to which there is lack of coordination in management in urban drainage system. It is recommended that there should be a single coordinating Body for planning, design, construction and maintenance of drainage system in urban areas

8.3.25 Strengthening of Local Bodies

The Urban Local Bodies manage drains in urban area but do not have adequate resources. It is recommended that the ULBs be strengthened in terms of manpower, equipment and finance.

8.3.26 Provision for Fund

Urban Local Bodies have poor financial resources and due to which the maintenance of drains remains neglected. Adequate funds to be provided to the ULBs for regular maintenance and cleaning in order to improve the drainage system. Urban Local Bodies need to look for different kind of funding for strengthening their financial resources. The lands along the drains, which have the potential should be developed to generate a regular income and a part of this could be used for maintenance of the drains.

8.3.27 Capacity Building

Presently, the staff engaged in the maintenance of drains are not trained and learns while working. There is no formal training for the staff for maintenance work. With the introduction of modern technology, the staff also needs to be trained to cope up with the technology. Regular capacity building programmes should be carried out.

8.3.28 Public Awareness Programme

There is a need to create mass public awareness about the consequences of dumping plastic, domestic waste and street cleaning into drains. This should be campaigned via media and other awareness programmes to make people more responsible.

8.3.29 Public Participation in Vigilance

With mass awareness programmes citizen can be made aware and may also be encouraged to report irregularities being noticed by them. In fact people should be encouraged to report any incident, which comes to their notice and needs Government/Authorities intervention. The surveillance and reporting by public will have better coverage and will be more effective than any surveillance by the municipal staff. However, some steps need to be taken to encourage the public to become proactive in reporting the events that need the attention of the public authority.

8.3.30 Free Reporting System

The first step in inviting citizen to report the incident of intervention is to make an arrangement to receive the information in such a way so that the willing person can provide the information easily and free of cost. In this regard, either the information can be received via E-Mail or via a toll free telephone number/ SMS, which could be widely publicized to receive the call form public.

8.3.31 Felicitation of the Information Contributors

In addition to facility for free reporting system, an appreciation of the person by the agency responsible for the maintenance is must. It costs nothing but appreciation by a local authority makes the person to feel the importance of the action taken by him and also assures him regarding the utilization of the information by the authority. The person who has provided the information may be felicitated at public/ annual function by the agency responsible.

8.3.32 Specifications for Surfactants (Detergents)

The surfactants (detergents) being used in house ultimately reach in drainage system. In the domestic waste the difficult items to be treated are detergents. Though there are specifications for detergents to be used for washing of cloths but the cleaning of utensil is also carried out by detergents. There is a need to specify the toxic level in detergents, which need to be adhered to by the manufacturers as all the detergents find their way to water system.

8.3.33 Adoption of Service Level Bench Marks of MOUD:

As part of the ongoing endeavour to facilitate critical reforms in the urban sector, the Ministry of Urban Development has now adopted National Benchmarks in four key sectors-Water Supply, Sewerage, Solid Waste Management and Storm Water Drainage. The Ministry of Urban Development would facilitate the adoption of these benchmarks through its various schemes and would also provide appropriate support to ULBs that move towards the adoption of these benchmarks. The service level benchmarks guidelines for Storm water Drain as provided by MOUD are given in Annexure 8.4. It is proposed that all State and local level functionaries should use Handbook of Service Level Benchmarking in achieving the goal of improved service delivery.

8.3.34 Adoption of Urban Storm Drainage Design Manual of MOUD

The Ministry of Urban Development (MoUD), Govt. of India has constituted an “Expert Committee for the preparation of Urban Storm Drainage Manual”. The comprehensive Urban Storm Drainage Design Manual is under preparation/finalization. The Urban Storm Drainage Design Manual once published by the Ministry of Urban Development will be followed for design, construction and operation & maintenance of the drainage system in NCR.