MASTER PLAN

**FOR**

**DRAINAGE OF STORM WATER DRAINAGE OF THE ALIPUR BASIN**

**IN**

**UNION TERRITORY OF DELHI**

****

**MASTER PLAN ORGANISATION**

**FLOOD CONTROL WING**

**DELHI ADMINISTRATION**

**1976**

**MASTER FOR ALIPUR BASIN**

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**MASTER PLAN REPORT FOR STORM OF ALIPUR BASIN**

INTRODUCTION:-

1.1 Alipur basin is situated on the western bank of the river Yamuna and is on the Northern part of the Union Territory of Delhi. The basin is bounded by the Delhi tail distributory of the Western Yamuna canal on its west, Shahalam Bund on its South, River Yamuna on East and diversion drain No.8 of Haryana State on North. The Najafgarh basin is adjacent to the Alipur Basin on the North. The Najafgarh basin is adjacent to the Alipur Basin, on the West on the South is the DDA Master Plan area. On the East, beyond the river Yamuna is the Shahdara basin. A general map of the features of Alipur basin is enclosed as Drawing A-I. The Grand Trunk Road passes through the centre of this basin from North to South . The Northern Railway line towards Amritsar also runs parallel to the G.T. Road. Part of this basin is protected from river Yamuna by the embankment known as right marginal embankment.

 The total area of this basin is 170 Sq. Kilometer ( 66 Sq. miles). It is generally sloping towards river Yamuna in the East. The maximum and minimum contours are 222.50 m ( 730.00 ft). 205.44 m ( 674.00 ft. ) G.T.S. respectively. The whole basin is rural, except a small area on the South where, about 17.40 Sq. Kilometer ( 6.8 sq. miles) falls within the Master Plan boundary of Delhi. There are Irrigation Channels coming from WJC system in Haryana Irrigation, in the western portion of the basin.

 Three major storm water drains and 10 tributary drains eists in the basin, which are described in detail In Chapter-V “Existing drains and their remodeling”.

 Topographically Alipur basin is a flat area. The basin consists of about 60 villages with a Population of about one lakh. The village populations According to 1971 census is enclosed as Drawing No.A-2 Some portion of this basin adjacent to the right Bank of river Yamuna, is Khadar area i.e. low lying Depressions. This area used to get flooded during Monsoons due to spill from the river Yamuna. After Construction of the right marginal embankment, flooding of this area from river Yamuna has been arrested and the area is being reclaimed gradually.

 The sub-soil water in this basin is generally saline and varies between 3 to 7 metres below the Natural ground level. Two plans showing the maximum and minimum water tables and one plan showing the saline and alkaline area are enclosed as Drawing No.A-3, A-4 & A-5. The sub-soil water tables are generally high towards South-Eastern corner near the Yamuna and near the Southern boundary of the basin along the Delhi tail distributory. In addition to its own catchment, it receives some discharges of storm water from Haryana State as well. The catchment area of Haryana State discharging into this basin is 51 Sq. Kilometer (20 Sq. miles).

**POPULATION STATISTICS OF THE BASIN.**

 There are about 55 villages in the drainage zone of the basin within the Union Territory of Delhi. The total population of the zone as per 1971 census is 80,547 (Drawing No.A-2). Out of the total area 170 Sq. Kilometers ( 66 Sq. miles) only 17.40 Sq. Km. ( 6.80 Sq. miles) area on the Southern Boundary is to be developed under the Master Plan programme for urbanization by the year 1981, and all other areas are rural. Accordingly to national capital region report, there is a proposal of radial arterial roads being developed all around the central core of urban Delhi. One of the arteries will be the G.T. road passing through the Alipur basin. However, it has been specifically mentioned in the report that no urbanization should be done in the rural areas of the Union Territory surrounding the urban zone, as it will cause over congestion.

**JURISDICTION OF M.C.D. AND DELHI ADMINISTRTION AS REGARDS DRAINAGE ARRANGEMENTS.**

 As already mentioned, Alipur basin is mainly agricultural. The whole area is rural except an area of 17.40 Sq. Kilometers on the South, which is being gradually urbanized. A number of important semi- urbanized villages such as Narela, Burari, Alipur etc. are stipulated within this basin of which Narela is going to be developed as an industrial Estate.

The internal drainage system of all these Villages are being maintained by the M.C.D. It has been observed that in a number of such semi-urban villages the internal drainage arrangements are not properly maintained. The following remedial measures are therefore suggested.1.2 Stress has been laid in the N.C.R. Report on the development of rural areas. Accordingly rural centres have been classified into the following three categories to make the planning more effective, realistic and disperse the population uniformly.

(i) Growth centres: - These will serve an area of 200-300 sq. kilometers and projected population of 1.20 lakhs to 2.00 lakhs by 1981. These centres would have activities mainly non-agricultural in nature with all centralized amenities and facilities in the field of education, medical, public health, whole sale and Retail shoppings, civic cultural and re-creational centers etc. In Alipur basin, the Alipur village is Proposed to be developed into a growth centre.

(ii) Central place villages:- These will serve an area in the radius of 30 to 80 kms. and a projected population Range of 20,000 to 40,000 in 1981. All the villages will also have a predominantly agricultural economy and will provide central service facilities for the Village in the cluster. In this basin, the villages Prhaladpur, Burari, Bakthawarpur & Narela will develop into Central Place villages.

( iii) Basic villages:- These will serve an area in the radius of 3 to 5 Kms. with existing abadi.

1. Central place and basic villages:-

 (a) Absence of any planned drainage system in the villages at present creates a very unhygienic Condition resulting in various diseases amongst the villagers. All drains in the villages must have Proper gradient for quick drainage. The drains must outfall into sump wells at the periphery of the villages where from these effluent waters can be distributed to the fields for irrigation purpose. If necessary, the sewage content may be diluted by putting additional tube wells water.

 It is suggested that complete plans of the villages showing their drainage systems are to be prepared by the local body and submitted to the Flood Control Wing, Delhi Administration, for necessary improvements to the same.

(b) Wherever the villages are normally flooded by river water or be surrounded by storm water the plinths of buildings should be raised above the maximum expected flood level. The existing Structures liable to flooding are also to be gradually raised higher. No unauthorized construction at low lying area should be permitted. Necessary enforcing legal binding against such unauthorized construction are to be issued to defaulting villagers.

(C) Villages which are liable to flooding normally must be provided with the permanent pumping Sets for draining out the water to the nearest available arterial drain. Development charges may be levied from the villages for installing such pumps. Such pumps will be utilized for shallow well irrigation, during non-monsoon months,

(B) Growth centres.

 The growth centres are at present having some sort of internal drainage arrangements which are very inadequate. No plan exists showing the details of the drainage systems. This must be properly surveyed and complete drainage plan with L-sections of the drains should be submitted to the Delhi Administration, Flood Control Wing for approval. Here also the drains must be terminated at Sump wells.Which in turn can be used to irrigate fields. The drains must be well planned keeping in view the future incre ase in population, increase in paved areas and increase in the industrial water. All drains in congested localities must be covered. Construction of building in low lying area should be banned and all such construction should be dismantled by the owners themselves/by the appropriate authority. If at all the buildings are to be constructed at low Areas the plinth must be kept above the expected flood level. All roads provided in such area should have levels above the flood level and covered drainage system by their sides. Persons misusing the drains or responsible for chocking, should be punished under law.

