International Journal of Engineering Science Invention
ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
www.ijesi.org ||Volume 4 Issue 1 || January 2015 || PP.24-29

Drainage Condition in Water Logged Areas of Central Part in Chittagong City Corporation

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ABSTRACT : *The aim of study was to find out the present drainage condition which is one of the major reasons to create water logging situation in central part of Chittagong City Corporation during monsoon season. Therefore, East Sholoshahar (Ward no 6), West Sholoshohor (Ward no 7) and Sholokbahar (Ward no 8) were identified as the study area for analyzing the existing drainage situation which may helpful for the concerned authorities to take appropriate decisions to minimize the problem of water logging. It had been found that the water carrying capacity of different types of drains (primary, secondary and tertiary) were reduced due to silt and waste dumping which aggravate the intensity of water logging problem in the low lying areas. The study also suggested some recommendations which need to implement as soon as possible with a view to mitigate the water logging problem during monsoon season.*

KEYWORDS: *Drainage, water logging, Chittagong City Corporation*

I. INTRODUCTION

Topographically Chittagong in Bangladesh is a Hilly city surrounded by Karnaphuli river and Bay of Bengal from different sides contributing the friendly urban growth. The climate of Chittagong city is influenced by strong tropical monsoon characterized by high temperature and heavy rainfall in association with high humidity (Rashid, 1991). Chittagong, the Commercial capital of Bangladesh also facing a number of socio-environmental problems, among them water logging during rainy season is one of the major environmental threats being considered. Day by day the situation becomes worse because of insufficient and unplanned drainage system. The situation is further aggravated without the necessary funds to extend and rehabilitate their existing drainage systems (DHI, 2002). Unplanned urban infrastructure development and poor maintenance of the existing drainage facilities may also aggravate the congestion problem even in the previously well drained city like Sylhet (Ahmed, 2009). Other developing countries are not also free from such problems (Singh, 2004). Artificial drainage systems may be an alternative to natural water bodies and swamps which helps to reduce the flood risk. Land use changes with impervious surfaces in cities like Chittagong considerably affect flooding which is further exacerbated by increased runoff, which quickly blocks drains and channels with sediment, wastes and debris (Barua and Van Ast, 2011).Some Master Plans on drainage systems for Dhaka and Chittagong were produced in the year 1960 and 1961 respectively. Bangladesh spends about 20% of its national budget on water development projects (Islam, 2001). The plans produced were basically zoning maps with very little or no reference to drainage planning. Drainage planning was taken over by drainage engineering without any conscious endeavor to integrate drainage planning with the land use planning process. Architects and planners went ahead with their zoning proposals for housing and industries where drainage systems were given a very little importance.

During the last 60 years and above, the nature and total amount of rainfall remains unchanged but the physical environment of the city undergone considerable changes by this time. The open spaces are decreased, thus when rainfall occurs in the city, it cannot percolate through and increased the surface runoff. The increased runoff does not pass through the existing drainage channels creates drainage congestion in the city particularly in low lying areas (Ahmed and Alam, 2010). In central part of Chittagong, some low lying areas such as Chawkbazar, Muradpur, Bahaddarhat, Bakalia and Shulokbohor are regularly waterlogged during rainy season. Houses, schools and colleges, shops and business premises went under three to four feet of water in the low lying areas of the city which causes sufferings to millions of its residents (Kabir et al, 2013) due to unplanned and poor maintenance of drains. In these areas, land development through artificial landfill of depressions, back swamps and floodplains generally reduces the water storage capacity of the area and may increase the water levels, resulting in an increased hazard and risk.Therefore, the study was aimed at identify the existing condition of drainage system in the study areas caused by heavy rains during monsoon season.

II. METHODOLOGY

The study was conducted to found out the existing drainage condition in the central part of Chittagong city, 3 wards (ward no 6: East sholoshahar, ward no7: West sholoshahar and ward no 8: Sholokbahar) were selected as study area and collected data of primary, secondary and tertiary drains of different locations of the study area.

