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# Issues and Solutions of Drainage System for Dehradun City

KEYWORDS: storm water, drainage, infrastructure, slope.

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**ABSTRACT** *The storm water drainage of Dehradun city is a complex situation, owing to the combination of a number of natural and man-made drainage systems. There are a large number of mid-size drains that are either unlined or have damaged lining. The current drainage system of the city employs simple covered drain systems in most parts. There is a quick need to plan for a proper solution to the sewage outlet of the rapid growing capital city of the hill state of Uttarakhand. In this paper, we are discussing the major issues of the drainage system along with plan to overcome the existing problem and reviewing the status of the existing drainage system of the city and the infrastructure for setup. Recognizing the problems of the drainage and storm water management, we present recommendations for the decision makers to find sustainable solutions for development of the city.*

## INTRODUCTION

Proper disposal of storm water is one of the crucial components of urban infrastructure services. In most part of the city, wherever low lying colonies have been developed, the responsibility of disposal of storm water lies with the Municipal Corporation. One of the fundamental issues normally neglected in our country is the comprehensive design of roads, drains, sewers and other utility network like water pipe, electric and communication cables etc. and their careful and meticulous execution. Instead, the foundations as well as the surface of the roads are not proper leading to early damage due to movement and weather conditions. Storm water drainage system is the process of draining excess water from streets, sidewalks, roofs, buildings, and other areas. The systems used to drain storm water are often referred to as storm drains, but they are also called storm sewers and drainage wells. Sometimes people confuse storm water drainage systems with sanitation sewers, but storm drains often function separately from sewer systems created for sanitation purposes. The purpose of the storm water management approach is to develop effective drainage systems that balance the objectives of maximizing drainage efficiency and minimizing adverse environmental impacts. The development of agriculture and of transportation networks has resulted in modifications to the natural drainage system. These modifications to land use and drainage patterns can be the source of drainage problems in rural systems. Rural and urban drainage are interrelated since both may contribute to the overall hydrology of a watershed. The objectives of storm water drainage design are: to provide a drainage system that will collect and convey storm water from a catchment to its receiving waters with minimal nuisance, danger or damage and at a financial and environmental cost that is acceptable to the community as a whole, to provide limit flooding of public and private property, both within the catchment and downstream, to acceptable levels, and to provide convenience and safety for pedestrians and traffic in frequent storm water flows by controlling those flows within prescribed velocity/depth limits.

## THE TOPOGRAPHIC & DEMOGRAPHIC CONDITIONS OF DEHRADUN CITY

The Doon Valley has the Himalayan range to its North, the Shivalik range to its South, the holy river Ganga to its East and the river Yamuna to its West. The city of Dehradun is surrounded by river Song on the East, river Tons on the West, Himalayan ranges on the North and Sal forests in the South. The Doon Valley is situated between the two most important rivers i.e. Ganga and Yamuna, located in a picturesque setting. The city is surrounded by dense forest all around and number of streams and canals dissect the city in the north-south direction. The high hills in the East and North and Shivalik in the South give an interesting topographical setting to the city. All the hill ranges around Dehradun (except the Shivalik) are rich in lime stone reserves.

| | |
|---|---|
| Total Area | 3088.00 sq. km. |
| Forest Area | 2200.56 sq. km. |
| Total Population | 1025.68 thousands |
| Urban Population | 515.48 thousands |
| Rural Population | 510.20 thousands |
| Total Literates | 597.39 thousands |
| Rural Literates | 239.97 thousands |
| Urban Literates | 357.42 thousands |
| Population Growth per Annum | 2.91 % |
| Population Density (persons/ sq. km.) | 332.00 |
| Urbanization | 50.26 % |

**(Source: Census Data, Government of India)**

In 1981 and 1991 decades, the decadal change in population of Dehradun was 21.33% and 21.85% respectively. The sudden jump to 39.73 % in the next decade is explained by the fact that in this decade Uttaranchal was made a separate State with Dehradun as its capital. In the decade 1991-2001, Dehradun achieved decadal population growth rate of 39.73 %, which was considerably higher than the national average of 21.53 %. Besides, the impact of factors like large investments in industries which are expected to be made in the coming years; the planned infrastructure and institutional improvement with financial assistance of the ADB; and the proposed overall development of the town under the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) will widen employment opportunities both in secondary and tertiary sectors. As Dehradun started with a low population base its population growth rate in terms of percentage is expected to be faster in the coming decades as a result of its economic factors mentioned above. On the basis of this understanding, it is assumed that the population of the city will grow at the rate of 4% per annum for 5 years following 2009, 3.5% from 2010 to 2014, and 3.0 % from 2015 to 2019. As the base population expands, the rate of growth in terms of percentage will gradually slow down although in absolute numbers population will keep increasing.