**1.3: Rainfall studies (Alipur basins).**

 The Alipur basin covers about 170 sq. km. of rural area of U.T. of Delhi. till 1973. The number of rain gauges within Delhi Territory was limited to only two stations i.e. Palam & Safdarjung, for which long term rainfall records were available. According to Reddy Committee recommendations, 14 Self-recording rain gauges were installed in consultation with IMD within the Delhi Territory during 1972. These are under control of the Flood Control Department of Delhi Administration, out of which Alipur and Bakthawarpur stations are within the Alipur Basin. Besides, there is Siraspur rain gauge station which is an ordinary one under control of Haryana Govt. and is situated in the Alipur Basin.

In all, data from seven rain gauge stations basin can be used for Alipur namely Bakthawarpur, Alipur, Siraspur, Badli, Gurmandi, Loni and Kanjhawala assessing rainfall in the basin. Rainfall data from the above rain gauge stations except Siraspur is however available for a period of only for 3 years, (which are self-recording rain gauge stations) and hence cannot be taken for storm frequency

analysis. The daily rainfall data of only Siraspur rain gauge station, which is an ordinary rain gauge located within the basin, is available for a period of 18 years (1958 to 1975) and has been put to frequency analysis. The influence of this station has been taken as 100% over the entire area of the basin.

DESIGN STORM:-

 Alipur basin mostly consists of villages, surrounded by vast tracts of agricultural land, drained by natural surface drains. According to the norms reported in Chapter-I, the drainage systems in the rural Delhi should be so designed as to restrict flooding to a maximum period of 3 days, with a return period of 5 years. From a statistical analysis of the maximum rainfall series of Siraspur rain gauge station for a period of 18 years ( 1958 to 1976), the 3 day maximum rainfall corresponding to 5 years & 10 years return period comes to 6.6” and 7.54” respectively ( vide analysis-I). For comparative study the point rainfall at Palam for which the data is available for longer period, has also been statistically analyzed, which gives the 3 day maximum rainfall of the order of 8.5” and 10.65” for a return period of 5 years & 10 years respectively (vide analysis-II). Similar studies of design storm were carried out by the Reddy Committee in 1958, on the basis of Palam data and a figure of 8.2” as the day maximum rainfall for 5 years frequency was recommended.

 With 6.6”as the design storm, the runoff, on the basis of 3 day retention and 15% runoff factor, comes to

=6.6 x 640 x 15 =8.8cusecs/sq. miles. 12 2x3 100

The drains in this basin having comparatively smaller catchments and lesser time of concentration, a slightly higher runoff of 10 cusecs/sq. mile is adopted. This will also bring the norms at par with adjacent drains of Najafgarh Basin.

RAINFALL DISPERSION FACTOR:-

 Rainfall dispersion factor need not be considered over the design storm in this basin, as it has been computed on the basis of the data from the rain gauge station situated within the basin and the catchments of the drains being relatively small.

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Analysis I (a)

Alipur Basin

Rainfall frequency analysis (Fitting of partial series Data) (for 3 days rainfall intensity-Siraspur Rain gauge).

No. of years = N= 18 (1958-75)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Year | Total PeakRainfall ( mm)(X) |  M | T=N M  | X=Log. T | XY | X2 |
| 1960 | 184.15 | 1 | 18.0 | 1.2553 | 231.2 | 1.57 |
| 1969 | 177.80 | 2 | 9.0 | 0.9542 | 169.5 | 0.91 |
| 1968 | 177.80 | 3 | 6.0 | 0.7782 | 138.2 | 0.60 |
| 1971 | 172.72 | 4 | 4.5 | 0.6532 | 112.8 | 0.43 |
| 1972 | 172.72 | 5 | 3.6 | 0.5563 | 96.2 | 0.31 |
| 1967 | 170.18 | 6 | 3.0 | 0.4771 | 81.2 | 0.23 |
| 1965 | 157.48 | 7 | 2.571 | 0.4101 | 64.5 | 0.17 |
| 1975 | 161.13 | 8 | 2.25 | 0.3522 | 53.3 | 0.12 |
| 1964 | 148.59 | 9 | 1.8 | 0.2553 | 37.6 | 0.065 |
| 1966 | 139.70 | 11 | 1.636 | 0.2138 | 29.8 | 0.046 |
| 1968 | 129.79 | 12 | 1.50 | 0.1761 | 22.9 | 0.031 |
| 1974 | 120.65 | 13 | 1.385 | 0.1415 | 17.1 | 0.020 |
| 1961 | 114.30 | 14 | 1.286 | 0.1092 | 12.5 | 0.013 |
| 1969 | 111.76 | 15 | 1.20 | 0.0792 | 8.8 | 0.0063 |
| 1970 | 102.87 | 16 | 1.125 | 0.0512 | 5.3 | 0.0026 |
| 1963 | 95.25 | 17 | 1.059 | 0.0240 | 2.3 | 0.0006 |
| 1973 | 92.71 | 18 | 1.00 | 0.0000 | 0.0 | 0.0000 |
| Total= | 2566.92 |  |  | 6.7879 | 1127.9 | 4.6135 |

Annexure-1(b)

Alipur Basin ( 3 days rainfall analysis).

 -

Y = E Y = 2566.92 = 142.61

 N 18

 - = E x = 6.7879 = = 0.3771

X N

 (X) 2 = 0.142

 B = EXY-NXY = 1127.9-18x0.377x142.61

 X2 – N(X) 4.6135-18 x 0.142

 = 162

* + 1. = 78.80

A= Y – B.X = 142.61-78.8 x 0.3771

 = 142.61 – 29.75

 = 112.86

Z= A+B. Log. T

= 112.86+78.8 x 0.699

= 112.86+ 55.05 = 167 mm.

Where Z = 3 days maximum rainfall for a return period of

5 years = 167.91 mm

 Or = 6.6 mm

10 years = 191.66 mm.