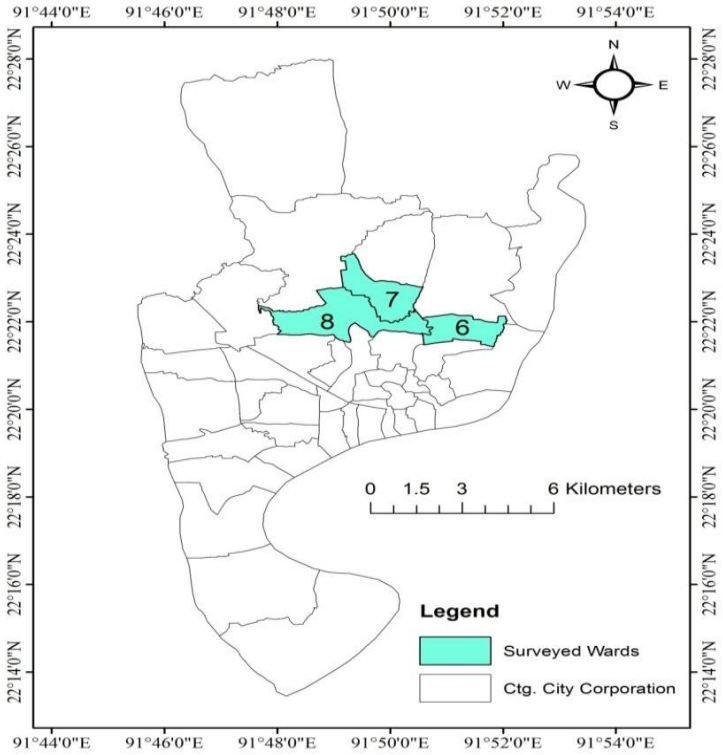


Figure 1: The study area

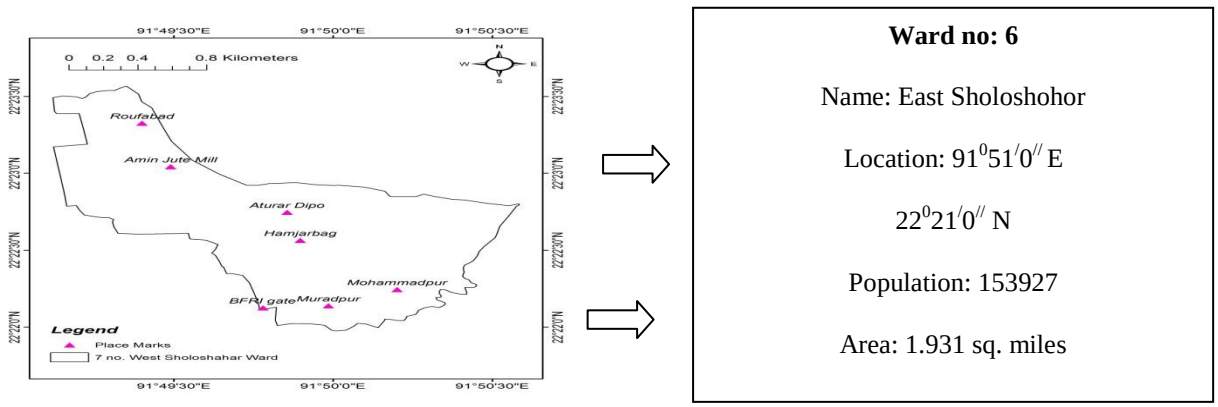
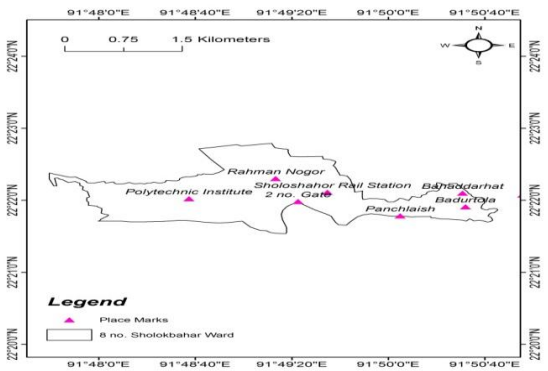


