

PHYSICAL INFRASTRUCTURE DEVELOPMENT STRATEGY FOR HARIDWAR CITY

A DISSERTATION

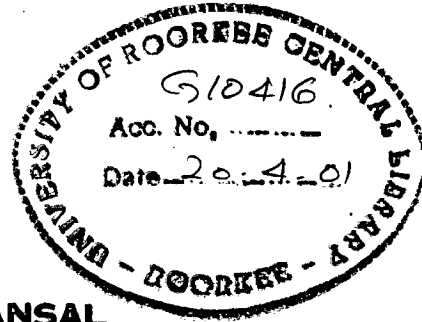
*Submitted in partial fulfilment of the
requirements for the award of the degree*

of

MASTER OF URBAN AND RURAL PLANNING

By

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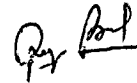
FEBRUARY, 2001

CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in the dissertation entitled '**PHYSICAL INFRASTRUCTURE DEVELOPMENT STRATEGY FOR HARIDWAR CITY**' in partial fulfillment of the requirement for the award of the degree of '**MASTER OF URBAN AND RURAL PLANNING**' submitted in the department of Architecture and Planning, University of Roorkee is an authentic records of my own work carried out during a period of eight month from July to Feb 2001 under the supervision of **Dr. Najamuddin**, Professor, in the Department of Architecture and Planning, University of Roorkee, Roorkee , India.

The matter embodied in this dissertation has not been submitted by me for the award of any other degree.

Dated 27 Feb,2001



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This is certify that the above state by the Candidate is correct to the best of my knowledge.



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Dedicating this project to my parents I thank them for their moral support all the time throughout the project their invaluable blessings proved to be the catalyst ion boosting the quantum of the project.

Last but not the least is special bouquet of thanks to all the friends who have contributed to this work directly or indirectly.

Rajeev Bansal
M.U.R.P

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CHAPTER 1
INTRODUCTION

PHYSICAL INFRASTRUCTURE DEVELOPMENT 01

INTRODUCTION

With the rapid growth of urban population there has been continuous accretion in number and size of urban centers both demographically and spatially. Provision of Urban Infrastructure has however, not kept pace with increasing size of towns and cities. As a result, burgeoning urban areas are putting strain on the already scant Infrastructure leading to a point of collapse. Large urban centers, although considered to be generator of economic momentum, display a picture of squalor and unhygienic conditions. Traditionally in India, urban local bodies and parastatal agencies have generally been providing urban Infrastructure as part of social and welfare services. By now, the concept and techniques for providing, delivery operations and maintenance of urban Infrastructure have changed considerably. It is increasingly being felt that government alone with limited budgetary resources would not be in position to make up with the galloping backlog in urban infrastructure services which are also required to be improved, augmented and upgraded to meet the emerging needs of urban areas.

With liberalization of economic policies, globalization of market economics, technological advancement, decentralization of planning and development functions, revitalization of municipal agencies, role of private sector participation in development process would be of vital importance.

Thus, at a glance, one can easily realize the need of ever increasing efforts in the direction of improving the physical infrastructure in India especially in the small cities like Haridwar, where a large No. of floating population causes tremendous pressure on all services. This study is a step in the direction of understanding the problems regarding the conditions of Physical Infrastructure in Haridwar City.

1.1 THE CITY OF HARIDWAR

Haridwar is the one of the holy cities as per Hindu mythology. It is the center of Sanskrit language and Hindu religious works. It is considered to be the most sacred place of Hindus. The temples and Ghats along the River Ganges are its main attractions for pilgrims and tourists.

The city is presently functioning as a center of trade and commerce, services and educational facilities in regional content. Haridwar Urban Agglomeration (HUA) covers an area of 12.75 Sq.Km with a population of 1,44,011 people. The city has been growing at an average annual rate of 2.9%. It is situated on 29°58' N Longitude and 78°-10' E latitude.

The existing city infrastructure is woefully inadequate to cater the present population. The problems get further aggravated by the continuous influx of pilgrims and tourists in form of floating population. Haridwar has acute traffic and transportation problems mainly on account of narrow roads, predominance of slow moving vehicles, inadequate public transport facilities, road side encroachments, lack of traffic sense and poor traffic management/enforcement. The water supply for a considerable segment of the population is inadequate and has to depend mainly on ground water supply, infiltration well and overhead tanks. The sewers and surface drains were laid long back and are usually choked during monsoon periods. Existing practice of solid waste management in the city is also not satisfactory and the pollution levels have increased significantly.

1.2 REGIONAL LINKAGES

Air

The nearest airport is Doiwala, which is 48 Km from Haridwar on Dehradun-Rishikesh road. At present only charter planes operate occasionally.

Rail

Haridwar is well connected by railways with major cities in India v.i.z., Delhi, Bombay, Howrath ,Lucknow, Agra ,etc.,

Road

Roads provide most important mode of communication with other parts of country.

Some Important distances are:

Rishikesh	24 Km.
Dehradun	52 Km
Deoprayag	94 Km
Badrinath	324Km
Mathura	344Km
Delhi	200Km
Agra	350Km
Lucknow	525Km

1.3 HISTORICAL BACKGROUND

Since time immemorial, Haridwar has been known as Mayapuri / Kapila / Ganga Dwar / Harihar Region etc. The present area of Haridwar is just a fraction of what it has been described as Mayapuri in Skand Purana which was bounded by Neela Parvat in East, Vasheya River in west, Nagtirth in South and Ratna Stambh in North.

Haridwar is known to be the worship place for priest Kapil. As per the descriptions in Puranas, when Holy Ganges reached the plains of Haridwar after descending from Gangotri, to escape the wrath of any of the Maharishi among Kashyap, Vashishishta, Yani, Vishwamitra, Khamdagni, Bhardwaj and Gautam it distributed its flow into seven streams so that to flow

through all the Ashrams. Thus, the place still is known as Saptrishi Ashram. King Shweta also worshiped Lord Brahma at the same place and thereafter the king was rewarded as whosoever will take a dip in Holy Ganges at this place will have the blessings of Brahma, Vishnu and Mahesha altogether. This place presently is known as Brahmakund or popularly as Har-Ki-Pauri.

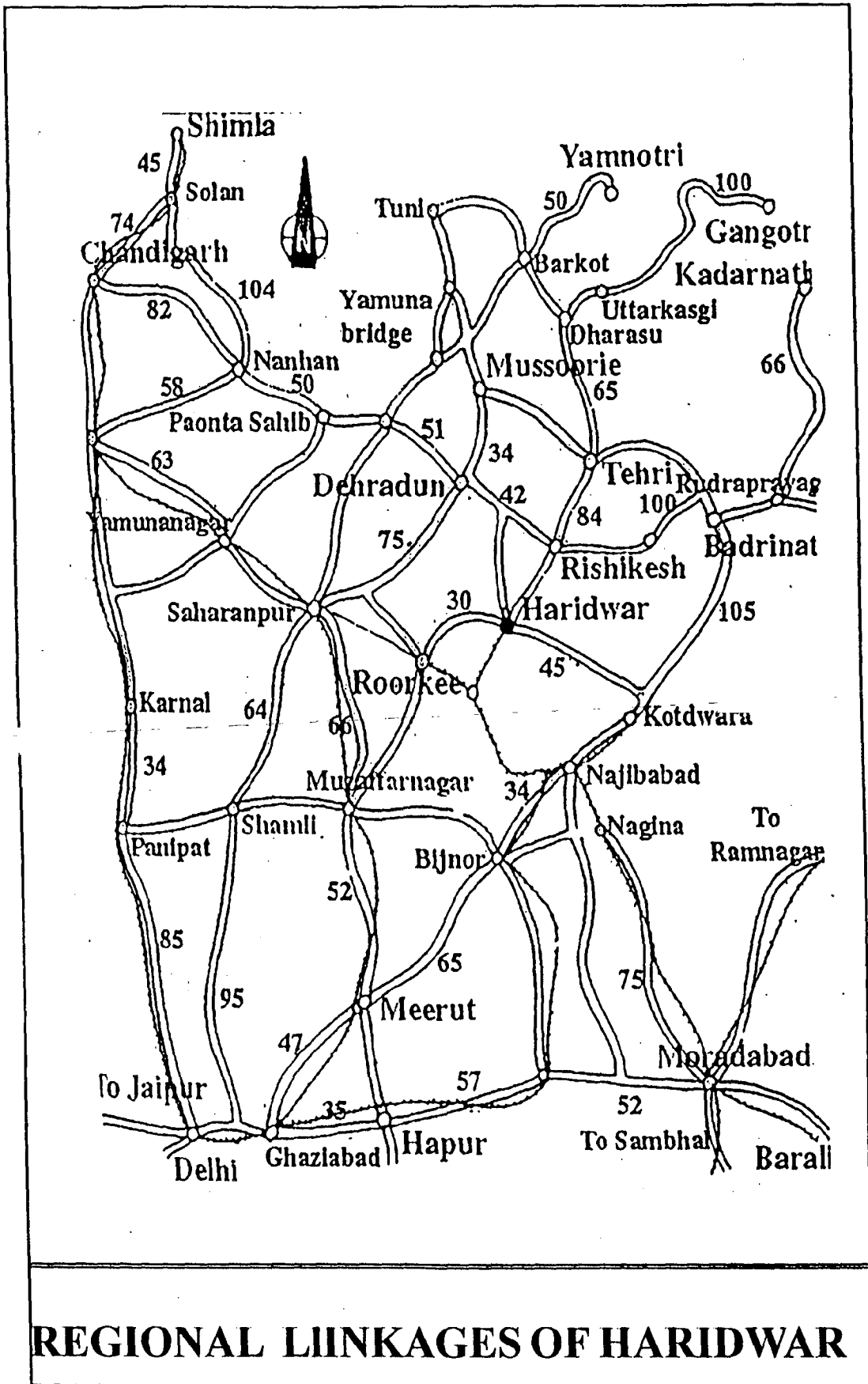
Around 3000 B.C. Pandava brothers owned a place know as Bhimgoda. King Ashoka also ruled Haridwar which is evident by the presence of Ashoka Stambh. Bhrathari, brother of king Vikramaditya also worshiped here and as a monument king Vikramaditya constructed the Kund and the holy steps (stairs). Thereafter this place is known as Har-Ki-Pauri. During the tenure of King Harshvardhana, Chinese explorer Hwain-Sang visited India for around 15 years and described Haridwar as Myun city which meant for the present days Mayapuri. The Maha Kumbh, celebrated every twelve years, has a great importance to tie up the whole country in one string in the religious context. In the Eighth century (A.D.) this city acclaimed a new name, Gangadwar but got devastated in later dates.

Haridwar regained its glory in the tenure of king Akbar. King Mansingh, friend and minister in Akbar's rulings laid the foundation for the present days Haridwar.

After descending 133 miles from Gangotri, Ganges find the first plains in Haridwar. The holy water of Ganga is being utilized for irrigation and other purposes since 1836 in Haridwar.

1.4 IDENTIFICATION OF PROBLEMS

Like many other cities in India, Haridwar also faces the problem of scarcity of services in terms of Physical Infrastructure, as compared to the rate of growth of population. The problems gets compounded many folds during the festive seasons due to sudden influx of



floating populations as pilgrims and tourists from all over the country. The lack of services in physical measures and improper hygienic conditions present a gloomy scenario in combination with the substandard health services.

To summarize, the following are the major areas of problems, which shall be included in this study to understand the situation better.

(a) Sewage Disposal

1. Sewage network is not spread to all parts of the city.
2. The capacity of treatment plant is not adequate for existing population as well as floating population.
3. Silting problems in sewer lines.
4. Surface drains are not properly designed.
5. Storm water disposal system is not efficient.

(b) Water Supply

1. In some pockets of city, water supply network is not properly designed.
2. The power of the pumping station is not adequate.
3. Water treatment plants are also absent.
4. Difficulties in extending the water supply network to up hill areas.
5. Improper maintenance of water lines.

(c) Solid Waste

1. Dustbins are not located in proper positions.
2. Improper management for collecting the solid waste.
3. Lack of public awareness.
4. Inadequate facilities for garbage collection, transportation, treatment and disposal.
5. Modern technologies like combustion chambers etc. are not employed.

1.5 AIMS AND OBJECTIVES

1. To study and analyze the existing infrastructure facilities w.r.t their provision efficiency and maintenance.
2. To study the gaps and short comings if the present system like management/ availability of resources / usage.
3. To study the impact of floating population on physical infrastructure.
4. To study the role of local bodies and urban local bodies in the physical infrastructure development.
5. To give, guidelines for a better service network.

1.6 SCOPE AND LIMITATIONS:

1. The study will confine itself to movement patterns, needs etc., of the existing population and floating population within urban agglomeration of Haridwar.
2. The study is limited to the existing infrastructure network of some selected urban services only and which is water supply, sewerage, solid waste.
3. To planning and layout design aspect to be emphasized more than the financial and management aspects.
4. The system is to be studied / analyzed w.r.t social, economic and technical factors.

1.7 METHODOLOGY:

The project will start with the collection , assimilation and analysis of various relevant data collected from the secondary sources. The identification of data gaps will lead to the required field study-survey, interviews to complete the information base, which in turn leads to the final analysis descriptive, statistical and graphic.