 = 7.54

Analysis – II (a)

Rainfall frequency analysis

Palam rain gauge station (3) day rainfall analysis numbers of years of records N=24(1951-1975)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Years | Annual PeakIn mm(Y) | M |  T=N M | X=Log 10 T | XY | X2 |
| 1972 | 382.60 | 1 | 24.0 | 1.3802 | 528 | 1.91`00 |
| 1967 | 246.20 | 2 | 12.0 | 1.0792 | 266 | 1.1600 |
| 1955 | 225.55 | 3 | 8.0 | 0.9031 | 204 | 0.8200 |
| 1964 | 202.70 | 4 | 6.0 | 0.7782 | 158 | 0.6100 |
| 1971 | 197.80 | 5 | 4.8 | 0.6812 | 135 | 0.4600 |
| 1958 | 190.00 | 6 | 4.0 | 0.6021 | 117 | 0.3600 |
| 1966 | 188.70 | 7 | 3.43 | 0.5353 | 102 | 0.2870 |
| 1956 | 185.93 | 9 | 2.67 | 0.4265 | 79 | 0.1820 |
| 1962 | 172.30 | 10 | 2.40 | 0.3802 | 67 | 0.1450 |
| 1954 | 166.62 | 11 | 2.18 | 0.3385 | 56 | 0.1150 |
| 1963 | 147.10 | 12 | 2.0 | 0.3010 | 44 | 0.910 |
| 1957 | 140.90 | 13 | 1.85 | 0.2672 | 38 | 0.712 |
| 1969 | 125.70 | 14 | 1.71 | 0.2330 | 29 | 0.544 |
| 1968 | 124.30 | 15 | 1.6 | 0.2041 | 25 | 0.416 |
| 1973 | 122.20 | 16 | 1.5 | 0.2041 | 25 | 0.416 |
| 1965 | 119.20 | 17 | 1.41 | 0.1492 | 18 | 0.223 |
| 1953 | 117.35 | 18 | 1.33 | 0.1239 | 15 | 0.177 |
| 1960 | 117.10 | 19 | 1.36 | 0.1004 | 12 | 0.0104 |
| 1952 | 103.63 | 20 | 1.2 | 0.0792 | 8 | 0.0063 |
| 1974 | 87.70 | 21 | 1.14 | 0.0569 | 5 | 0.0032 |
| 1970 | 86.20 | 22 | 1.09 | 0.0374 | 3 | 0.0014 |
| 1969 | 67.00 | 23 | 1.04 | 0.0170 | 1 | 0.0003 |
| 1951 | 63.50 | 24 | 1.00 | 0.0000 | 0 | 0.000 |
|  | 3774.98 |  |  | 9.2270 | 2022 | 6.6265 |

Analysis II (b)

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Y = E Y = 3774.98 = 157

 N 24

-

X = E X = 9.2270 = 0.384

 N 24

(X)2 = 0.1475

B = E XY - NXY

 X - NX2

 = 2022.24 x 157 x 0.384

 6.6265 - 24 x 0.1475

= 2022 – 1450 = 572

 6.6265-3.54 3.0865

=85

A Y – B X = 157-185 x 0.384

 = 157.71 = 86

3 days maximum rainfall

for 5 years return period = A+B Log 10 T = 86+185 Log 10

 = 86 + 185 x 0.699

 = 86 + 130

 = 216 mm.

 = 8.5 inches.

3 days maximum rainfall

For 10 years return period = 271 mm.

 = 10.65 inches.

2.0 Design criteria

* 1. Design discharge
		1. Rural drains:- The rural drains in the Alipur basin have been designed to restrict the flooding to a maximum period of 3 days with a return period of 5 years. A unit discharge of 10 cusecs per sq. mile has been adopted and the design discharge for the rural drains. The basis has been discussed in the chapter on rainfall, in detail,( Refer Para 1.3)

2.1.2 Urban drains:- For the urban drains the unit discharge has been calculated as ½ cusecs per acre. The basis of this has been discussed in chapter of the outline of Master Plan.

* 1. Design section:-

 The section of the drains have been designed with manning’s formula for open channels for uniform flow.

2.2.1: Value of ‘n’:

 The following values of a have been adopted.

1. Unlined section in natural earth: 0.025
2. Lined section – Brick lining and/or

Rubble masonry: 0.017 to 0.018

2.2.2 Bed Slope: - The bed slopes in the different drains have been decided with the following considerations:-

1. To avoid falls in the drains as far as possible.
2. To limit the velocities within permissible values.
3. To maintain the existing section of bridges and culverts as far as practicable.

* + 1. Velocity:- All the drains in the basin are proposed to be notified. Velocity in the drains are kept within the non silting and non scouring limits and they are generally between 0.45 m/sec to 1.22 m/sec. in case of unlined sections and upto 2,.7 m/sec. in case of line sections.
		2. The following side slopes are provided for all unlined rains.

 In cutting 1 (H): 1 (V)

 In filling 2(H):1 (V)

* + 1. Free Board: - Minimum free board of 0.3 m has been provided where the section of the drain is very small. In other cases free board has been provided as given below:-
	1. Discharge upto 500 cusecs free board 0.5 m
	2. Discharge more than 500 cusecs free board 1 m.

 In certain cases of drains, no free board has been allowed depending upon the topography of the area.

* + 1. Provision of Roadway.

 Inspection paths of minimum 5.0 m. width has been proposed on both the banks in case of important drains.

2.3 Bridges/culverts

2.3.1 Water way: - In case of culverts/bridges which are existing and the drain across is proposed to be remodeled, remodeling of culverts/bridge has not been recommended for cases where the ratio of water way between water way in drain to that of culvert is 0.5 and more. If the ratio is less, the culvert bridge is recommended to have an additional opening of suitable span.

 In case of new culverts/bridges, the water way shall be suitably designed.

* + 1. Afflux:

In case of existing culverts, which are not recommended to be remodeled, it is ensured that value of afflux is limited to 0.2 m. For new construction of bridges/culverts, following are recommended to be adopted.

(a)New structures closely located 0.16m (max).

 (b)New structure considerably 0.225 m (max)

* + 1. Depth of foundation:

The depth of foundation of the bridges/culverts are to be checked for safety against a design discharge of 30 percent excess of design discharge at the location of bridge/culverts.

* + 1. Vertical clearance:-

Following minimum vertical clearances are recommended to be adopted for new bridges/culverts:-

(a) Discharge upto 0.30 cumecs: 0.15 m.

(b) Discharge between 0.30 cumecs and 3.0 cumecs: 0.45 m.

(c) Discharge between 3.0 cumecs and 30.0 cumecs: 0.60 m.

 (d) Discharge above 30.0 cumecs: 0.90 m.

However, in case of existing cross-drainage works, the above norms are not adopted except that a minimum free board of 0.2 m. is only allowed.

1. Problem of Drainage congestion at present.

The water logging and drainage problem in this basin can be generally categerised as follows:-

* 1. Drainage congestion during rainy season.

On account of depressions at several points in the basin of storm water from the surrounding areas which do not have proper outlet into some regular drain, collects during the monsoon in these depressions. The major problems in the category are around the following villages.

* + 1. Jheel near Lampur village

 This Jheel is near the Haryana Border. This Jheel receives storm water mostly from Haryana. A link drain called the Bankner Link drain was partly constructed in the Alipur drainage scheme for draining out this area, but the work on the drain was not completed. As a result, large tracts of fields got submerged whenever there is heavy rainfall in the catchment. The Bankner link drain has been proposed to be remodeled & extended to carry the whole of the discharge of Lampur Jheel area and also discharges of Narela Link drain-I ( see also Para 3.2.1), which will drain out part of the Narela village on the North. The Bankner link drain will outfall into Drain No.6 near Haryana border.

* + 1. Kadipur, Kushak Khurd and Horse shoe Jheel.