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**THE EXISTING DRAINAGE SYSTEM OF DEHRADUN CITY**

The city has a natural drainage pattern due to hilly terrain with sufficient gradients to drain off storm water easily in to the two main natural drainage channels i.e. rivers Bindal and Rispana. The Asan, Tons and Dulhani rivers discharges in these two rivers directly or through their tributaries. The slope of both the main rivers i.e. Rispana and Bindal is from North to South. There are 8 numbers of drainage basins covering the town: Bindal Basin; Bindal Sub basin No.1; Bindal Sub Basin No.2; Bindal Sub Basin No.3; Rispana Basin; Asan River Basin; Dulhani River Basin; and Tons River Basin. Due to the faster growth of population and rapid increase in the land prices habitation has extended to the low lying areas which do not have proper drainage outlets. Dumping of garbage, particularly plastics, causes serious reduction in waterways of main drainage channels. In the old city areas, space for construction of roadside drains is a major problem. Due to improper cutting of the forests and depletion of green cover, the top soil of the surrounding hills is being eroded causing accumulation of silt in the rivers which results over flow and back flow of water in residential and commercial areas.

**A list of major water logged areas of the city and probable causes are provided in the following table:**

| S. No. | Locality | Probable Causes |
|---|---|---|
| 1. | Darshan Lal Chowk | Undersized drains |
| 2. | Race Course | Inadequate size of drains |
| 3. | Subhash Road | Obstruction to discharge into road side drain |
| 4. | Sevak Ashram Road | Improper side drains |
| 6. | Nehru colony | Encroachment on drains |
| 7. | Rajiv Nagar | Lack of proper drains |

**THE PROPOSED DRAINAGE SYSTEM FOR DEHRADUN CITY**

The sloping town of Dehradun is an advantage in drainage planning. Although slope is not uniform, nor always gentle, this has been used judiciously to avoid the need for pumping. Pumping is not only a rather expensive proposal to construct, it is equally expensive to operate and maintain. The entire system is based on gravity flow. The Proposed Drainage System should comprise of 3 components – (a) Main drains along Main Roads and Nalas and (b) Area (i.e. Mohalla) Drainage, where problems have been identified and (c) Branches and Lateral Drains.

Rectangular drains are proposed in the town because in most of the areas land availability is the constraint Up to 1.05 meter depth, Brick Masonry drains have been proposed. From 1.1 metre to 2 metre depth, there are two alternatives – (a) stone masonry drains and (b) RCC drains. Considering lack of good workmanship, RCC sections have been considered preferable and used in the cost estimate. Above 2 meter, RCC drains have been proposed. RCC Slab cover will be provided where necessary. Along roads with busy traffic, particularly where space is limited, drains will need to be fully covered with openings with openings for inlet of run-off. To protect drain cover slabs, cement concrete kerbs with openings will be provided. For larger sections, and where direct traffic loads are likely to come upon drains, RCC box drains are proposed for the sake of strength and economy. In exceptional cases, underground drainage as RCC pipes with manholes at suitable interval may be used where space is severe constraint and RCC box drain construction is not feasible, such as through congested settlements. For protection against encroachment in foreseeable future, roads are proposed along both banks of main nalas passing through undeveloped areas at present. However, in many situations, even such space is unavailable. Where so possible, an attempt has been made to provide such facility. In addition to above in few colonies, the layout is contrary to the natural slope of ground, leaving no roads or spaces along which drains can be laid according to down slope; in still others, drainage path is blocked by walls erected by institutional developments. These colonies have common boundaries with these institutional areas.

**CONCLUSION**

Water quality concerns are some of the important issues in urban storm water system design. While meeting the discharge standards, the system should be cost-effective as well. It is important to realise that all drainage systems are designed to a set of criteria that are subject to economic, social and environmental constraints. It is not feasible to design for all circumstances and there will always be instance when extreme events will exceed the design criteria. The design process therefore should be one of risk management, whereby the consequences of larger events than the design event are assessed for their cost and environmental impacts. There is a need for continuous research, development and application on the Drainage and Storm Water Management of Dehradun city, so that suitable adaptation to local conditions are designed and applied.

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