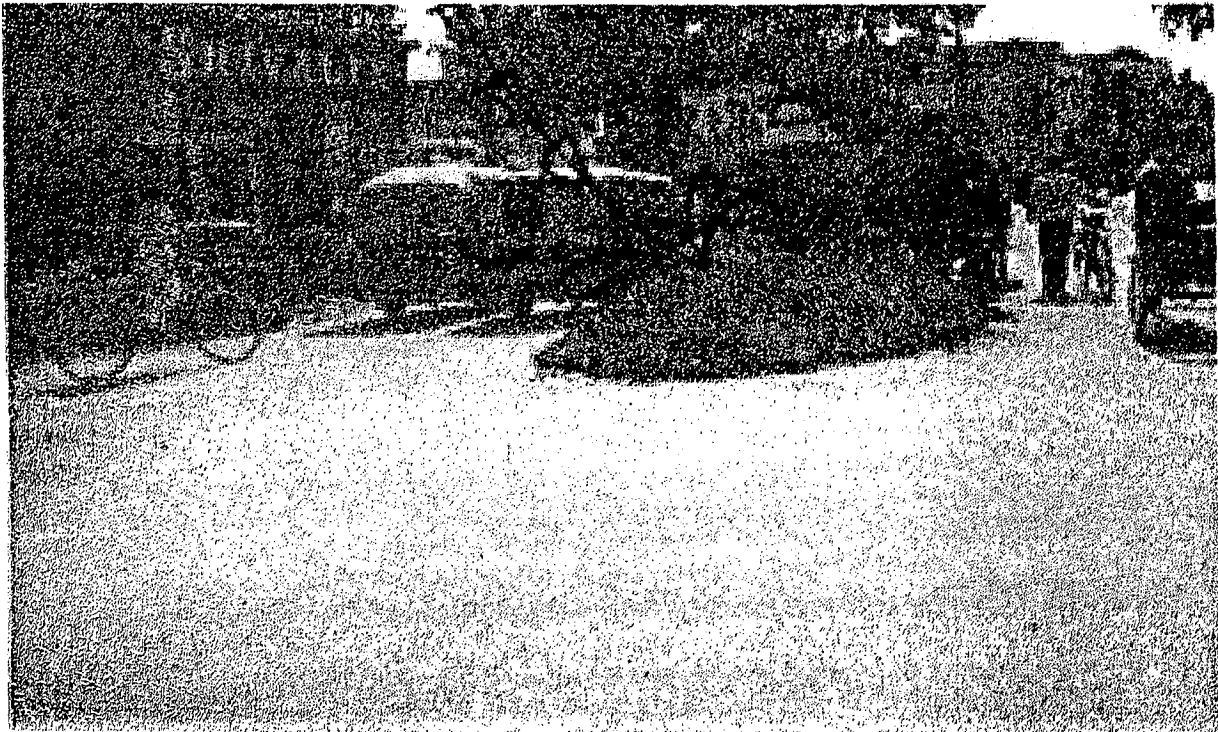
This analysis plus the cause-effect relationship in the form of network diagrams will provide material for making a base for planning. The area of study comprised mainly Haridwar municipality, Kankhal and Jwalapur, But for the future development of Haridwar effect of surrounding area also taken into account.

1.8 CURRENT APPROACH

Infrastructure services in India are, by and large, the responsibility of the local governments. At present in most of the cities Municipal authorities, State government departments at local levels such as PWD, Public Health, Medical, Education etc. and parastatal agencies v.i.z., Electricity Board, Housing Board etc are providing Infrastructure facilities and services. Urban Local Bodies generally take care of water supply, drainage and waste disposal. The state electricity board provides bulk supply of power and the local authorities are expected to maintain supply. Local bodies are generally concerned with layout of streets and maintaining them in good order while major link road are provided by state public works department and development authority.



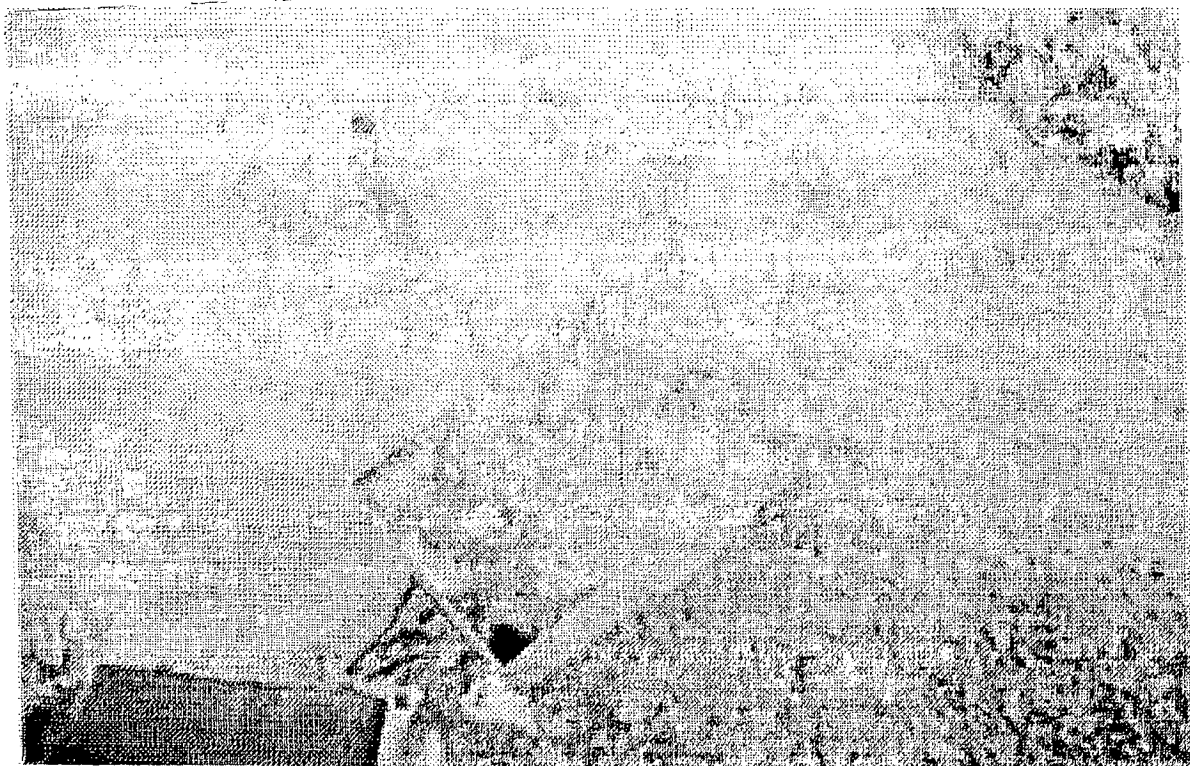
LACK OF PUBLIC AWARENESS



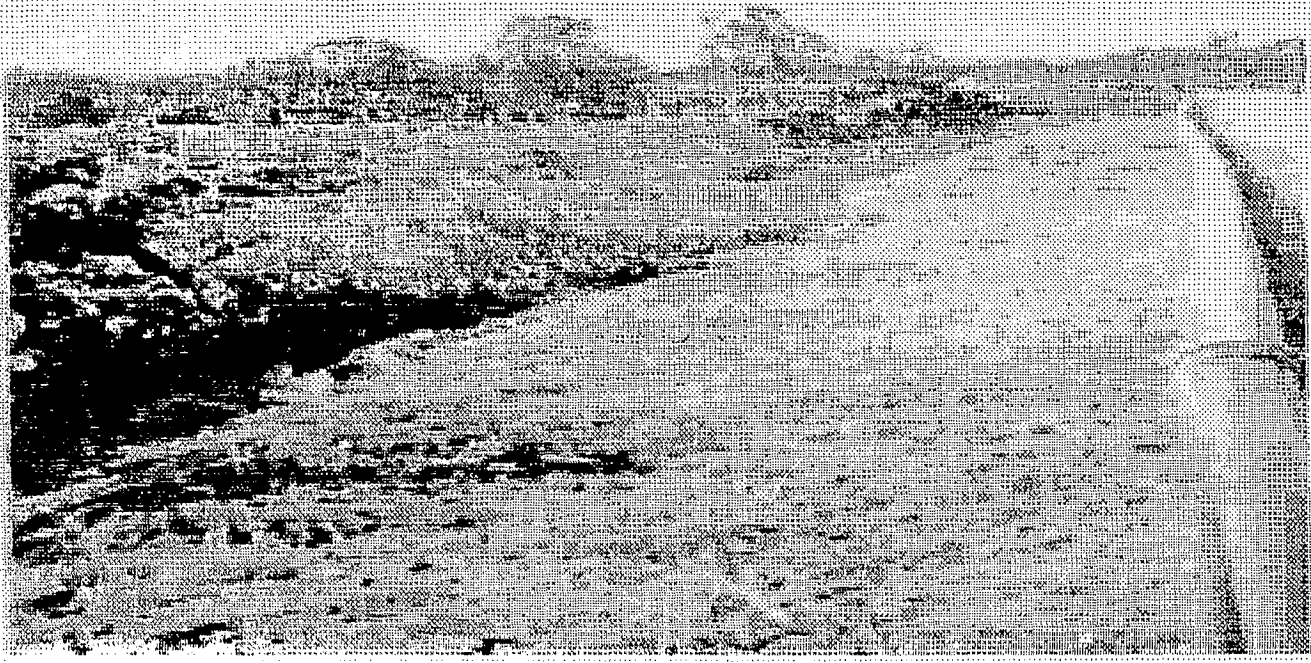
IMPROPER MANAGEMENT FOR COLLECTING THE SOLID WASTE



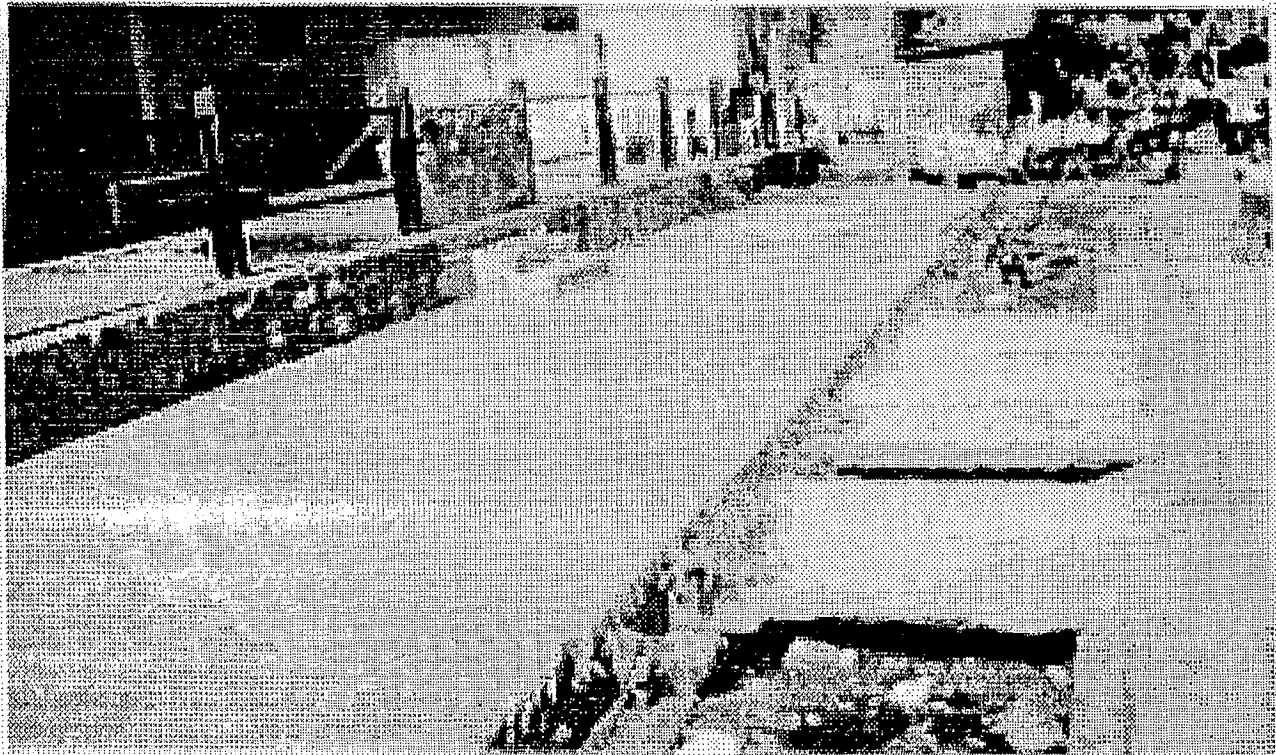
IMPROPER COLLECTION OF SOLID WASTE



DUST BINS ARE NOT PROPERLY PROVIDED



IMPROPER MAINTENANCE OF WATER LINES



CHOCKED OFF SURFACE DRAIN

CHAPTER 2
LITERATURE REVIEW

2.1 STATUS OF INFRASTRUCTURE

Infrastructure may be defined as the physical framework of facilities, utilities and support system through which goods and services are provided to the public. Infrastructure facilities are generally grouped into two major categories.

(i) Physical Infrastructure

- (a) Water supply
- (b) Drainage
- (c) Sewerage
- (d) Water disposal system
- (e) Transportation and power supply

(ii.) Social Infrastructure

- (a) Education
- (b) Health
- (c) Telecommunication
- (d) Fire fighting services
- (e) Socio-cultural, recreation parks
- (f) Banks and financial institution
- (g) Housing and other services

2.2 INDIAN SCENARIO

- * In Indian context, on an aggregate, 21 percent of urban population is living in slum and squatter, where access to basic services is extremely poor.

Water supply

- * Although 83% of urban population is reported to have access to safe drinking water, there are severe deficiencies in quantity and quality of water available to urban residents. About

49% of urban population is covered with sanitation facilities while rest of the urban population is devoid of such services.