 The area bounded on all sides by Shahalam bund, G.T. Road, Burari Creek and Bawana Escape, used to be inundated by Yamuna every year during the floods. With the construction of the Right Marginal Embankment, the area is now free from the effect of flood, but the local storm water as well as the flow from across the G.T. road during monsoon gets concentrated in these Jheels. There being no proper link from these Jheels to the only drainage channel of this area, viz. Burari Creek, these areas remain inundated for long period. A number of link drains have now been proposed to drain out the water of these Jheels into the Burari creek. After construction of these link drains and remodeling of Burari Creek, the drainage problems of the area is expected to be solved. The L-Section of the proposed rains and remodeling of Burari drain are attached as Appendix A-21, A-22, A-23, A-24,A-25.

* + 1. G.T. Road- Northern Railway line pocket.

The area between G.T. Road and Northern Railway Link and South of Bawana Escape is also having drainage problem. At present, the storm water gets stagnated in large areas in this region or crosses the G.T. Road and gets collected in the Jheels ( referred in Para 3.1.2). It is now proposed to drain this part by the provision of a link drain running towards South and out falling ultimately to Najafgarh drain through the Model Town Area.

* + 1. Narela Mandi & Bhorgarh

Narela has developed into a town due to the large marketing centre. The mandi is situated in the Southern part of the village. Considerably quantum of sullage flows out of Narela and in the absence of the adequate drainage system, sullage stagnates near a culverts on Alipur-Narela road, giving room for health hazards. The problem of drainage is accentuated during monsoon, disrupting the marketing activities.

DDA is proposing to set up an industrial estate on the South of Narela village. Reckoning this area as urbanized, a considerably quantity of storm water will have to be drained from this proposed industrial area, for which at present there is no link drain available in the neighborhood.

Bhorgarh village, South of Narela on the Narela-Alipur road suffers from drainage problem during monsoon due to non-existence of any drain. Originally there was a proposal to construct a Bhorgarh link drain draining to Bawana Escape and this was dropped when the Alipur drainage scheme was being revised. Since this area is on the lower contours, it is felt that a link drain is necessary.

 In order to cater for all the above three drainage problems, a link drain is being proposed, from culverts near the Narela Mandi, along the Narela-Alipur road, which will carry the discharges from Narela Mandi, Narela Industrial Estate and the Bhorgarh pocket and will ultimately join the Bawana Escape at RD 13716 m. The proposed L-Section is shown in Appendix A-10. It is suggested that during the non-monsoon period, the sullage from Narela Mandi, which is being carried by this link drain, will be utilized for irrigation purposes in the fields opposite Bhorgarh, by supplementing it with tube well water.

* 1. Village ponds situated in the Abadies.

A few villages mentioned below are having ponds in their neighborhood, where the storm water from the villages collects during monsoon. These ponds are to be connected at their periphery, to the nearest regular drains, as otherwise they overflow inundating the hutments and the roads, in the villages.

* + 1. Narela Pond.

The major problem in this category is the pond near village Narela. Part of the village and the storm water from the Northern part of this semi-urbanised village collects in a pond at its Northern end. During monsoon, MCD resorts to pumping to remove the surplus water from the pond and disposing it off the surrounding agricultural fields. For disposing of the surplus water of the pond during monsoon, a link drain (Narela link drain No.1) is proposed to be taken to Bankner link drain (also see Para 3.1.1). It is feasible to utilize the sullage water for irrigation during the dry season, after supplementing it with tube well water. The alignment and L-sections of these proposals are marked at Appendix A-17.

3.2.2:- Sanoth.

The pond in Sanoth village also over spills the adjacent link road and floods the fields, in the absence of any regular connection to the Sanoth link drain. Proper drainage channels within the ‘Lal Dora’ area has to be provided by the MCD, upto the Sanoth Link drain.

3.3: Village affected during high flood of Yamuna

Under this category a number of important villages such as Gopalpur, Wazirabad, Jagatpur, Hiranki, Mohammadpur-Ramzanpur, Tigripur & Palla suffer during the high flood in the river Yamuna, when the flood water surrounds them and cuts them off for a number of days and at the same time the crop is destroyed in the cultivated fields all round. The Right Marginal Embankment already constructed from Wazirabad Barrage to Bawana Escape outfall point, needs to be extended further, upto the Haryana Border, thereby protecting, most of the above villages such as Mohammadpur-Ramzanpur, Tigipur, Hiranki Palla etc. The these villages that are between the R,M.E. and Yamuna i.e. Gopalpur, Wazirabad and Jagatpur, however needs a ring bund to protect them and a link road on embankment and suitable culverts. After extension of R.M.E. proper drainage provision will have to be made for drawing out the local storm discharges from these villages.

Alignment of the proposed extension of R.M.E. and the internal drainage system are shown in Drawing No.A6 & A20. The new drains proposed in this area will outfall into river Yamuna directly through outlets suggested in the proposed embankment.

* 1. Inadequate surplusing arrangements of Irrigation channels.
		1. Khera Kalan

The major problem for drainage, due to overflow or seepage of the irrigation water, is in the region near Khera Kalan village. The irrigation water from Delhi Tail Distributory seeps through the irrigation channels and collects near inhabited portion of the village. A drain called Khera Kalan drain which is supposed to carry this water through adequate is at present failing to relieve the water logging of this area. A proper section of Khera Kalan drain has been proposed and this is enclosed as Appendix A-13.

* + 1. Rajpur Distributory.

A similar problem of less magnitude exist at the tail and of the Minor of Rajpur distributory. The surplus water of this minor passes through a few depressions and ultimately falls into the Hamidpur link drain. Unless these depressions are properly connected, the surplus water stagnated in these areas hampering proper cultivation in the fields. Extension of Hamidpur Link drain in its upper reaches has therefore been proposed. Hamidpur Link drains outfalls into Drain No.6.

* 1. Drains carrying storm water from outside Delhi.

Originally, drain no.6 from Haryana used to carry a discharge from a vast area beyond the Union Territory of Delhi and used to discharge into Delhi. Recently, diversion drain no.8 was constructed by the Haryana Government for intercepting the discharge of drain No.6 and running in Haryana Territory itself. However, storm water from adjacent catchments North of Delhi-Haryana boundary are directly coming to the Alipur Basin. This discharge from about 19.00sq. miles of area, is being catered by the drain No.6. As per the decision reached in the Ministry of T& P, the spill from drain No.8 into Drain No.6 should not be more than 200 cusecs. Drain No.6 should therefore be adequate to take a spill of 200 cusecs of water from Drain No.8 in addition to its self catchment of 35.32 sq. miles (out of which 19 sq. miles if in Haryana). It is suggested that a discharge and gauge reading station to be located during monsoon at the border, to check, if more than the agreed discharge of 200 cusecs is at any time being passed from Haryana and to report, whenever, such overflow is sent to Delhi Territory.