Figure 2: Ward no 6



Ward no: 7

Name: West Sholoshohor

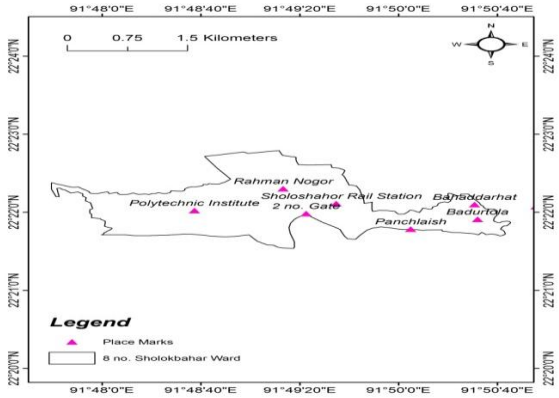
Location: $91^0 50' 0''$ E

$22^0 22' 0''$ N

Population: 151846

Area: 1.569 sq. miles

Figure 3: Ward no 7



Ward no: 8

Name: Sholokbohor

Location: $91^0 49' 0''$ E

$22^0 23' 0''$ N

Population: 178676

Area: 1.931 sq. miles

Figure 4: Ward no 8

III. METHODS OF DATA COLLECTION

The study sites were selected purposively. A reconnaissance survey was conducted before the collection of final data of different drainage locations. Measurements of drains were taken according to the types of drains. There were three types of drains such as primary, secondary and tertiary drains. Width, depth and length of each type of drains were measured carefully to find out their present water carrying capacity as compared to their actual capacity at the time of construction. The secondary data had been collected from Chittagong Development Authority (CDA); Chittagong City Corporation (CCC); Meteorological Department and engineers who were associated in planning and building the drainage system of the Chittagong City corporation area.

Calculation:

*Water carrying capacity = (width*depth*length) ft^3*

= (result) m^3

IV. RESULTS AND DISCUSSION

The reason of long lasting water logging situation in the city as well as in the study area is mainly due to inadequate drainage capacity. According to the experts, lack of enough drains and their reduced water holding capacity helps in creating drainage congestion due to heavy rainfall.During measurements of different kinds of drains i.e. primary, secondary and tertiary drains in the study area, it had been found that width and depth of almost all the drains are decreased from their initial width and depth at the time of constructions. As the width and depth of the drains were decreased the water carrying capacity of the drains also decreased. The water carrying capacity of primary drains in the ward 6, 7 and 8 were decreased to on an average 28.25 m^3, 31.64 m^3 and 28.76 m^3 respectively from their initial capacity i.e. 45.30 m^3 at the time of construction (Table-1).

Table 1: Measurements of water carrying capacity of primary drains in the study area

No of locations	*water carrying capacity (m^3) of primary drains*		
	Ward no 6	***Ward no 7***	***Ward no 8***
1	43.21	33.00	44.58
2	28.18	38.36	33.52
3	30.68	28.00	21.52
4	33.93	35.79	14.68
5	27.41	23.20	17.86
6	25.60	12.71	18.64
7	23.25	37.92	33.27
8	23.20	40.60	44.44
9	14.39	33.30	20.84
10	32.66	33.53	38.26
Average	28.25	31.64	28.76
% required	37.62%	30.15%	36.51%

- Water carrying capacity: 45.30 m^3 (at the time of construction)

  The water carrying capacity of secondary drains in the ward 6, 7 and 8 were decreased to on an average 16.02 m^3, 15.867 m^3 and 18.98 m^3 respectively from their initial capacity of 27.17 m^3 at the time of construction (Table-2)

Table 2: Measurements of water carrying capacity of secondary drains in the study area

No of locations	*Water carrying capacity (m^3) of secondary drains*		
	Ward no 6	***Ward no 7***	***Ward no 8***
1	18.25	22.96	9.60
2	21.31	18.80	13.90
3	11.15	10.15	28.57
4	13.83	19.21	20.84
5	23.02	14.21	21.20
6	19.31	23.12	17.94
7	10.37	11.11	22.46
8	14.75	9.06	14.95
9	5.74	11.72	19.57
10	22.48	18.35	20.76
Average	16.02	15.87	18.98
% required	41%	41.60%	30.14%

- Water carrying capacity: 27.17 m^3 (at the time of construction)

The water carrying capacity of tertiary drains in the ward 6, 7 and 8 were decreased to on an average 3.95 m^3, 6.71 m^3 and 6.91 m^3 respectively from their initial capacity of 9.06 m^3 at the time of construction (Table-3).

Table 3: Measurements of water carrying capacity of tertiary drains in the study area

No of locations	***water carrying capacity (m^3) of tertiary drains***		
	Ward no 6	**Ward no 7**	**Ward no 8**
1	2.46	9.85	5.66
2	5.13	8.80	5.66
3	3.72	6.69	4.44
4	4.48	9.17	12.04
5	1.94	4.65	9.06
6	5.57	5.78	6.57
7	4.58	2.15	4.98
8	2.68	5.98	4.44
9	4.98	9.33	11.09
10	3.94	4.68	5.12
Average	3.95	6.71	6.91
% required	56.40%	25.94%	23.76%

- Water carrying capacity: 9.06.2 m^3 (at the time of construction)

According to field survey, the required water carrying capacity of primary drains would be increased to 37.62% in ward no 6, 30.15% in ward in 7 and 36.58% in ward no 8. In case of secondary drains, capacity would be increased to 41% in ward no 6, 41.60% in ward no 7 and 30.14% in ward no 8. Again for tertiary drains, the drainage capacity would be increased to 56.40%, 25.94%, and 23.76% in ward no 6, 7 and 8 respectively (Figure: 5).