Waste water management

- Nearly 46% of urban house hold use water borne toilets but only 26% of the urban households are connected to the public sewerage system.
- According to CPCB (Central Pollution Control Board) even among metros only five metropolitan cities house have proper wastewater collection system.
- Ten metropolitan cities house reported to have sewage treatment facilities of which four each have partial primary and partial secondary treatment facilities while the remaining two have secondary treatment facilities only.

Delhi	-	78% waste water treated
Bangalore	-	75%
Chennai	-	63%
Calcutta	-	50%

- * A survey of mode of disposal conducted by CPCB for 142 class- I-city reveal interesting picture.

80% of class I cities	-	disposal is on agricultural land
30% of class I cities	-	discharged into rivers either directly On through drains.
22% of class I cities	-	discharged on both agricultural land and river,Lakes, sea and ponds etc.

- None of metropolitan cities in the country have 100% underground Sewerage system.

Lucknow	-	33%
Kanpur	-	97%

Nagpur - 24%

Pune - 85%

- Nearly 300 urban centers have sewerage system in which only 70 towns/city have sewage treatment facilities.
- As for as sanitary facilities are concerned about
 - 35% of urban resident have access to sewerage system
 - 15% have septic tank system
 - 20% have service latrines.
 - 30% use the open spaces.

Solid waste management

- Total solid waste generated in the cities = 80,00 metric tonns.
- 60% of solid waste generated is collected for proper disposal. Approximately Rs.130-260 per tonne is spended on collection, transportation and disposal of solid waste in Indian cities.
- The scenario of solid waste management in mega cities is as follows:

	Name of city	Solid waste Generated (MT/day)	percentage
1.	Mumbai	5000	87
2.	Delhi	4600	90
3.	Chennai	3500	90
4.	Calcutta	3500	75
5.	Hyderabad	2800	75
6.	Bangalore	1800	70

- For garbage collection and disposal 1.16 scavengers are employed per thousands of urban population as against the norms of 3-5 scavengers/1000 urban population.

Urban transport System

- In central areas of majority of the metropolitan cities in our country the speed is as low as 5-10 km per hour.

Electricity

In 1947	-	1362 MW
In 1995	-	81164 MW

The per capita consumption of electricity, which was less than 15 units in 1951, 314 units by 1995 .

2.3 MANAGING URBAN DRAINAGE SYSTEM BY B.S. SCKHON

This paper give emphasis on the provision of drains, their maintenance, role of different agencies involved in the development of roads/streets and drains which are often overlooked in the planning and development process. A brief idea of this concept is as follow; The complexity of agencies involved in the provision, maintenance and management of drains and uncontrolled & haphazard development of cities generally caused uncontrolled plinth level of buildings. The drainage behavior is affected with this differential plinth level development. In this paper drainage character of Amritsar have been studied and a strategy of level controls is suggested to manage the urban drainage problems.

ISSUES INVOLVE IN DRAINAGE

In Amritsar it has been observed that drains are functioning well in planned residential areas.

The education of people, their awareness about the protection of drains helps the smooth flow

of water in the area. The problems become more serious in Old City having 40% area is unsaved with underground sewer lines. All over the city both in planned and unplanned areas, drainage problems are very high in commercial areas, the road side open drains are encroached by the shop keepers, that block the flow of the surface water the drains after results in water accumulation and flooding during rains.

Generally, the plinth level is kept about 1 1/2 feet above the road surface level. But keeping in mind the successive rise of road surface, the plinth level of buildings is higher than this, In Amritsar. These higher plinth levels not only disturb the drains but also needs huge quantity of earthwork. This increases the cost of development and large-scale land-destabilization in surrounding areas.

The following approach are suggested by the author to manage the drainage effectively.

- The city has insufficient size of drains. In the design of drains complete landuse analysis and socio-economic behavior of the people should be included.
- The density controls and building regulation should be managed strictly as in Amritsar; high-density areas have more impervious areas that generate more water.
- The majority of the problem of maintenance can be solved with proper coordination among different agencies and involving people in the management of drains.

Level Control in Cities

To manage the developed areas in future a system of level controls should be ensured.

Permanent control points are to be fixed in the different parts of the city. These control levels will help to fix the formation level of all roads, plinth of buildings in different areas and depth of drains in the area.

3.4 PLANNING FOR URBAN INFRASTRUCTURE AND ITS MANAGEMENT

PROBLEMS, ISSUES AND NEW DIRECTIONS

In this paper author has tried to reveal the acuteness of the problem arising from urbanization in urban infrastructure development & its remedial measures. The main point discussed in this paper is as follows: -

Total population of India has been estimated as given in Table below

Year	Projected Population (million)
2000	1042
2025	1442
2050	1699
2075	1820
2100	1870

If we take the urbanization at 55 percent by 2025 and 75 percent by 2050, the total urban population in 2025 and 2050 would be 790 and 1274 million respectively.

Rapid population growth contributes to stress the urban infrastructure. How will India cope with the inevitable 18-19 million annual addition or 1.6 million per month or 60,000 per day in the coming years? Several explanations can be offered for this widespread surge of interest in the physical infrastructure. Nearly 30% of the total population of about 98 crores are living in towns cities in India. Today, India has 6 mega cities and 23 metropolitan cities, which are expected to increase to 40 by year 2001. There are also 300 large towns and 3,396 medium and small towns. The urban areas in India presently face severe concerns arising from the gap between the demand and supply of urban services, housing, population, environmental

3. No infrastructure should be provided free. Infrastructure is more likely to be economically efficient when it is subject to user charges. User charges should be based on economic prices and willingness to pay.
4. The cost of development, operation and maintenance of four basic infrastructures networks namely railway; highway, power grid and communication are highly sensitive to the location and structure of cities. The available infrastructure and its potential should be identified and prepared for future urbanization and to achieve sustainable development.
5. Providing more funds to this scheme should strengthen the scheme of Urban Basic Services for the poor (UBSP).
6. There should be attempts to involve all the stakeholders in urban development in urban infrastructure development projects through Public-Private-People-Participation (PPPP).

3.5 THE INVOLVEMENT OF LOCAL BODIES IN THE PROVISION OF INFRASTRUCTURE SERVICES WITH SPECIAL REFERENCE TO WATER SUPPLY AND SEWERAGE SYSTEM

S.Ramarao and Mr. Debasish Benarjee

This paper deals with the necessity of augmenting the financial resources of the Local Bodies for improving and sustaining the system offering some minimum level of service through appropriate price mechanism. The brief idea of the paper is as follows:

PROBLEMS

- a) Pricing mechanism is poorly organized Tariff rates not reflecting the true market costs. It is therefore revealed that there are perennially accumulated arrears under the current account.

- b) High maintenance bill (including wages / salaries and electricity charges skyrocketing), resulting in high unit costs.
- c) Leafages (for instance, aged and corroded pipe lines leading to profuse leakage's of water getting undetected), pilferage due to mushrooming growth of slums and illegal connections.
- d) Large component of the slum population necessitating increases in provision of the services as a social commitment with nil or no financial returns.

OBJECTIVES

The Specific objectives set forth for the paper are as follows:

- * To review the patterns of pricing, cost recovery and the related management issues.
- To examine the financial performance.
- To assess performance of services and improvements (reliability, service hours, etc.) and the Willingness To Pay (WTP) for these services by different user categories.
- To suggest the required institutional arrangement.

INSTITUTIONAL REFORMS

Some of the important measures are described below:

(A) Short Term Measures

Improvement in collection mechanism could be brought about through collection targets to those involved in bill collection. Incentives may be allowed in those cases achieving 100% collection of the given current demand.

(B) Manpower Management

It is widely acknowledged that the Agencies are overstaffed. The result is low output per employee and increasing maintenance cost. The ways to deal with the situation is to initiate detailed work-studies and downsizing the excess manpower and thus reduce the O & M costs.

(C) Management Information System (MIS)

Development of database in more unconventional manner is required. For instance, user typifies income Group Wise, number of metered and non-metered connections, meters working and not working revenue and maintenance expenditure by user category, is the type of data needed for various planning policy making purposes. Delhi has attempted updating of data and computerizing resulting in the recovery of substantial sums of arrears.

(D) Delayed Payment

Levying penalty on the delayed payments at the prevailing Bank rate of interest would tend to improve the collection performance. It is all the more essential to enter into a variety of contractual arrangements with the private operators in services delivery, management, leasing and concessions.

(B) LONG-TERM MEASURES

It is necessary to make the WS & SW system a purely private operated one in a BOO or BOT sense, the political acceptability becomes an important question.

2.6 THE PROCESS OF INTEGRATED INFRASTRUCTURE PLANNING

The process of planning and implementing a multisectoral and multiyear investment program entails a number of steps, which are as follows:

1. Define a local government lead agency for the planning exercise and assign authorities of inter-agency coordination with this lead agency.
2. Take existing national and regional development plans into account and review existing urban master plans in order to define through a rapid urban appraisal the expected urban development scenario.
3. Identify infrastructure needs on the basis already known deficiencies and through community surveys (real demand surveys).
4. Compile information about ongoing and already committed projects and investment.
5. Prioritize projects for each sector and prepare 'long list' with projected revenue and subsidy position of the local government.
6. Tally desired investment program with projected revenue and subsidy position of the local government.
7. Development a Revenue improvement action plans, which will help to raise local income within the planning period.
8. Tally the expected results of the revenue improvement action plan with the draft investment plan, and prepare a realistic short list of prioritized projects.
9. Prepare an institutional development Action plan that takes into account the coordination and integration of various local agencies for the implementation of various local agencies of the investment program and for the revenue improvement action plan.
10. Conduct with the assistance/supervision of higher levels of government an appraisal of multi-year investment program.

11. Make necessary, additional institutional and legal arraignment for the implementation of the program by establishing temporary functional project management and monitoring units

CHAPTER 03
CASE STUDY

3.0 CASE STUDY

This case study is being done as part of literature review from the Published Paper “Resources Mobilization Plan for Urban Infrastructure Development “ A case of Varanasi from ‘*Source International conference on Urban Infrastructure financing and pricing*’.

3.1 GEOGRAPHICAL POSITION: -

Situated at banks of holy Ganges Varanasi is described as 83°N Latitude and 25°35'E Longitudinal. Varanasi is well connected to Delhi and other most important cities of Northern India via National Highway No.2 and NH-56 (Lucknow –Varanasi). Also Varanasi enjoys an efficient railway system. Adjacent areas are: Sarnath temple in East, Shivpuri in West, Babatpur and Cholanpur in North and Ramnagar in South.

3.2 CRITERIA FOR SELECTION OF CASE STUDY: -

A case study must be satisfied the following conditions:

- i. Historical background of cities must be similar.
- ii. Industrial profile must coincide.
- iii. Employment structure must be coincide.
- iv. Problem faced by both the cities must be similar in nature.
- v. Reasons for the growth of the city must be same.

Varanasi is selected, as the case study for this thesis as the reason specified above match with the city of Haridwar and both have almost parallel structure. Even though the population of Varanasi is much more as compared to Haridwar, it holds good for Haridwar as both cities face the common problems caused is the floating populations.

Postulates

Haridwar

1. Situated on the banks of holy Ganges.
2. Center of religious activities as per Hindu Mythology.
3. Organically developed with the passage of time, centuries after centuries.
4. Growth of the population was due to reasons, ashrams and akharas Of Sadhus. People came Haridwar and started to live here so as to meditate and to get peace of the soul
5. Goods transported to various parts of the the country via road networks as well as the railway network. National NH-58 passes through Haridwar connecting it to Delhi while the railway network connects Haridwar to almost every major city of Northern India.
6. Industrial growth is concentrated in the industrial zones allocated by the H.D.A while a few industries are scattered everywhere in the city .The city life is very much influenced

Varanasi

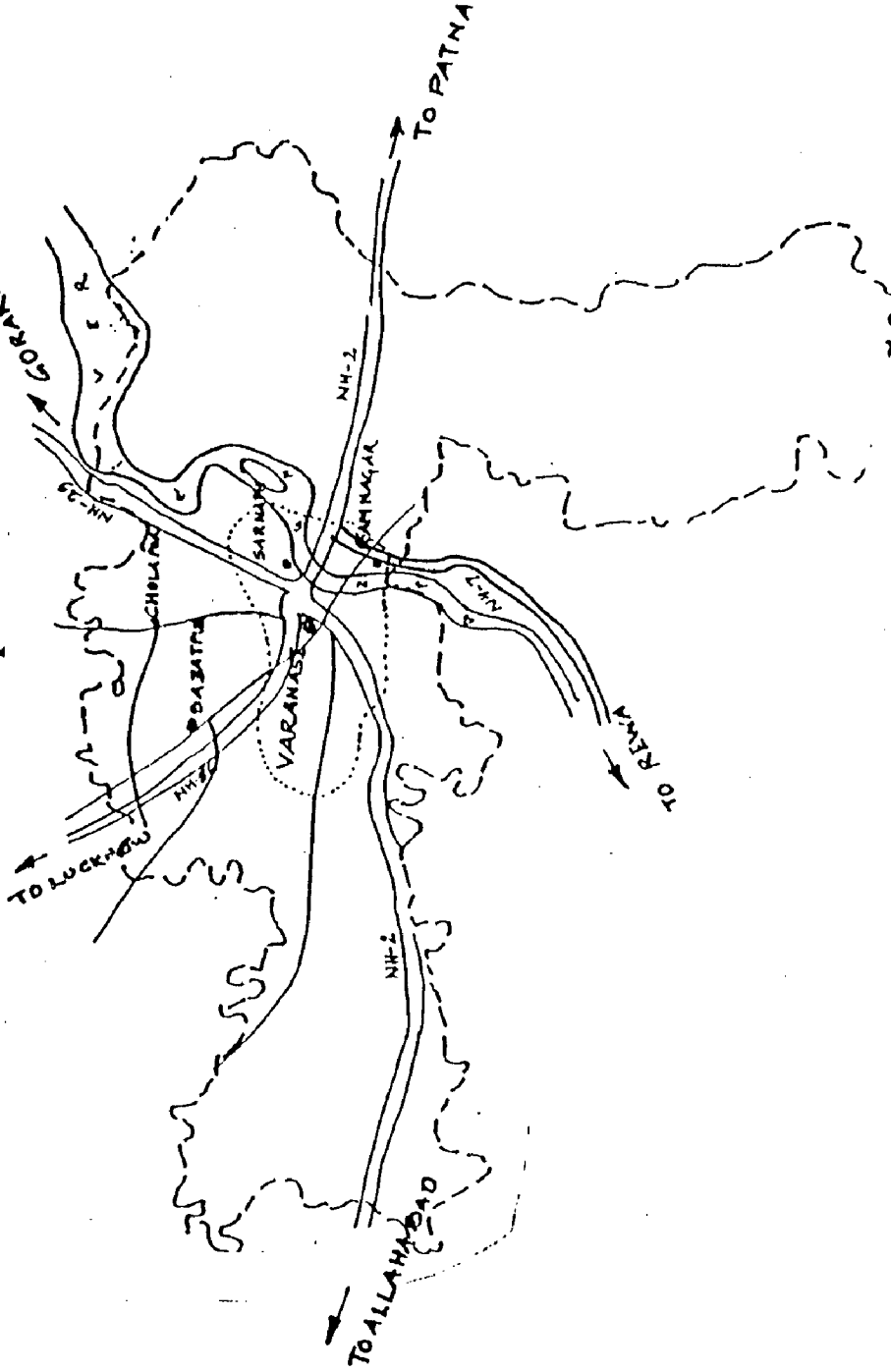
Ganges bifurcates the city in two parts.
Main Attraction of Hindu pilgrims.
Due to the Holy Ganges.
Organic growth of the City.