1. Improvement proposals made by previous consultants.

Four different authorities had previously examined the drainage problem of the U.T. of Delhi. They are:-

* + 1. Reddy committee 1959.
		2. Moti Ram committee-1964
		3. J.P. Jain committee-1968
		4. J.P. Tripathy, Member (Floods) -1973 of the above reports, Shri J.P. Jain and Moti Ram had discussed in details drainage problem in the Alipur Block and their summary of recommendations are given below:-
	1. Moti Ram committee:-
		1. The outfall of Bawana Escape into the Yamuna has become chocked and should be cleared.
		2. A ring bund should be constructed round the existing garbage dump at Badli.
		3. Proposals may be invited for improving conditions in areas served by drain No.6 which suffer from flooding at present.

4,2 J.P. Jain Committee.

4.2.1 Model experiments maybe carried out at the Central Water & Power Research Station, Poona, to find out as to what adverse effects, if any, the construction of bunds in low reaches on the right bank above Wazirabad Pumping Station, which will Cut off same of the valley storage, will have on the U.P. Side, Shahdara Bund, and the gauge of the Railway Bridge. If this is not very appreciable, the construction of the bunds may be taken up gradually. Levels of those villages, which suffer damage even during normal floods in the Yamuna, may be raised.

4.2.2 The ring bund around village Mukhmelpur should be completed, raised and strengthened before the flood season of 1968. For draining out the water from the area within the bund a gated sluice should be provided. Arrangements should also be made for pumping out the water from the enclosed area into drain No.6 and Bawana Escape when the water level in them may be high.

4.2.3 Burari bund should be raised, strengthened and extended upto village Jagatpur and the river side slope should be pitched. A gated culvert may also should be provided in the existing gap between the bund and the village.

* + 1. For protection of village Jagatpur, Burari Bund should be extended upto village Burari and the spurs recommended by Poona Research Station should be tied to it. Every 4th spur starting from the last spur on the downstream side should be made of stone in the last 100 feet along with its nose. It should also be provided with stone apron of suitable width and thickness. However, before this work is taken up, economics of this scheme as compared to the cost of shifting the village to a safer place should be worked out and the more economical alternative should be adopted.
		2. In order to deal effectively with the waters coming down from the rural and urban areas of Delhi State itself, a supplementary drain of capacity varying from 4,000 cusecs at head to 4,500 cusecs at the tail which will take off from Najafgarh drain on its left bank near R.D. 88,000 opposite the outfall of the proposed Pankha Road or the cantonment drain and run in a north easterly direction for about 7 miles and then take a turn towards the east until it meets the Shah Alam Bund which will form its right bank and fall into Najafgarh drain below its tail regulator should be constructed now or later as may be found feasible. However, necessary steps to acquire the land required for constructing the drain which will be 15 to 16 miles long and will have a bed slope of 1 in 8,000 should be taken up as early as possible as the acquisition proceedings take a long time.
		3. Remodeling of Bawana Escape for a maximum discharge of 715 cusecs at its outfall should be completed as early as possible and the work of clearing its existing link drains and constructing new ones also needs to be expedited.

* + 1. While remodeling drain No.6, the capacity of the proposed Escape from Nahri Major distributory of Western Yamuna Canal near village Narela and the siphon for the latter which will drop into its should be kept in views.
		2. Upper portion of Burari drain as also Burari creek needs to be suitably remodeled.
		3. Until a Master Plan for drainage of Delhi State is prepared, and approved by the competent authority the clearance of all drainage schemes, whether old or new should be obtained from the Flood Control Wing before they are taken up for execution.

5.0 EXISTING DRAINAGE SYSTEM AND PROPOSED REMODELLING.

 5.1 In the Alipur basin, there are three major drainage system viz. Bawana Escape, Drain No.6 and Burari Creek and drain. These drainage systems are discussed in detail as under:-

* 1. Bawana Escape

The Bawana escape forms the major drain for Alipur basin. This crosses the basin. This crosses the basin from North-West corner and drains down to Yamuna River at a point 10 Km. North of Wazirabad pump station. At present in the basin of Bawana Escape, nearly 1611 hectares of irrigated/agricultural land gets inundated during monsoon, due to inadequate drainage facility. A depth of water of 0.6 m to 0.8 m stagnates on these fields for sufficiently long periods causing substantial loss to the cultivators in the basin.

Bawana Escape has a length of 26.34 km. from Daryapur to its outfall point in Yamuna. The catchment area of Bawana escape is about 8750 hectares, exclusive of the catchment area of Drain No.6 (which joins Bawana Escape in its lower reach). The overall catchment area of Bawana escape is about 18100 hectares, at its outfall point and has a maximum discharge carrying capacity of 39.20 cumecs at outfall point.

Bawana escape has the following link drains through which the basin is drained into Bawana escape.

 Length catchment area Max. discharge.

1. Ghoga link drain 5.18 Km. 1480 hect 1,65 cumecs

2. Sanoth link drain 3.35 Km. 1235 “ 1.36 cumecs.

3. Narela link drain No.II. 3.360 Km. 620 “ 11.20 “

4. Nayabans link drain 7.04 Km. 1925 “ 2.12 “

5. Alipur link drain 4.40 Km. 770 “ 0.85 “

The self catchment area of Bawana escape is 2720 hectares.

Bawana escape, in addition to functioning as drain to dispose of storm water would also function as an escape for Delhi Tail distributory. During the dry weather, Haryana Govt. proposes to let out a discharge of 1000 cusecs into River Yamuna through Bawana escape from DTD, for purposes of augmentation of Water Supply to Delhi City. However, this maximum discharge from DTD is confined only to dry season (and not during monsoon when Bawana Escape is carrying storm water).

Hence proposed section of Bawana escape is designed for a minimum discharge capacity of 1000 cusecs. The discharge in Bawana escape is more than 1000 cusecs only after Drain No.6 joins this, and thus the design section of Bawana escape is changed in the downstream of junction of Drain No.6.

There is no regulator present at the outfall point of Bawana escape in river Yamuna, as such when river Yamuna is in floods, back-water effect will exist in Bawana escape. In order to contain the back flow, the banks of this drain have been sufficiently raised above FFL of Yamuna (at 3.00 lakhs cusecs discharge.) The proposed section of Bawana escape has been retained on similar lines and top with of banks are kept as 211.200 in (for Right Bank ) and 211.200 in ( for left bank), so that there will also serve as roads.

 Since Bawana escape crosses Northern Railway track and G.T. Road, the proposed design has taken into consideration feasibility of modification, without dismantling the existing structures.

 The link drains draining into Bawana escape are discussed separately in Para 5.6.

5.3 Drain No.6

 Drain No.6 was originally the tail end of a drain from Haryana, carrying large storm water discharge from a vast area beyond Union Territory of Delhi. As per the estimates of Haryana Govt. the catchment area of the drain (at its present junction for Drain No.6 with No.8) is 4700 hectares. With the construction of Division Drain No.8, which now independently carries the storm water within Haryana Territory to Yamuna, the present catchment area of drain No.6 is only 655 hectares at the point where the drain enters Delhi Border.

As per the decision reached in the Ministry of Irrigation Power, the spill from Drain No.8 into Drain No.6 shall be limited to 200 cusecs and that too, when Drain No.8 is flowing above its HFL (The full supply discharge of DrainNo.8 at this point is 6500 cusecs.).