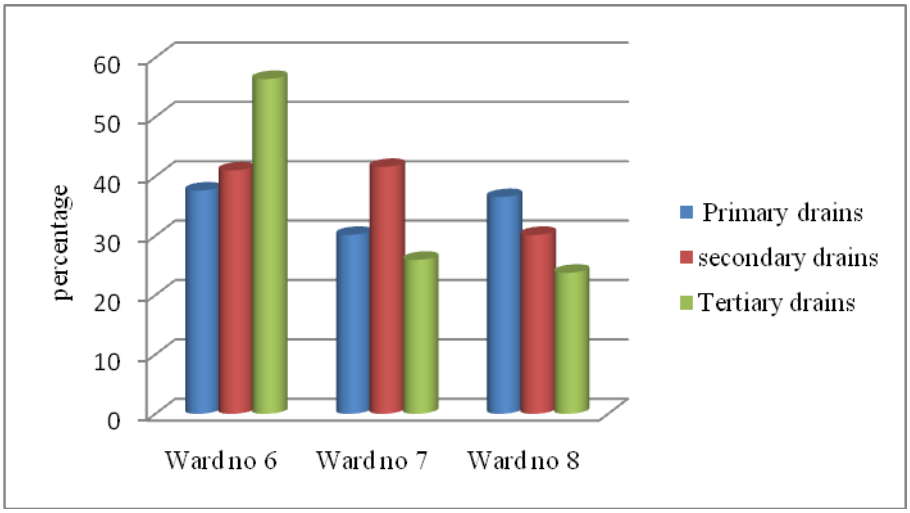


Figure 5: Percentages required to increases the water carrying capacity of drains in the study area

V. RECOMMENDATIONS

As a developing country, we have resource constraints. We should not encourage overlapping of activities due to shortage of fund for construction, operation and maintenance of enlarged drainage networks throughout the city. All the government agencies needs to adapt their future plans for the city in line with the recommendations and directives made in the Chittagong Metropolitan Master Plan 1999, financed by the United Nations Development Programme (UNDP) and United Nations Centre for Home Settlement (UNCHS).The regular maintenance or rehabilitation of drainage systems will reduce the frequency and extent of water logging or flooding. Self cleansing channels cannot be constructed throughout the study area because of its topographical characteristics. The efficiency of any drainage improvements constructed reduced due to lack of maintenance programs. In study area, the existing drainage networks must be regularly maintained to keep the drains clean, free of silts and in a state of good repair. But the limited budget is one of the main barriers to maintain the drainage systems. For better maintenance activities in all existing primary, secondary and tertiary channels, sufficient number of labor force is required as the size of the system increases.

Maintenance of drainage might be characterized according to their function. Therefore, maintenance of primary drains might be separated from the maintenance of secondary and tertiary drains. This includes:

- A continuous process of maintenance activities will be performed in secondary and tertiary drains throughout the year with large number of small teams, while
- Maintenance of primary drainage systems will be performed by large size teams during the months of October and February.
- Primary drainage systems should be maintained at least once every two years and secondary and tertiary drains at least once per year before monsoon season.
- Entrance and exists ways of drainage channel needs to be free from obstacle creating materials, resulting in increase of hydraulic efficiency of drains
- Narrow drainage waterways in some areas causes surcharged flow at the structure. Therefore, raising or widening of drains reduces such problem
- Pipes that are used for services crossing channels needs to be widening to increase the flow rate of water

VI. CONCLUSION

Generally Chittagong City Corporation (CCC) is maintaining the drainage system, but very difficult to do that alone without the help of other government and non government concerned authorities. Therefore, it is necessary to make proper coordination between concerned authorities which helps to take clear decision for maintenance and operations of drainage networks and also for implementing the drainage master plan for Chittagong. It is hoped that, this study will be helpful to take appropriate mitigative measures by the concerned

authorities after reviewing the existing drainage condition in major water logged areas in central part of Chittagong City Corporation.

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