Holy Ganges had always been Religious considered as the blessing of Gods and thus scarcity of place is obviously very religious. Dip in Holy Ganges destroy the outcomes of sins.

Varanasi enjoys the flowless traffic conditions by virtues of the presence of NH-56 and Nh-02 connecting it to Dehli and the other parts of the Northern India. Also the efficient railway network provides a boom for industrial growth.

The textile industry in Varanasi finds its roots deep in its context. Mostly industries are connected in the Southren parts while small scale

District Map of Varanasi



Legend

District Boundary
 Municipal Boundary
 Roads
 Rivers

District Map
 Scale NTS

PHYSICAL INFRASTRUCTURE
 DEVELOPMENT OF HARIDWAR
 CITY

by the pressure of B.H.E.L industry

industries are scattered is well known for its Saree ,metal tabacco products.

7.The daily life style and activities of the inhabitants are very much influenced by by the presence of Holy Ganges and people show a considered respect to their deities.

Being an important city as per the Hindu mythology, it is obvious that the lifestyle of the public must get Influenced by this factor. Ganges plays a vital role in the daily life of public.

8.The rate growth of population on Haridwar is 2.9%.

The rate of growth of population in Varanasi is 2.7%.

Despite all the above mentioned similarities Haridwar and Varanasi still posses few differences as well .To summarize:

Haridwar

1. The populationof Haridwar is 1.44Lakh Appox., within the municipal boundaries.
2. Haridwar is situated quite close to the beginning of the river Ganges. Also a branch of Shivalik ranges touches Haridwar giving it an outlook of hilly terrain on some parts.
3. Haridwar bears the maximum load of floating population during the festive seasons esp. at the occasions of Maha Kumbh, celebrated every 12 years and during monsoon seasons the festival

Varanasi

Varanasi supports a population of 10.31 lakh which comparatively is a huge.

Varanasi is situated at the culmination of river Ganges and its on more of plain terrain.

As there is no such big festival celebrated in Varanasi the pressure caused be the floating populations are not as intensified as it is in

of Kabar and Shivratri.

Haridwar.

4. Haridwar is comparatively a very small city and has on the banks of river Ganges enjoying the status of district.

Varanasi has acclaimed the status of Metropolitan city in 1991 and thus The level of administrative is different as that of Haridwar.

3.3 CLIMATE

Very hot summers and pretty cold winters define the extreme climatic conditions. The months of May and June are the hottest with temperature soaring mercury upto 38 °C mark while during December and January are the coldest the temperature reaching as Low as 10° C. Hot summers are characterized by dry the dusty winds. Annual rains fall in 675 mm and is considerably fluctuating.

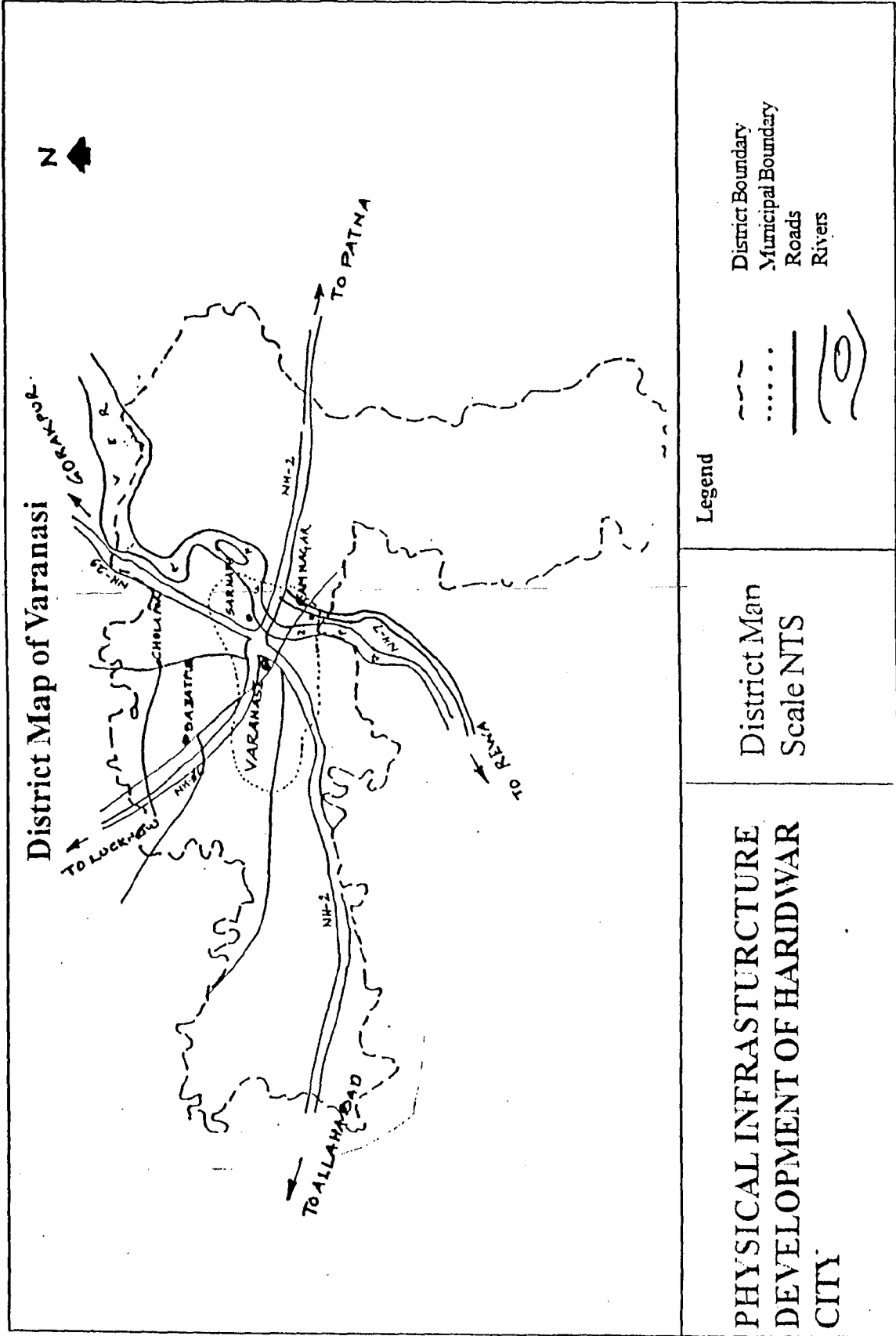
3.4 DEMOGRAPHY

The accumulative population of city is 10.31 Lakh. The city has been growing at an average annual rate of 2.7 percent and attained a metropolitan city status in the year 1991. Estimates indicate that the population here would double itself in the next 20 years.

3.5 PROBLEMS

The existing city Infrastructure is woefully inadequate to cater to the present population.

1. The problems get further aggravated by continuous influx of pilgrims and tourists in form of floating population.
2. Varanasi has acute traffic and transportation problems mainly on account of narrow roads, predominance of slow moving vehicles, inadequate public transport, and roadside



encroachments, back of traffic sense and poor traffic management/enforcement.

3. The water supply for a considerable segment of the population is inadequate and has to depend main on ground water supply.
4. The sewerage and drainage system were laid long back and are usually choked during monsoon period.
5. Existing practice of solid waste management in the city is also not satisfactory and the pollution levels have increased significantly.
6. Housing is also on active problem with about 40% of the population living in slums.

3.6 ASSESSMENT OF EXISTING AND PROJECTED URBAN SERVICES AND FACILITIES IN VARANASI

Physical Infrastructure

i. Water Supply

Varanasi had a good beginning in the provision of civic amenities with the introduction of piped in the year 1892 but further Improvements commensurate with population growth and city expansion have not taken place.

- * Varanasi is presently supplied = 286 mld.
- * Estimate requirement in the year 2015 = 602 mld
- * Current deficit being = 48 mld.
- Current water supply from since Ganga (42%) and Tubewells (58%)

ii. Sewerage System

The present sewerage system covers only 50 to 60 present of the city with many outer areas are unsewered.

- * Total capacity of treatment plants 122 mld but are treating 112 mld sewage.

- * It is estimate that wastes water discharge by the year 2015 would reach 422 mld.

iii. Solid waste

- * Varansi city generates about 450 MT of solid wastes daily at any average rate of 350 gm/capita/day.
- * To provide for the estimate 1339 MT of solid waste generation by 2015.

iv. Traffic and Transport

- * Varanasi is experiencing traffic congestion in most area of city due to predominance of slow moving vehicles (40 to 69% of total traffic composition) and inadequate public transport system.
- o The vehicular growth in the city has doubled from 1.22 Lakhs in 1991 to 2.41 Lakhs with an increase of 12 percent per annum but the road network has remained static our the last two decades. The volume- capacity ratio on most of the inner city roads is more than 1.

v. Power

- o Varanasi draws 220KV power from UP Grid via Obra.TPS and 132 KV power via Marudeh sub-station link. The peak power demand for 1995-1996 was 230 MVA by domestic, commercial and industrial consumers having 72%, 25% and 2.8% consumption respectively.

7 RESOURCE MOBILIZATION PLAN FOR VARANASI

The quantum of capital investment required to be mobilized in the period 1997-2015 for providing the infrastructure facilities on the basis of identified Projects/schemes/requirement in different section are summarized below: -

Based on the preliminary cost estimates as present below, a total of Rs. 5928 crores will be needed to finance the project and schemes proposed in the development plan upto the year 2015.

Sector	Sector wise Phasing Cost estimate (1997 to 2015)				Total
	1997-2000	2000-05	2005-10	2010-15	
A. Built-up Area					
1.a Hosing	969.00	495.05	615.00	846.00	2925.00
1.b. Slum Improvement	12.00	14.00	15.00	--	41.00
2. Industry	33.25	39.90	50.05	60.20	183.40
3. Trade & Commerce	70.24	71.17	95.77	58.77	295.95
4. Other Areas	393.53	228.50	279.28	368.14	1269.45
B. Green/open/ Vacant Area	124.00	71.00	90.00	114.00	398.60
Cost of Infrastructure					
Water supply	14.59	18.66	11.37	7.64	52.26
Sewerage & drainage	67.70	54.50	34.40	22.70	179.00
Solid Waste Manga	3.30	4.50	3.10	2.80	13.70
Transport Facilities	86.50	96.00	44.00	31.00	257.50
Tourist facilities	2.00	4.00	7.00	10.00	23.00

Education facilities	26.12	20.20	23.84	29.96	100.12
Health Service	5.58	5.56	7.96	8.02	27.12
Power	35.00	37.00	42.00	48.00	162.00
Total C	240.70	240.72	173.87	160.12	814.70
Grand Total	1842.81	1159.99	1318.47	1607.23	5928.30

The housing industry trade and commerce and public and semi public uses have been identified as the sectors that would generate net surplus capital which can be used to finance the other associated section/areas like main sewer/water supply line, city roads, education, health facilities etc.

3.7.1 HOUSING, INDUSTRY AND TRADE AND COMMERCE

About 40% of the land under housing is to be earmarked for roads, parks, convenient parking etc. therefore net saleable land would be 3900 ha at an average net selling rate of Rs.1100 per sqmt. In the housing sector 6500 ha gross residential area to be developed for the projected land of dwelling unit and sold to various categories of consumers till the period of 2015 AD. The cost of developing the land has been estimated at Rs.450 per sq.mt. It is proposed to the capital from the consumers in installments so that after 2-3 years the much needed facilities such as main water supply, sewer line, power, transport etc, would also be built up when the land possession is finally given to the consumer.

Similarly, in the other sectors, i.e. Industry, trade and commerce and public & semi public, the total land developed would be 524ha, 658ha and 778 ha respectively in gross term for the identified schemes.