Drain No.6 has a length of 13.0 Km. upto its outfall point in Bawana escape. The total catchment area is about 9350 (with 4850 hectares of catchment area lying in Haryana State) and has a maximum discharge carrying capacity of 19.10 cumecs at outfall point.

 Drain No.6 from North and joins Bawana escape, crossing the G.T. Road at two locations. The drain collects storm water from Northern and Eastern portions of Alipur basin and has the following link drain apart from its own catchment.

 Length Catchment design discharge

1. Bankner link drain 5.85 Km. 3920 hec. 7.40 cumecs

2. Tikrikhurd link drain 1.94 Km. 392 hec. 0.74 “

3. Hamidpur link drain 4.55 Km. 1720 hec. 1.90 “

Self catchment area of Drain No.6 is 3320 hectares.

There is no regulator present at the outfall of Drain No.6 into Bawana escape, and when River Yamuna is floods, back water effect will also exist on this drain through ‘Bawana escape as such the banks of the drain will have to be raised above FSL of Yamuna. The top width of embankment is proposed to be retained at 3.0 m. so that the same can function as an inspection of path. In view of the fact that this drain crosses G.T. Road at two locations, the culverts here need remodeling. However, at one location i.e. at RD 7130 a new culvert of sufficiently large size is under construction which when commissioned need not be remodeled. the link drains draining into drain no.6 are discussed separately in Para 5.7.

* 1. Burari Creek and Drain.

Another important system of drain in the Alipur basin is the Burari creek and Burari drain. Burari creek serves the majority of area lying between R.M.E. and G.T. Roads on East and West, Bawana Escape on North and Shahalam bund in the South. This area was originally being inundated by Yamuna’s floods before the construction of the Right Marginal Embankment. Now, due to the nature of shallow basin, the local storm water stagnates during monsoon for sufficiently long periods to affect cultivation and also affecting the fertility of soil.

A number of link drains are now being proposed to drain out the Jheel area viz. Kadipur, Kushak-Khurd, Horse show Jheel, Mukundpur etc. drain to the Burari creek. The length of this drain is about 13.25 Km. upto the outfall point at Najafgarh and a catchment area about 3760 hectares.

 Apart from its own catchment self-catchment (area of about 1910 hectares) the following area the proposed link drains.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Length | Catchment area  | Discharge |
| Kadipur Link drain | 2.20 Km. | 463 hect. | 0.59 cumecs. |
| Horse shoe link drain | 2.0 Km. | 386 hect. | 0.43 cumecs. |
| Horse shoe link drain II |  0.60 Km. |  386 hect. |  0.43 cumecs. |
| Radio Colony link drain. |  2.55 Km. |  450 hect. |  15.60 cumecs. |
| Burari drain II |  0.50 Km. |  2.30 hect. |  0.26 cumecs. |

Burari creek falls into Najafgarh drain and at the outfall point, a gated regulator exists. Though the civil works for regulator is completed, the provision of gate is not made till date. Burari creek is below the back water level of Yamuna, even at low floods. Hence provision of this gate is very essential.

 Burari Drain I, at the upper part of the area starts near Bawana escape and drains directly to Yamuna across the R.M.E. Due to this direct outfall into Yamuna a regulator is existing at the outfall point, near RME.

 Link drains falling into Burari creek drain are discussed separately in Para-5.8.

 There are no important roads crossing these proposed rains, as such remodeling of culverts do not arise.

At present considerable urban discharge from Model Town area are discharged into Burari creek, by pumping. Very serious water stagnation therefore occurs during monsoon, whenever Yamuna levels are high. To avoid this, a detailed scheme is worked out and described below.

5.5 Wazirpur complex.

As already discussed in Para 3.1.3, there is hardly any proper drainage arrangements for the rural catchment area covering villages Budh-Bijapur, Siraspur, Libaspur, Samipur etc. between G.T. Road and Delhi tail distributory. During monsoon period, the storm water collects in depression and then flows across G.T. road to the Jheels on the eastern side thus causing a serious congestion in the Burari creek region.

Similarly, a large part of urban area like Shalimar Bagh, Model Town are being drained through a small covered drain called Wazirpur drain, which is again out falling into the tail portion of Burari creek. The Burari creek region behind Model Town is already a very low swampy region and the discharges from these urban areas stagnate and meander into extensive agricultural fields around Burari Creek. During monsoon, the water from this area will have to be pumped out for considerably long periods, as pumping will have to be restored to, even at Yamuna’s flood level of 5000 cusecs.

Master Plan expert committee examined this issue in detail and has suggested that independent drains discharging directly to Najafgarh drain by gravity flow will have to be constructed to prevent water logging and serious problems of pumping. Only storm water from very low lying areas like area East of Model town will have no other alternative other than draining to Burari Creek.

This problem of the construction of a new drain collecting in the storm water from the rural areas of Siraspur, Libaspur etc. and the proposed urban area around Hyderpur, Shalimar Bagh has been studied in detail and a scheme has been drawn out (Detailed separately under West zone drains). This drain will initially run parallel to G.T. Road and turn at Shahalam bund and subsequently run bordering the Swampy region behind Model Town. The existing storm water drains in Model Town area are not proposed to be remodeled as these are pipe drains below G.L. The proposed drain has huge discharge as such will involve acquisition of land in built up area.

An in dependent drain running parallel to Mall Road is also envisaged falling out directly to Najafgarh drain to ensure that as much of storm water is taken independently as possible and not overloads the already large proposed drain behind Model Town.

As already mentioned, the Burari Creek outfall being very low, it will be obligatory to close the Burari Regulator for a number of days during the monsoon period, to prevent back water entering the basin from River Yamuna Najafgarh drain. This closure of the regulator will cause serious water logging in the agricultural land and hence pumping out will be absolutely necessary. At present, there exists a pump house of MCD, which is used o pump the water from the N.G. Drain surroundings to coronation Pillar sewage treatment plant. It is recommended that the same pump house be occasionally used for pumping out the storm water from Burari creek into N.G. drain by making suitable arrangements in the pipe line etc., so that the same pump house can work without much interference for the purpose for which it was originally built. Construction of a new pump house to function only for a limited period of a year, for this purpose, is not economical.

It is therefore essential that the existing tail regulators at Burari Creek and N.G. drain are suitably remodeled and also additional pipelines are carried to the pump house of MCD near the tail regulator of Burari Creek.

* 1. Link Drains of Bawana escape.

As already brought out in Para 51, there are five link drains feeding Bawana escape, each of which are independently discussed in the succeeding paragraphs.

* + 1. Ghoga Link drain.

This is one of the major link drains for Bawana escape. The drains starts at Ghogha village, has a length of 5.18 Km. and a catchment area of 1480 hectares (A portion of the catchment area viz.347 hec. is in Haryana). The bed level of this drain is above HFL of Yamuna at 3.0 lakh cusecs discharge as such back water flow in the drain does not arise. However, during lean seasons, there will be flow in Bawana escape from Delhi Tail distributory (for purposes of augmentation of drinking water supply to Delhi), and hence provision of a regulator and the outfall point of Bawana escape is essential.

* + 1. SANOTH LINK DRAIN.

 This is another major link drain feeding Bawana Escape during monsoon. This drain starts from a pond near Sanoth, meanders a length of 3.35 Km. and a catchment at area of 12.35 hectares. The bed level of this drain is above HFL of Yamuna at 3.00 lakh cusecs. However, a regulator at the outfall point of Bawana Escape is essential to prevent backing up of water from Bawana Escape during the lean period. At present structure exists at the outfall point, but provision of wooden karries has to be made.

* + 1. Narela Link drain No. II

 The importance of this drain has already been discussed in Para 3.1.4. The drain has length of 3.60 Km. before out falling into Bawana into Bawana Escape. The catchment and of this drain is 310 hectares (Urban) and 310hectares (Rural). At present no drain is existing and this is a new proposal. It is recommended that an outfall point into Bawana Escape, to ensure HFL of Yamuna through Bawana Escape does not enter the drain.

5.6.4 Naya Bans Link drain:-

 This is another link drain out falling into Bawana Escape. This drain starts near the ridge at village Naya Bans and during the course of its run, it collects storm water from two other link drains called Khera Khurd Link and Khera Kalan Link drains. Naya Bans Link drain has a length of 7.0 Km. before out falling into Bawana escape and the total catchment area at the outfall point is 1926 hectares.

The two subsidiary drains to Naya Bans link drain have lengths of 2.74 Km. and 0.86 Km. and catchment areas of 615 hectares and 485 hectares respectively. These two drains, Viz Khera Khurd and Khera Kalan have discharges of 0.43 cusecs and 0.56 cusecs respectively. The existing sections of the drains are quite adequate to carry the anticipated discharges.

 The alignment of Naya Bans link drains, as existing, is not proposed to be changed, except for the fact that the stretch of drain running parallel to railway track will have to be rebuilt. This is due the reason that Railway authorities are doubling the railway track, as such the drain which used to flow in borrow pits is now filled up.

5.6.5 Alipur Link Drain.

 The drain starts from the village Alipur and outfalls into Bawana escape. The drain has length of 4.40 Km., a catchment area 770 hectares and a maximum storm water discharge of 0.85 cusecs. Since this drain out falls into Bawana escape at the junction of Bawana Escape and G.T. Road, the back water effect due to HFL of Yamuna in Bawana escape influences the discharge, as the bed level of Alipur link drain is same as of Bawana escape. A structure for regulator at the outfall point in to Bawana escape already exists, which needs remodeling as well as provision of a gate of suitable size.

* 1. Link drain of drain No.6.

Drain No.6 has mainly three link drains as already brought out in para 5.43, each of which are discussed in succeeding paragraphs.

* + 1. Bankner Link Drain.

This drain starts from Lampur Jheel and the problems connected with this have already been discussed in para 3.1.1 The total length of this proposed drain is 5.85 Km. and a self catchment area of 3920 hectares out of which 2620 hectares lie in Haryana State. Termination point of Bankner link drain is at RD0 of drain No.6.

 Bankner link drain has a distributory in Narela link drain I (which again has been separately discussed in Para 3.2.1). This link drain as Proposed is altogether new and hence the proposed Narela link drain I will have a length of 1.00 Km. a catchment area of 90 hectares and the section will have a maximum discharge capacity of 3.17 cumecs. This drain will have to cross the existing Nahri Major distributory and as this irrigation canal is running on embankment, proposed cross drainage work of Narela link drain-I with Nahari Major will not pose a problem. The drain can cross the irrigation canal through RCC pipes.

No outfall regulator is required either for Bankner link drain or Narela link drain-I.

* + 1. Tikri Khurd Link drain.

This drain takes off from an existing pond near village Tikri Khurd and outfalls in drain No.6. The length of the drain is about 1.94 Km. a catchment area of 392 hectares and a maximum drainage capacity of 0.43 cumecs. The existing section of the drain is adequate to take the anticipated discharge and hence no remodeling is proposed. Since back water effect of River Yamuna will exist through Bawana escape and drain no.6, provision of an outfall structure with provision of wooden karries is essential at the outfall point into Drain No.6.

* + 1. Hamidpur Link Drain

At present, a 3.80 Km. length of drain exists from Hamidpur village out falling into Drain No.6 But no defined shape of drain exists at the upstream and of this drain upto Rajpur distributory, which at present is getting terminated into depressions near Hamidpur village. In order to ensure effective drainage. Hamidpur link drain is being extended from its present starting point. Once completed the link drain will have a length of 4.55 Km., a catchment area of 1720 hectares (out of which 970 hectares area is in Haryana State) and a maximum drainage capacity of 1.90 cumecs. An outfall structure with karries would also be essential to prevent back water effect from Drain No.6, as bed level of this drain at the outfall point is well below the HFL of River Yamuna at 3.0 lakhs cusecs discharges.

5.8 Link Drains of Burari Creek.

Primarily there are four link drains proposed to Burari Creek drains, and a fifth drain, Burari drain No. II which is existing outfalls into Burari creek near the tail regulator. The link drains are discussed in detail in the succeeding paras.

5.8.1 Kadipur Link Drain.

At present there exists a depression between Kadipur and Kushak Khurd villages, which has no natural outlet and during monsoon this depression gets water logged. Hence a new drain is proposed to drain out this area and connecting this drain to Burari Creek. The length of the drain is 2.20 Km. It has a catchment area of 463 hectares and a discharge of 0.59 cumecs at the outfall point.

5.8.2:- Horse Shoe Link Drain-I and II.

There are two patches of depressions between Khushak Khurd village in north and Mukundpur in South, where water stagnates for pretty long period and renders the saucer portions uncultivable. There two depressions are separated by a raising ground and during monsoon stagnated water takes the shape of a horse shoe (in plan). It is proposed o drain out there two patches of Jheels by two independent drains and connecting them to Burari Creek. The length of horse shoe link drain-I is 2.00 Km. has a catchment area of 386 hectares and a discharge of 0.43 cumecs at the outfall point. Horse shoe link drain II has a proposed length of 0.60 Km. a catchment area of 386 hectares and a discharge of 0.43 cumecs.

5.8.3 Radio Colony Link Drain.

 The vast stretch of land North-East of Model Town colony and South of (and enveloped peripherally a great extent0 Shahalam bund is marshy virtually all the year through. At present no drainage arrangements exist, to drain out this area and thus this stretch has become a breeding ground for mosquitoes. The area is also considerably low-lying as such natural drainage is not existing. The entire area of 450 hectares get water logged during monsoon, tending to become a lake. A drain exists in the middle of this area, with banks on either side carrying the sullage/sewage water pumped by MCD pump house and draining into Burari creek. Thus, the surface water of this marshy area cannot be drained out by the present drain.