The capital recovered from the saleable hand for the different sectors are given below: -

Sector	1997-2000	2000-05	2005-10	2010-15	Total
Housing	1273	649	808	1112	3842
EWS	58	30	37	51	176
LIG	333	170	212	291	1006
MIG	707	360	448	617	2132
HIG	175	89	111	153	528
Industry	4	113	142	170	528
Trade & Commerce	90	295	399	246	519
Public/ Semi Public	36	133	167	213	1280
Total	1893	1190	1516	1741	6940

3.7.2 TOURISM SECTOR

The other sector, which generates capital for Varanasi, is tourism. Due this activity a sizable number of people are attracted every day to Varanasi, exerting lot of pressure on the civic facilities and also generating funds for financing these activities.

It would be proper and in the interest of the city to at least indicate nominal amount which can be generated through such activities and used for providing civic services to population. It is thus proposed that a nominal amount of Rs.2.0 per tourist per day could be charged on tourists falling in Low Income group (60% of total tourists) and Rs.5/- per tourist in high Income group. Bond on the above approach, the revenue generation to the Local body on account of tourism activity is indicated below till the period of 2015 AD

	1997-2000	2000-05	2005-10	2010.15
Tourists	41.60	66.80	107.80	173.77
(No in Lakhs)				
Revenue Collection	4.08	8.96	14.37	23.19
(Rs. Crores)				

3.7.3 LOCAL BODIES RESOURCES

(a) Varanasi Nagar Nigam V.N.N

The level of revenue generated by VNN under the existing rates, charges and collection mechanism is not sufficient to meet even its revenue expenditure. However, a certain quantity of fund is transferred annually by the state to VNN under certain committed works.

Year	Revenue Generated
2000	20
2005	45
2010	82
2015	50

(b) Varanasi Jal Sansthan VJS

VJS undertakes work related to water supply and sewerage. There is ample scope for improving its financial strength and making itself sustainable. The water rates are Rs.2 per kl for domestic use, Rs.6 per kl for Industrial use and Rs4 per kl.

Estimate of Revenue Generation through water supply

Sl.NO.	Item	1995	2000	2005	2010	2015
1.	Water supply mld	286	401	448	522	602
2.	Recovery (%)	40	60	60	80	90

3. Average rate (Rs./Re)	2.34	2.34	2.34	2.34	2.34
4. Wastage	25	22	20	15	10
5. Stand Post public Utility services	15	15	15	15	15
6. Total Saleable water Per Tecor (million Lt.)	66549	97040	11376	137658	168093
7. Income (Rs. Crores)	6.23	18.62	18.62	25.77	35.40
8. Expenditure (Rs. Cr.)	10.18	14.27	16.30	18.58	21.43
9. Net revenue (Rer)	-3.95	-0.65	2.32	7.19	13.97

(c) Varanasi development Authority (VDA)

It has to play an Important role in over all ordination of development funds generated way of sale of Land - after finalizing various schemes in close co-ordinates with other departments, the estimate sum at would be distributed among departments.

VDA has been mobilizing funds through Loans from HUDCO, State Governments etc.

(d) Mandi Parishad

This body has control over all the wholesales trade in the city .The objectives of this body are to ensure proper price to the farmers and to develop adequate infrastructure facilities in the city for carryout the whole sales trade in the proper way.

In lieu of their services, they Levy 2% of turnover of the whole sale market as ' Mandi Shulk'. Through this they're annual Income about Rs.4 Crores. They spend about 40%

of their Income on salaries and other expenses and the remaining 60% is spent on development work.

(e) Other Local bodies

i. P.W.D. - Maintains roads mainly outside the Municipal boundary and does not collect any user charge.

ii. Electricity board. Maintains roads mainly the supply of electricity throughout the city.

Collects the revenue by billing individual users as per the consumption of the used indicated by wattage meters. However, certain irregularities in terms of the line losses and theft drag the electricity board into the budgetary deficit every year. Concrete steps are required in this direction v.i.z., checking and controlling the illegal usage, and imposing severe punishment to the people indulged in any misuse of electrical resources.

Based on the above strategy, the resources mobilized through land development (housing, Industry & commerce), tourism and Local bodies are given on table.

Sector	2000	2005	2010	2015	Total
Housing	1273	649	808	1112	3842
Industry	94	113	142	170	519
Trade & Commerce	290	295	899	246	1230
Public & Semipublic	236	113	167	213	749
Total (A)	1893	1190	1516	1741	6340

B. Resources from Dedicated taxes

Tourism	4	9	14	23	50
VNN	20	45	82	150	297
VJS	--	12	36	70	118
Mandi Parishad	10	--	15	15	52
Other Local Bodies	4	5	5	5	19
Total (B)	38	83	152	263	536
Total	1931	1273	1663	2004	6876

CHAPTER 4

CASE STUDY AREA CHARACTERISTIC

PHYSICAL INFRASTRUCTURE DEVELOPMENT 41

4.1 CASE STUDY AREA

Hardwar stands as the gateway to the four pilgrimages of Uttarakhand. Geographically and geological, Hardwar, lying at the feet of Shiva's hills, i.e., Shivaliks, in the Hardwar district of Uttarakhand, is a doorway. Suryavanshi prince Bhagirath performed penance here to salvage the souls of his ancestors who had perished due to the curse of sage Kapila. The penance was answered and the river Ganga trickled forth from Lord Shiva's locks and its bountiful water revived the sixty thousand sons of king Sagara. In the traditions of Bhagirath, devout Hindus stand in the sacred waters here, praying for salvation of their departed elder. It is doorway to the sources of the Ganga and the Yamuna, 3000 to 4500 meters up into the snowy ranges of the central Himalayas. The 'Aarti' worship of the Ganga after sunset and the floating 'dia' (lamp) is a moving ritual.

4.2 AREA UNDER MUNICIPAL BOUNDARY : 547,23 Hectares.

4.3 CLIMATE:

Hardwar is located at a height of almost 300 meters. One should never expect any sort of pleasant high altitude climate here. During the summers the temperature usually hangs around 40 degrees but winters sees the mercury dipping as low as six degrees. So neither of the seasons are suitable or ideal for tourists to venture in Hardwar. The monsoons further add to the miseries of the visitors. The best seasons to visit Hardwar are some where between September and June.

4.4 DEMOGRAPHY

The growth and decay of town largely depends upon the population studies. Through these studies one can assess the future land requirements, amenities and facilities and various other requirements of the town. The demography profile can be divided into three part v.i.z a. Permanent population, Camping population, and Floating population The permanent population of Haridwar Union (excluding B.H.E.L. township which is a separate town Area Committee) as per 1991 census is 149011.

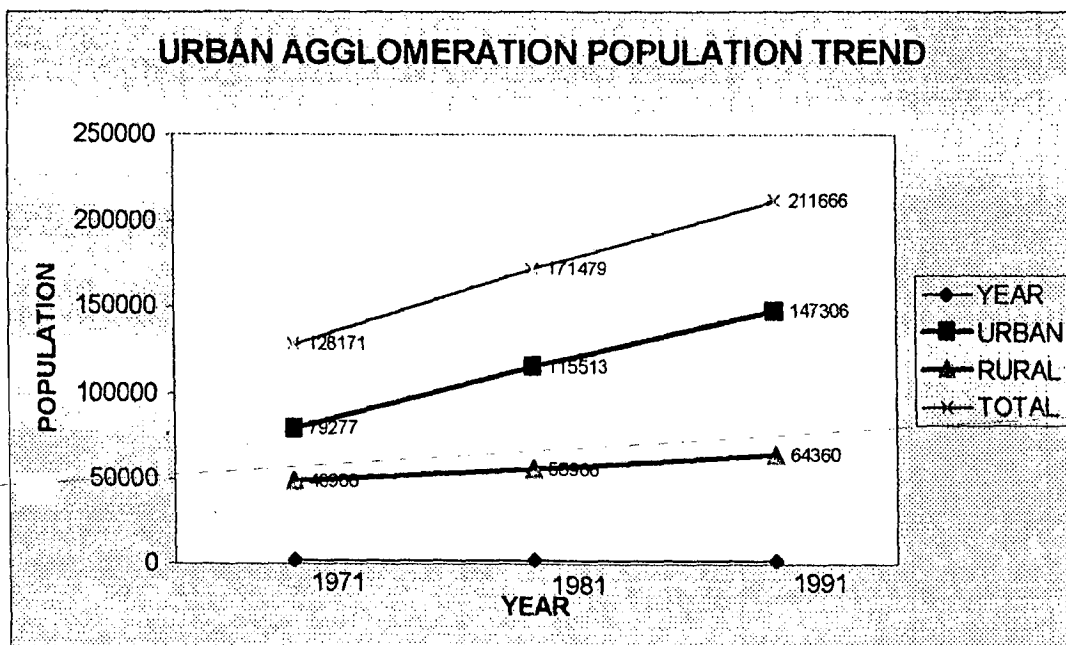
4.4.1 Permanent Population:

Hardwar union comprises of three townships namely Hardwar. Kankhal and Jwalapur. The decade wise and ward wise population figures for Hardwar Union and rate of growth are given in following tableNo.01and table no. 02.

Decade wise population table no.01:

YEAR	POPULATION	INCREASE DECADE	INCREMEN TAL INCEASE DECADE	% INCREASE PER DECADE	RATIO OF POP TO PREVIOUS DECADE
1911	28837	-	-	-	-
1921	30764	1927	-	6.68	1.07
1931	33287	2523	+696	8.20	1.08
1941	40823	7583	+5013	22.64	1.23
1951	56175	15352	+7816	37.16	1.38
1961	58418	2338	-13014	4.16	1.04

1971	79277	19351	+17013	33.07	1.33
1981	115513	36316	+16965	46.05	1.41
1991	149011	33126	-3191	29.06	1.235



Ward Wise Population table no 02:

Sources: office of Nagar Palika Haridwar

S.NO.	Ward No.	Name of Ward	Population of Ward	No. Of Family
1.	1	Kudth	5522	682
2.	2	Ambedkar Nagar	5943	1167
3.	3	Tibri	6365	1152
4.	4.	Valkiki Basti	6012	928
5.	5.	Jogiya Mundi	5438	894
6.	6.	Ravidas Basti	6273	873

7.	7.	Nirmila Basti	4740	1053
8.	8.	Kadkhari	5683	1102
9.	9.	Maya pur	5689	1118
10.	10	Madenyan	6436	911
11.	11	Katrayan	5815	696
12.	12	Achayayan	4650	855
13.	13	Har Ki Pauri	4977	1102
14.	14	Gau Ghat	4894	695
15.	15	Mahthan	4990	424
16.	16	SarvanNath Nagar	4733	778
17.	17	Bhoopat wala	5348	686
18	18	Ayra Nagar	5971	1551
19.	19	Rishi kul	4791	797
20.	20	Krishna Nagar	5905	1085
21.	21	Chaklan	5908	1114
22.	22	Avas Vikas	4979	1056
23.	23	Lakdaran	5628	741
24.	24	Govidpuri	5270	998
25.	25	Rajghat	4789	853
26.	26	Ladha Mundi	4832	1059
27.	27	Kassawan	5682	793
			149011	25163

4.4.2 Camping population

Besides the permanent population Haridwar has a floating population, mainly pilgrims, for 8 to 9 months. From March to October the average camping population 1,00,000 to 1,25,000 per month

4.4.3 Floating population:

Floating population consists of pilgrims' patient's tourists (Indian and foreigners both), visitors sight sees. On special occasions such as on Makar shankranti in winter and Baisakhi in summer when 5,00,000 to 10,00,000 people visit Haidwar. On the main mela day (Kumbh Mela 1998) total floating population were 51,00,000 people. According to Nagar Palika sources shows the festival population(Table No 03)

Nav sambrat	5 Lacs
Ram Navmi	3Lacs
Bhasakhi	15Lacs
Moon eclipse	05 lacs
Ganga Dheshra	07 Lacs
Guru Purnima	05 lacs
Nav Ratri	07 lacs
Guru Nanak Jayanti	12 lacs
Marak Shankranti	08 lacs
Moni Amavacya	13 lacs
Somti Mavas	10 lacs
Vasant Panchmi	05 lacs
Magh Purnima	06 lacs

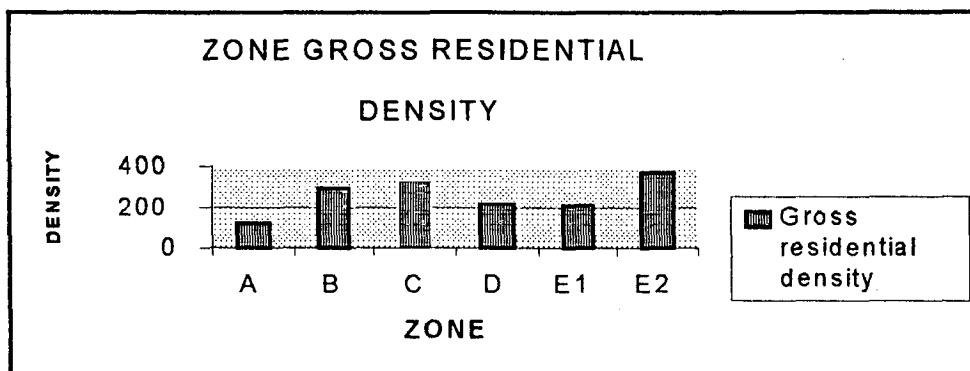
Maha Shivratri	04 lacs
Kavad Mela (one Month)	20 lacs
Savan Mela	20 lacs
Saturday/Sunday	0.96 lacs
Sun eclipse	10 lacs