 It is now proposed to provide a drain almost as the same alignment of the existing drain and a branch drain perpendicular to it by lowering the bed of the drain. The drain has a length of 2.55 Km., a catchment area of 450 hectares and a maximum storm water discharge of 15.60 cumecs.

* + 1. Burari Creek Drain-II

Earlier to the construction of RME, Burari Creek drain-I used to outfall with Burari Creek at its outfall and by the construction of RME, only its course has remained, now being named Burari Creek drain-II. Hence the existing section is too large to carry the anticipated discharges of storm water, as the present length of drain is hardly 0.5 Km. a catchment area of 230 hectares and a discharge of 0.26 cumecs at the outfall point. Hence no remodeling of drain is being proposed.

* 1. Burari drain.

As already explained in the last sub para of para 5.4 this is an independent drain in the basin, mainly drained by Burari Creek. This drain starts at the outfall of Bawana escape to Yamuna and runs parallel to RME and outfalls into the river Yamuna. The existing section of drain is adequate to take the storm water. A regulator also exists at the outfall point to Yamuna. The length of the drain is 5.9 Km. long, a catchment area of 644 hectares and a maximum discharge of 0.71 cumecs.

6.0 Outfall structures

As already brought out, the Alipur Basin has one main drain falling directly to river Yamuna and the other drains fall into either Bawana escape & Najafgarh drain. Hence the consideration on provision of outfall structures should be decided on the drainage congestion of drain & problem of flooding.

 Except for Bawana escape, Drain No.6 and Burari Creek drain, for all other drains which are liable for back water effect due to full flow in main drain, outfall structures with provision of karries would meet the requirement (exception however again being Burari drain-I which is directly out falling into River Yamuna through RME, where in a regular gate already exists and no new provision is to be made).

6.1 Outfall structures at Bawana escape

 The banks of Bawana escape, as existing now, are also functioning as embankments preventing the ingress of the floods of river Yamuna to cultivable lands protected by RME. As and when RME is extended Northwards upto Haryana border, the left bank of Bawana Escape will also function as an embankment. The section of these banks a suitably shaped as to function in the desired way. Also, no regulator exists, at present, at the outfall point of Bawana escape to river Yamuna. As such provision of a regulator or recommendation for the same now, would not be in order, as already suitable precautions have been taken at outfall points of all link drains to Bawana escape. Once the principle of raising the Banks of Bawana escape above HFL of Yamuna is accepted and also for the fact that the bunds upto this height area already existing, status-quo can be maintained, as this meets the technical requirements.

6.2 Regulator at Drain No.6

At present, no gated or un-gated regulator structure exists at the outfall point of Drain No.6 to Bawana escape. However, the drain has banks suitably raised to contain the HFL of Yamuna (back water of Yamuna through Bawana escape) within the embankments. In view of the fact that the existing banks are safe, it is not proposed to provide regulator structure at the outfall point. However, a gated structure may be necessary to prevent entry of the 1000 cusecs water to be passed through Bawana escape into Yamuna River from Haryana. This will have to be shared between Haryana and Delhi.

6.3 Regulator at Burari Creek drain.

 This Burari creek drain, as already discussed, is draining low lying areas between RME and Shahalampur bund and also areas upto urbanized portion of Delhi. As such this area is always threatened with flooding even due to high flow level in N.G. drain. Hence a regulator is under construction at the out fall of Burari creek drain Into N.G. drain. The regulator constructed has a discharge capacity of 25.50 cumecs against an anticipated discharge of 23.70 cumecs in the drain, by considering an allowable afflux 30 cm. After the regulator is closed, it is proposed to operate the pump of the MCD pump house already existing near the tail regulator, to pump out the water getting accumulated on the upstream of this gate, into the N.G. drain.

7.0 Maintenance

The responsibility of maintaining the drains in the rural areas rests on the Flood Control Wing of Delhi Administration. Here also it has been observed that on several drains the annual maintenance is not properly done. At certain places the villagers themselves block these drains either to prevent flood in of their area or to take up cultivation in the drain beds. Such practices are to be checked completely and constant vigil by the field staff of the Flood Control Wing of Delhi Administration is required, to stop any unauthorized blocking of the drains any time during the year. The blocking is sometimes due to crossing of irrigation channels, which is to be totally discouraged. Crossing if any should be with pipes allowing adequate water way for the drains to pass unobstructed. The field staff of the Flood Control Wing of Delhi Administration should submit a report of all such obstructions created along the drainage channels every fortnight and these are to be cleared before the next 3 days positively. At the end of every monsoon immediate silt clearance of the drains should be taken up. Cultivators blocking a drain or cultivating in a drain bed are to be legally punished. Section Officers allowing such male practices should also be taken to task.

For the purpose of surplusing of irrigation water, the Haryana Govt. who are looking after the irrigation channels running through this basin should take every step to provide proper surplusing weir and connecting channels to the regular drains in the neighborhood. Whenever the seepage water through the irrigation channels stagnates in the surrounding fields the irrigation department or Haryana Govt. has to repair the bunds immediately and arrange for pumping out the seepage water so collected in the villages. The Flood Control Department of Delhi Administration is to collect all such problems from the villages and send reports immediately to the Haryana Govt. for immediate remedial measures.

8.0 Sub-soil water condition of the Alipur Basin.

 Flood Control Department of Delhi Administration is maintaining a number of sub-soil water observation pipes fixed by them all over the Union Territory of Delhi, at an approximate spacing of one Kilometer. The observation of these points are taken normally four times a year. This work was taken up from the end of year 1972.Since then, whatever data collected has been analyzed and two plans are enclosed as Appendices A-3 and A-4 indicating there in the contours of sub-soil water table at the highest and lowest saturation conditions. It has been observed that the water table is high along the D.T.D. and along the banks of river Yamuna near the South-East corner of Alipur basin. On the Northern side the water table is relatively low with an average depth below ground between 10’-O’ to 15’-O’. The irrigation system serving this basin is maintained by Haryana Government. In view of the low ground water table more irrigation facilities are necessary in the Northern part of the basin. The drainage system in between Bawana escape, R.M.E. Shahalam Bund, G.T. Road requires considerable relief from water logging. The Burari creek drain is to be remodeled. The regulator at Burari is under construction and after completion the water from Najafgarh drain will not back flow into the Burari creek.

* 1. In view of the high sub-soil water in this region, leaching can be noticed in various depressions. The Agricultural Department has to be consulted for a proper investigation and a scheme to be formulated to give relief from this problem. The agricultural department must also suggest the means for improving the fertility of the soil as well as the type of crop most suitable for this area.

9.0 Pumping

 In rare cases the flood in the river Yamuna coincides with a heavy rainfall in the catchment area of Delhi. If these two occur simultaneously there is a possibility of serious drainage congestion in the Burari Creek catchment, since the Burari creek outfall point is liable to be submerged during high floods in Yamuna. It is therefore proposed that in such rare occasions, the M.C.D. pump house the Najafgarh tail regulator may be utilized for pumping out the stagnated water around Burari Creek tail and throwing it into Najafgarh drain. For this purpose additional connecting pipes upto the low load may be provided from the M.C.D. pump hou