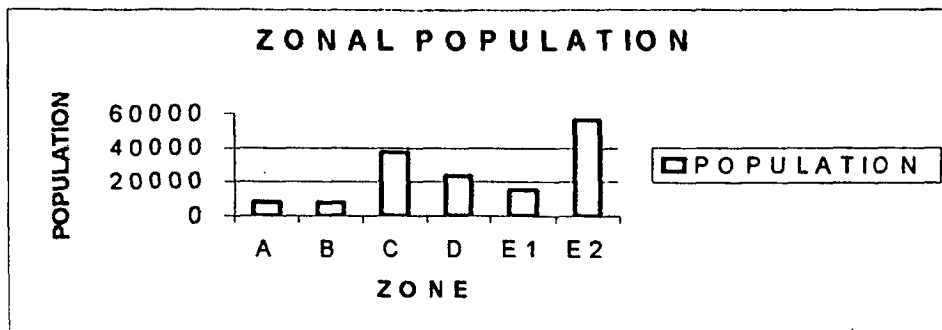
4.5 Density of population

Residential density is a measure of housing space, and helps in assessing the overcrowding as well as inefficient use of urban land distribution of zone-wise population and gross residential density is shown in table no.04

Zone	Population in hectare	Area	Gross residential density (persons per hectares)
A	8117	67.50	120
B	7668	26.05	294
C	36,950	109.35	338
D	23,175	104.25	222
E1	14,900	70.34	212
E2	56,495	152.34	369

source: census 1991





4.6 Occupation pattern

According to census of 1991 year, the numbers of workers are increasing, which represents the more probability of getting employment with ever-increasing permanent population as shown in table no. 05

YEAR	TOTAL POPULATION	TOTAL WORKERS	%AGE OF WORKERS
1971	79,277	23,145	29.18
1981	1,15,513	31,723	27.46
1991	1,49,011	40,825	27.34

Table no. 05

Sources: office of Nagar Palika Haridwar

4.7 Literacy rate:

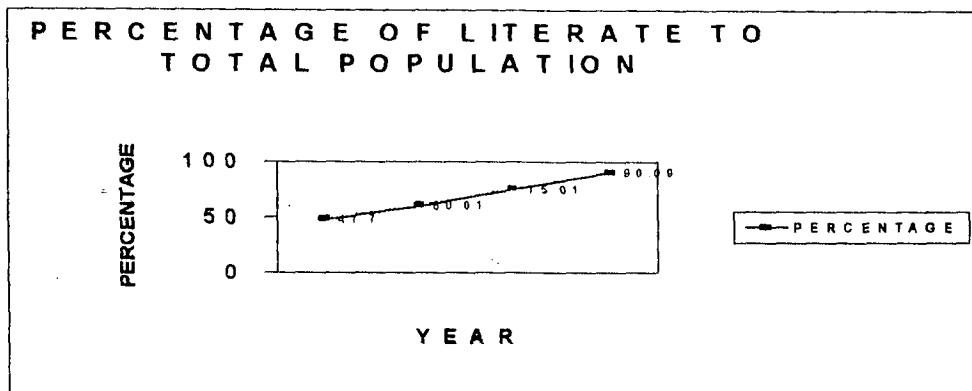
The literacy rate in Haridwar City was 75.01 percent for 59.7percent for males and 35.1 percent for females. According to Nagar Palika source literacy rate was 90.09 percentage as shown in table no. 06

Year	Total population	Percentage of total population
1971	79,271	47.70
1981	1,15,513	60.01

1991	1,49,011	75.01
1999	1,95,211	90.09

Table no. 06

Sources: office of Nagar Palika Haridwar



4.8 Land use pattern:

Land use pattern of any city or town is a direct measure of its function efficiency, which is governed by deposition of amenities and facilities, land utilization rate, inter-relationship of work residence and priority for various uses. Land use pattern of Haridwar is of mixed type like any other old Indian City as shown table no.07



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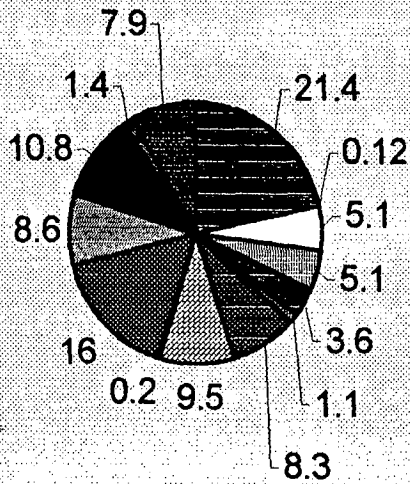
Classification of Landuse of Haridwar urban area table 07

-According to Master plan 1985-2001

S.No	landuse	Area (In arce.)	Area (In Km.)	Percentage of Total area	Percentage of develop area
Built up area (A)					
1.	Residential	627.89	2.54	21.4	38.7
2.	Commercial	30.58	0.12	1.0	1.9
3.	Industrial	148.55	0.60	5.1	9.2
4.	Community facility	148.76	0.60	5.1	9.2
5.	Transport	105.78	0.43	3.6	6.5
6.	State & Semi State office	33.68	0.14	1.1	2.1
7.	Religious places	242.58	0.98	8.3	15.0
8.	Camping place	277.4	1.13	9.5	17.1
9.	Travel	4.55	0.02	0.2	0.3
		162005	6.56	55.3	100.00
(b) Undeveloped Area					
10.	Open space	468.18	1.90	16.0	
11.	Green Area	252.69	1.05	8.6	
12.	Agriculture	815.74	1.28	no.8	
13.	Jungle	42.35	0.17	1.4	
14.	Water bodies	232.23	0.94	7.9	
	Total	1311.19	5.34	44.7	
	Grand total	2931.64	11.90	100.00	

Sources: office of H.D.A Haridwar

CLASSIFICATION OF HARIDWAR LANDUSE (1985)



- RESIDENTIAL
- COMERICAL
- INDUSTRIAL
- COMMUNITY FACILITIES
- TRANSPORTATION
- SEMI STATE AND STATE GOVT.
- RELIGIOUS SPACES
- KAMPING AREA
- TOURIST PLACE
- OPEN SPACES
- GREEN AREA
- AGRICULTURE
- JUNGLE
- WATER BODIES

CHAPTER 5.0

EXISTING SCENARIO OF INFRASTRUCTURE SYSTEM

5.1 Water Supply Network

Water supply is one of the crucial items of the infrastructure required for urban development. Without guaranteed supply of safe water large-scale urban development can not be successfully planned. There are various uses of water such as for domestic, industrial, mining and irrigation purposes. Urban water supply generally caters to the domestic and industrial needs. Therefore, while planning for any city or town, it is necessary to have long range plan of water supply for industry and domestic consumption continued and systematic growth of towns and cities.

A water supply network includes sources of water, storage facilities and the distribution network. Haridwar is having a well functioning water supply network spread over the entire town since 1927. There is no scarcity or problem in the supply of safe potable water to any section of the vast spread population but problems creates when influx of floating population increases.

Urban water needs can be divided into various sectors on the basis of the diverse kind of uses.

The water demand of a city two aspects.

- a) Domestic water demand.
- b) Water demand at city level.

The following tables from 8 to 10 are various standards for water demand and their breakup sector wise and population wise.

AVERAGE DOMESTIC CONSUMPTION IN AN INDIAN CITY

S.NO	USE	CONSUMPTION (LPCD)
1	Drinking	5
2	Cooking	5
3	Bathing	55

4	Washing of cloths	20
5	Washing of utensils	10
6	Washing and cleaning of houses and residences	10
7	Flushing of latrines	30
	Total	135

Table-8 Source : Bureau of Indian standards (IS : 1172 – 1971)

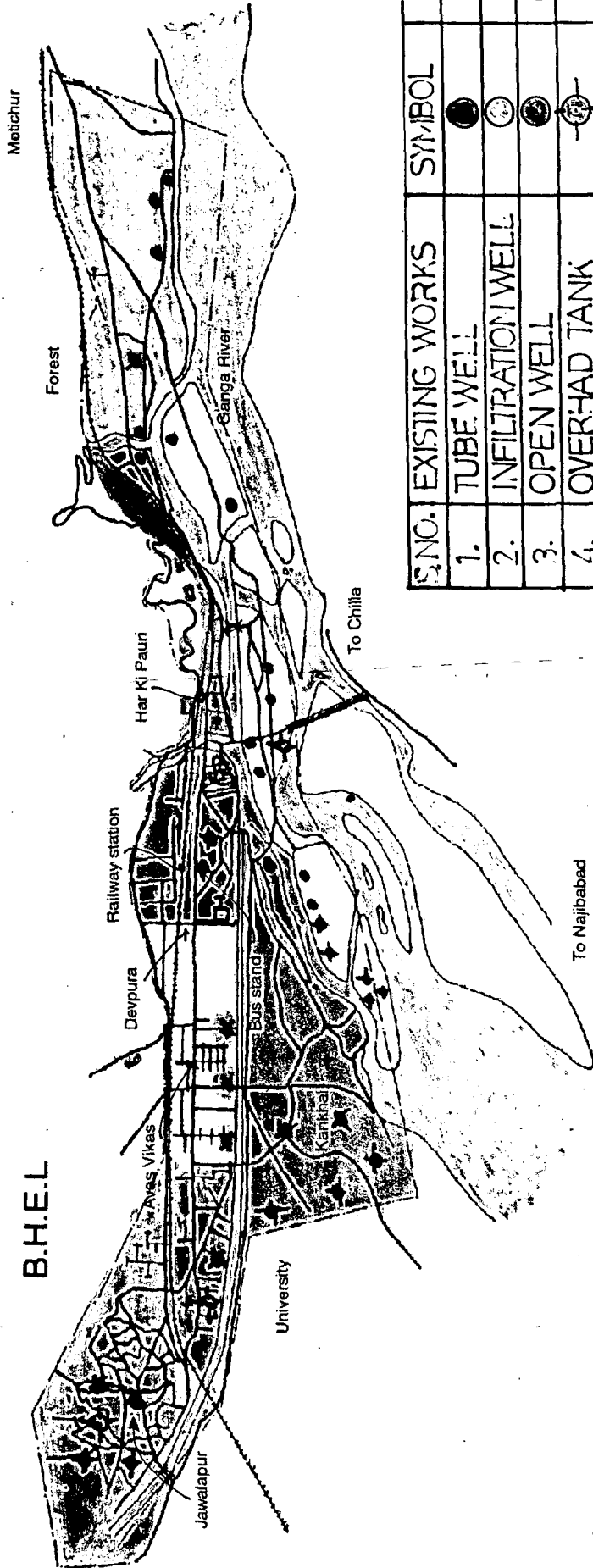
The city level demand varies according to the population size. On an average, the per capita demand for Indian cities may vary as shown in the following table. It must be noted that there is a big gap between urban and rural demands. As urban demand is about 150 lpcd to 300 lpcd, rural demand is 70 to 100 lpcd. On an average, world's urban water demand is 150 lpcd or about 55 cum per year and average rural water consumption is only 50 lpcd or 18 cum per year.

VARIATION IN WATER DEMAND AS PER CITY SIZE

S.NO.	POPULATION SIZE	DEMAND (LPCD)
1	Less than 20,000	110
2	20,000 – 50,000	110 – 150
3	50,000 – 2,00,000	150 – 180
4	2,00,000 – 5,00,000	180 – 210
5	5,00,000 - 10,00,000	210 – 240
6	More than 10,00,000	240 – 270

Table-9 Source : Bureau of Indian Standards.

Layout plan of Municipal Boundary Area



S.NO.	EXISTING WORKS	SYMBOL	I/O.
1.	TUBE WELL	●	17
2.	INFILTRATION WELL	○	16
3.	OPEN WELL	⊙	C3
4.	OVERHEAD TANK	—○—	05
5.	CLEAR WATER RESR.	■	05
6.	TEMPORARY WELL	⊙	02
7.	SHALLOW WELL	○	01

PHYSICAL INFRASTRUCTURE DEVELOPMENT OF HARIDWAR CITY

EXISTING WATER SUPPLY

SCALE
N.T.S

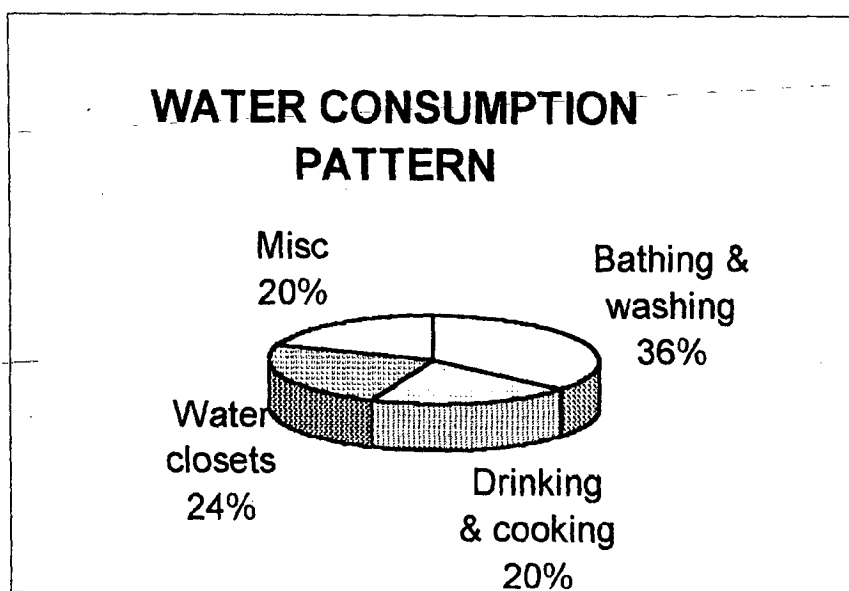
Legends/Notes
Based on the range prepared by town planning unit H.D.A Haridwar, errors in the map, if any may be due to computer rendition

River 
Roads 
Municipal Boundary 

BREAK-UP OF CITY LEVEL DEMAND

S.NO.	USE	DEMAND (LPCD)
1	Domestic	135
2	Industrial	50
3	Commercial	20
4	Public	10
5	Waste & Theft	55
	Total	270

Table-10 Source : Bureau of Indian Standards



5.1.1 PRESENT STATUS OF SOURCES

Haridwar is situated on the bank of river Ganga, the second largest river of India, in the upper Indo-Gangetic plains. River Ganga is a perennial river having good quality of flow even during dry weather. However, for the water supply of the town, the water is not tapped from the river. Instead, the ground water table being at a small depth of about 25 feet, the water is

taken from the ground water reservoir and the river water is let to flow unchanged for the downstream towns and villages for domestic, industrial and irrigation purpose.

For continuous and efficient supply of water the town is divided into 12 sectors. Water from the ground reservoir is taken out through tube wells and infiltration wells. In Jwalapur open wells are also used. Depending upon the need of water, each sector has been provided a number of wells and storage facilities in the form of over head tanks. Due to topographical and land use pattern some sectors depend partly or completely upon nearby sectors.

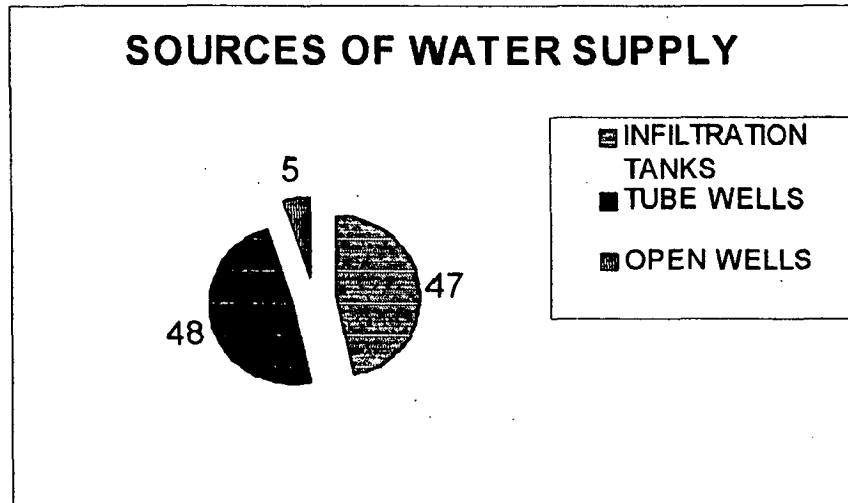
INFORMATION ABOUT WATER SUPPLY

i.	Number of sector	14
ii.	No. Of tube wells/infiltration wells/ open wells	33
iii.	Present per day water supply (16 hours pumping)	61.47 MLD
iv.	Present per capita water supply	263 LPCD
v.	Standard per capita water supply	270LPCD
Vi	Total discharge from tube wells	=47%
Vii	Total discharge from infiltration wells	=48%
viii	Total discharge from open wells	=05%

Source: Jal Nigam, Haridwar (1998-1999)

MLD - Million liters per day

LPCD - Liters per capita per day



Following are the sources of water supply of the town at present: (table no. 11)

S.No.	Source No.	Situation	Discharge 1999 (1pm)
-------	------------	-----------	-------------------------

(A) INFILTRATION WELLS :

1-	IW-25	Saptrishi	2200
2-	IW-27	-do-	2200
3-	IW-16	Bhopatwala	1200
4-	IW-26	-do-	2200
5-	IW-18	Pantdeep	2200
6-	IW-21	Roribelwala	2450
7-	IW-24	-do-	2200
8-	IW-25	-do-	2200

9-	IW-28	Bairagi camp	2150
10-	IW-29	-do-	2100
11-	IW-17	Lalta Rao	2400
Sub Total			30800

(b) TUBE WELLS :

1-	TW-7	Roribelwala	2000
2-	TW-4	Mayapur	750
3-	TW-5	-do-	2000
4-	TW-6	-do-	1350
5-	TW-11	-do-	2200
6-	TW-13	Jwalapur	3400
7-	TW-20	-do-	900
8-	TW21	Ambedker Nagar	2200
9-	TW-20	Rajnagar	3150
10-	TW-12	Jwalapur	3000
11-	TW-26	-do-	1200
12-	TW-19	-do-	2200
Sub Total			27250

(c) OPEN WELLS:

1-	OW-33	Jwalapur	800
2-	OW-15	-do-	2170
3-	OW-32	Jwalapur	2250
		Sub Total	5220
		Grand Total	63270

(B) STORAGE AVAILABLE FOR THE TOWN IS AS BELOW PRESENTLY :

S.No.	CWR/OHT	Location	Capacity (KL)	Staging (M)	Year of Construction
1.	CWR	Tibri	2270	-	1927
2-	CWR	Brahmpuri	1125	-	1981
3-	CWR	-do-	1125	-	1981
4-	CWR	Mansaevi	650	-	1981
5-	CWR	-do-	450	-	1972
6-	OHT	Ramrakha park	450	18.76	1974
7-	OHT	Aryanagar Jwalapur	450	15.24	1968
8-	OHT	Bhalla Inter College	340	15.24	1956

9-	OHT	Rotari	2250	18.00	1984
		Rangshala			
10-	OHT	Near Bhopatwala	270	15.24	1968
		ToLI Barrier			
		Total	9380 k l	-	-

Distribution of the town consists of CI/AC/PVC pipes ranging in size from 80mm dia to 500mm dia with total length as 105 kms. Approximately.

SUPPLY DEMAND EQUATION:

The duration of supply is only 16 hrs from all sources which contributes to only 267 lpcd , in general no shortage of water is experienced.

Factors Contributing to shortage:

- * Underestimated demand
- * Illegal conditions
- * leakage's
- * Poor maintenance
- * On line boosters.

5.1.3 TARIFF STRUCTURE

The connections are non-metered and a flat rate is being charged in form of water charges, which depends upon plot area as per the following table. also, water taxes are being charged depending upon the assessment of building and distance of building from main water supply line.

The municipality charges the expenditures on water under the following two heads....

a) Water tax (included within the house tax.) Charged annually.

b) Water charges (charged annually) .

The water charges are being charged on the basis of the following table set as a standard by the municipal authorities in 1997 depending upon the nature of the usage of water as well as the size of the plot in case of domestic use.

Domestic	Rs. Per month	Rs. per upper floor
upto50 sq.m	15.00	-
50-100	20.00	10.00
100-200	30.00	15.00
200-300	5.00	25.00
300-500	35.00	35.00
above 500	100.00	50.00
Non domestic		
<u>Restaurant</u>		
Small	100.00	
Big	200.00	
Tea shop	50.00	
Hotels	300.00	
Dharamshala	100.00	
Ice cream	100.00	
Hospitals	50.00(upto 15 beds)	
	150.00 (above 15 beds)	

Petrol pump	100.00.
Misc.	50.00

5.1.4. OPERATION AND MAINTENANCE

Haridwar municipal area is divided into 14 sectors for water supply, operation and maintenance in an appreciable manner. Collection of water tax and water charges is being done by Nagar palika. The following details are:

YEAR	EXPENDITURE		RECOVERY
	MAINTENANCE	WAGES	
1996-1997	1,39,073	67,69,866	43,20,992
1997-1998	2,41,396	71,66,294	43,45,769
1998-1999	3,24,423	94,24,651	51,39,522
1999-2000	5,00,000	1,40,00,000	55,12,118

(PROJ.)

Table No.12 Source Nagar Palika Account Section, Haridwar (1999-2000)

5.2 SEWERAGE FACILITIES

With the growth of the cities, the more primitive methods of excreta disposal have necessarily given place to the water sewage system. Even in the small towns the greater safety of sewerage, its convenience, and freedom from nuisance have caused it to be adopted wherever finances permit.

SEWAGE:

It is the liquid waste from the community and is generally conveyed by the sewer. Sewage again is differently classified depending on its nature and sources.

- (i) Domestic sewage (from dwellings units, business or institutions)
- (ii) Industrial sewage (from industrials viz. chemical refuse)

The domestic and industrial sewage collectively is termed as the sanitary sewage. Storm water is the liquid flowing in sewers during or following a period of rainfall and resulting there from. Some underground water may find its way through joints into sewerage system is termed as infiltration.

SLUDGE :

Sludge is the spent up water from kitchen, wash basin etc., It will not include the waste from urinals, water closets, stables etc., It is normally carried along with the domestic sewage where sewer system exists. But as the sludge may be carried though surface drains for disposal whereas excreta disposal may be done by means of septic tank

5.2.1 SEWERAGE SYSTEM

This is the system of sewers including all appurtenances required for sewage disposal.

Namely:-

(i) COLLECTION WORKS: Collection works are provided for collection sewage from different points of occurrence and conveying sewage to any desired points with the help of a sewer system.

(ii) **SEWAGE TREATMENT** : Sewage treatment covers any artificial process to which the sewage is subjected in order to remove or alter its objectionable constituents so as to render it less dangerous or offensive.

(iii) **SEWAGE DISPOSAL** : Sewage disposal applies to the act of disposing of sewage by any method may be to a body of water or on land. It may be done with or without any previous treatment of the sewage. The last stretch of truck sewer carrying sewage to the disposal point is known as outfall sewer.

5.2.2 AIMS AND OBJECTIVES OF SEWERAGE WORKS

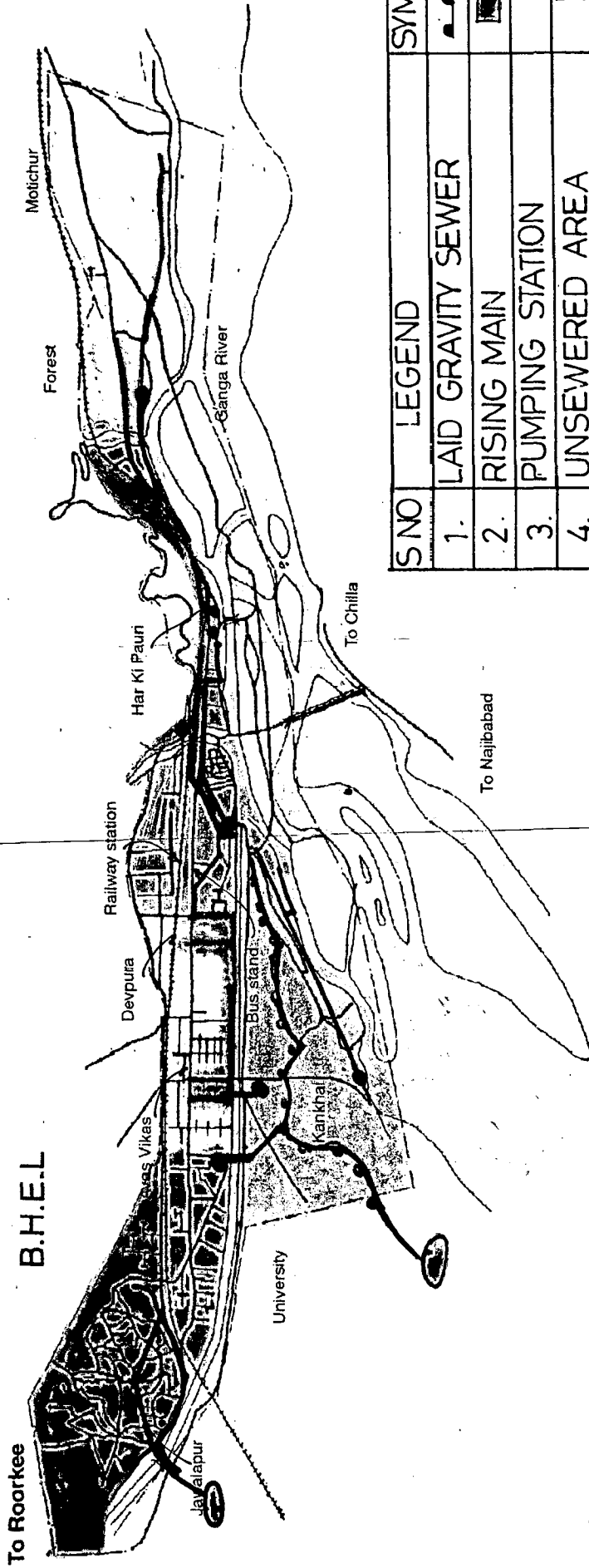
- a). To provide a good sanitary environmental condition in a city.
- b). To dispose off human excreta to a safe place by a safe and productive means.
- c). To dispose off all liquid wastes from a community to a proper place to prevent harmful breeding of flies, mosquitoes, bacteria etc.
- d). To treat the sewage if required so as not to endanger the body of water, or land to get polluted where it is finally disposed off.
- e). Proper disposal method should be adopted to protect sub soil water getting polluted.

5.2.3 Sewerage System in Haridwar

At present the collection, treatment and disposal of the sewage is being looked after mainly by the Ganga Pollution Control Unit in association of the Haridwar Development Authority (HAD) and the Nagar Palika.

Layout plan of Municipal Boundary Area

To Rishikesh



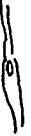

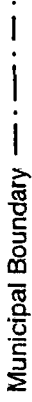
S NO	LEGEND	SYMBOL
1.	LAI D GRAVITY SEWER	—
2.	RISING MAIN	▬
3.	PUMPING STATION	●
4.	UNSEWERED AREA	▨
5.	TREATMT. PLANT SEW.G. FARM	○

**PHYSICAL INFRASTRUCTURE
DEVELOPMENT OF HARIDWAR
CITY**

**EXISTING
SEWERAGE FACILITIES**

**SCALE
N.T.S**

Legends/Notes
Based on the range prepared by town planning
unit H.D.A Haridwar, errors in the map, if any
may be due to computer redtion

River 
Roads 
Municipal Boundary 

The sewer system in the small residential areas is being developed by the H.D.A. and the finances involved in the laying of the sewer system is thus charged by the H.D.A. from the residents in terms of the development charges. The sewage thus collected from the independent households is collected to the sewer which dispose off it in the main sewer lines which in turn are being laid by the Ganga Pollution Control Unit on the financial aids from the State govt. The Ganga Pollution Control Unit thus collects the treatment and disposal of the sewage.

On the other hand the Nagar palikas looks after for the operation and maintenance of the sewer system through out the city.

Sewerage system was introduced in Haridwar in 1938. Since then it has been entered to various parts of the town. At present 90% of the town is covered with the sewer system. In the last sewerage project the whole Haridwar City has been divided in five sewerage zones, depending upon the topography of the area and capacity of old works.(as shown in map)

AT PRESENT

- Total amount of sewerage collection per day - 30 Mld.
- Total capacity of sewerage treatment plant = 18 Mld.
- Amount of untreated sewage = 12 Mld.
- Population not served by sewer system = 30,000 people.
- Number of pumping stations = 11 No.
- Total length of sewer line = 90 Km.
- Total annual expenditure in operation and maintenance = 407.00 Lack.

(1999-2000)

Table No.13: Present Sewerage Facilities in Haridwar

Sources : Ganga Pollution Board ,Haridwar

5.3 SOLID WASTE

Everything in this world is bound to be a waste sometime or the other. How so ever important or useful anything may sound today but soon or later when it gets out of use it is bound to gain a reputation as waste matter. Every community will produce different types of solid wastes and proper disposal of these will be included in the sanitary program of the locality. The solid waste thus produced can be classified as follows:

1. Rubbish:

Rubbish denotes all non-putrescible wastes except ashes, viz., paper, cans, broken glasses, wood, cardboard, scrap metals etc., rubbish is responsible for the creation of nuisance when it is scattered by careless handling or by wind.

2. Garbage:

The term garbage is used to designate those pulrescible wastes resulting from food products. These include cooked and uncooked vegetables rotten fruits etc. as these may cause fly and other insect problems and also these ferment readily resulting in the production of bad odours.

3. Refuse:

All sorts of solid wastes from a community may be termed as refuse. Generally accepted components of refuse include all putrescible and non-putrescible solid wastes with the exception of body wastes i.e., excreta. Such wastes include garbage, rubbish, ashes, dead animals, and industrial wastes. When collection is done together it is termed as mixed refuse.

Collection removal and disposal of refuse is a very important aspect of urban sanitation and is becoming a challenging problem to public health engineers to provide proper health, comfort and aesthetic situations for the community. The use of mechanical equipment's in

collection of the refuse and sanitary methods of its disposal are found to be essential in case of urban areas.

Effective planning of the method of collection and disposal of refuse of any urban area demands intensive of the study and quantity of refuse. Produced by it. It varies widely from place to place depending on the habits of people, the standard of living, climatic condition of the place, population density nature and number of industries etc.

Refuse in general may contain the different constituents for average Indian condition as given below: -

Item	% by weight
Garbage	45% to 50.00%
Paper	01% to 2.0%
Glass	0.25% to 1.00%
Rags	0.5% to 1.0%
Plastic	1.00% to 2.00%
Carbon	20.00% to 25.00%
Nitrogen	0.5% to 2.00%
Phosphours	0.5% to 2.00%
Potash	0.5% to 2.00%

The above table is given only to have an idea about physical –chemical characteristic of refuge an average Indian city may produce.

COLLECTION SYSTEM:

Collection system of solid waste can be divided into two broad categories.

I PRIMARY SYSTEM

Primary collection involves the collection of solid waste from house to house i.e., the points of generation to a suitable nearby common location (dustbins Garbage vats etc.) from where the refuse is further collected and transported to the point of disposal.

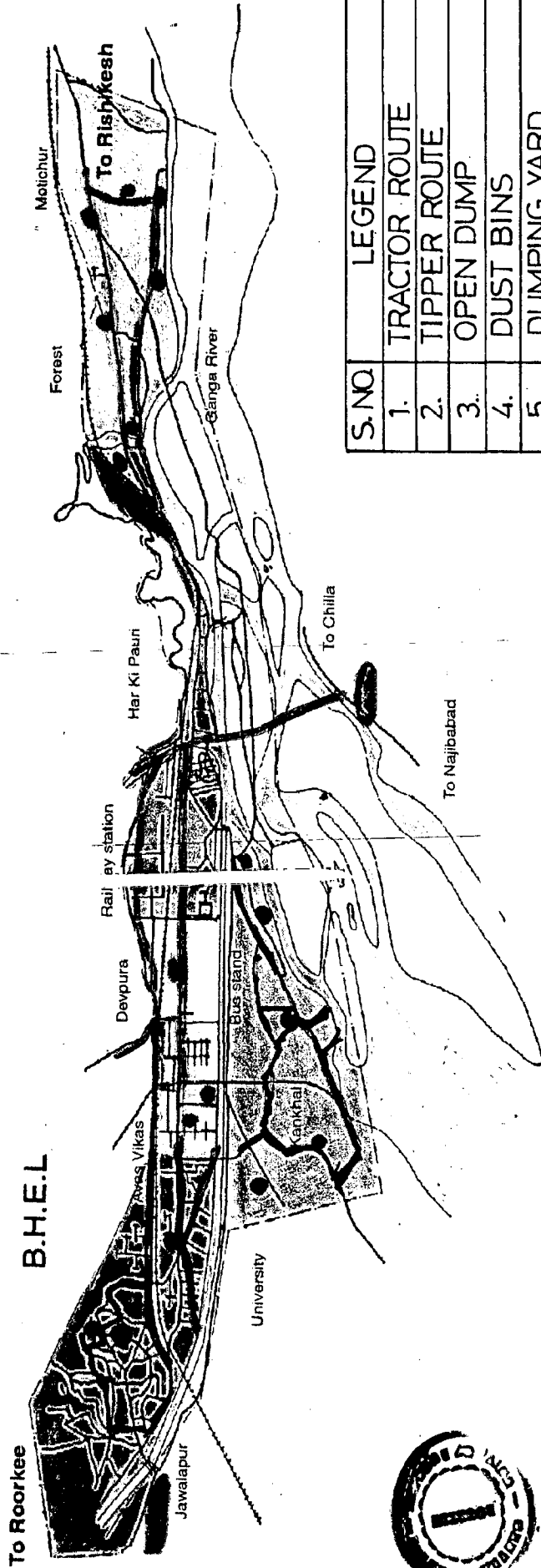
- i. **Communal Storage** : which may require delivery of wastes by the house-holders over a considerable distance. Communal storage bins of 1.00 to 2.00 Cu.m capacities at distance of 50-100 meters are likely to be acceptable to the residents and may junction better.
- ii. **Block Collection** : the Households deliver the waste to the vehicles at the time of collection, the time and route of the vehicles are made known to each area being served .
- iii. **Kerb Side Collection**: where house holds put out and later retrieve the storage bins. Residents must place their bins on the foot ways in advance of the collection time and remove them after they have been emptied.
- iv. **Door to Door collection** : The collector enters the gardens or courtyard carries the bins to the vehicles empties it, and returns it to its usual place.

2 SECONDARY COLLECTION

Secondary and transportation of the solid wastes to the disposal sites is often done by heavy motor vehicles. For the purpose of transportation following vehicles/equipment's are used.

(I) Flat bed trucks

Layout plan of Municipal Boundary Area



S.NO	LEGEND	COLOR
1.	TRACTOR ROUTE	
2.	TIPPER ROUTE	
3.	OPEN DUMP	
4.	DUST BINS	
5.	DUMPING YARD	

**PHYSICAL INFRASTRUCTURE
DEVELOPMENT OF HARIDWAR
CITY**

**EXISTING SOLID
WASTE FACILITIES
SCALE
N.T.S**

Legends/Notes
Based on the range prepared by town planning unit H.D.A Haridwar, errors in the map, if any may be due to computer rendition

River
Roads
Municipal Boundary

(ii) Truck with tipping arrangements

(iii) Container career system

(iv) Dumper placer

The refuse sanitation program cannot be satisfactory until necessary measures have been taken to ensure the inoffensive disposal of these wasting. Normally the following methods are employed for the purpose of disposal:

(a) Dumping (b) sanitary land file (c) composting (d) incineration

DUMPING:

Some components of refuse are suitable for open dumping. These include street sweeping & ashes and some rubbish. However this will result in serious hazard if garbage or moved refuse is disposed off in this manner. Dump area should be carefully chosen, so that these cause a minimum chance of complaints from the nearby residence.

Undesirable aspects of dumping area that it constitutes health hazard and create breeding ground for flies mosquito's and rodents.

SANITARY LANDFILL:

Sanitary landfill differs from ordinary dumping. In this system material is placed in trench and properly compacted and covered with earth at the end of the working day.

COMPOSTING:

Organic solid wastes received from a community are converted into stable humus like end product having a high fertility value. During composting exothermic, thermophilic complex biochemical reaction take place which occurs naturally in the biodegradable solid organic matters under both anaerobic and aerobic conditions.

INCINERATION:

In this method of refuse disposal the refuse is burnt off and the volume is much reduced. So the refuse containing harmful microorganisms are turned into quite harmless material.

5.3.1 Existing situation

The present arrangement for collection and disposal of solid waste is inadequate and in many areas inefficient. At present, the garbage is piled up on the sides of the roads, from where it off-loaded into handcarts and later into garbage containers. However, the wastes are removed regularly only from very selected places like Railway Station, Main Bazar, Jwalapur Main Bazar .

Haridwar has been divided into five zones and further these zones are subdivided into 24 wards for the purpose of smooth and efficient Sanitation Management These Zones are headed by the Chief Sanitary officer. Besides these, there are approximately 465 "Safai Karamacharis" is on pay rolls of the corporation. Each one is entrusted with a specific area of operation, for the collection of solid wastes. Among them 400 are on permanent basis and remaining are employed on daily/wages basis.

The management structure of Health department of Nagar Plika are .

- Safai Karamacharis

Haridwar	=	155
Devpura	=	73
Kankhal	=	80
Jwalapur	=	156
* Driver	=	13
* Head fitter	=	01

* Contract based Driver	=	06
* Iron Man	=	01
* Labour	=	04
* Spray Helper	=	04
* Cleaner	=	05
* Safai Havldar	=	09
* Daily Wages Driver	=	04
* Sweeper	=	10

To design an effective system for the solid waste disposal it is important understand the present scenario. This phenomenon takes place under the influence of local public representatives who don't care about the proper process and they even disobey law for their own benefits. The overall permanent population of Haridwar city is estimated to be 2,25,5000 people with a floating influx of nearly 1,00,000 people per day as an annual average. The quantity of solid waste generated by the permanent population is 0.60 kg per capita per day with an additional 0.30 kg per capita per day of the floating population. Thus the total solid waste generated is 162 metric tonnes per day. This is further enhanced due to the hillocks slit at an average rate of 28 metric tones per day (calculated from yearly monsoons, earth from hill silt of sewer and nala). Present disposal system is only filling up ditches which leads to unhygienic and contaminates environment. Present disposal sites are near eastern Ganga canal adjacent to chandi road.

The breakup could be summarized as

- (i) Summer monsoon silt = 2/3 of yearly
- (ii) Winter monsoon silt = 1/4 of yearly

MONTH WISE SOLID WASETE GENERATE:

JAN TO MAR	1750 QTL.
MAR TO APR	2000 QTL.
APR TO AUG	2500 QTL.
AUG TO OCT	1750 QTL.
NOV TO JAN	1500 QTL.

THE PRESENT INFRASTRUCTURE FACILITIES ARE AS GIVEN IN THE TABLE BELOW

S.No.	Vehicle fleet	No.	capacity	trips per day
1.	Carrier bus	(34nos.)	4.5 cum (10 qtl).	
2.	J CB	(01 no.)		
2.	Loaders	(04 nos.)		
3.	Tipper trucks	(06 nos.)	30 qtl.	06 each (12-18 trips when required)
4.	Tractor trolley	(07)	20 qtl	02-04
5.	Car mover	(01)	10 qtl.	03
6.	buffalo carts	(08nos.)	1/2 metric ton	03-04

Table No 14 :Present Solid Waste Management Facilities.

Source: Health Department of Nagar Palika.

Total solid waste collected and disposed = 180 metric ton per day

Unattended solid waste = 8 metric tones per day.

(But that is helpfully lifted by the rag pickers, scavengers especially at Haridwar the fast wind and rain clean the solid waste).

5.3.2 EXPENDITURE AND MAINTENANCE

At present there is no provision of collecting funds from the inhabitants in connection with the procedures of and solid waste disposal. Nagar Palika is the only authority involved in the collection and disposal of the solid wastes from the entirety. The expenditures incurred in the entire procedure are met by the Nagar Palika from its house taxes accounts. The labours and equipment involved are working are being provided by the Nagar Palika. The expenditure on maintenance of the equipment's and running of the vehicles is also being met from the above mentioned accounts thereby causing increased pressure over the revenues generator. The details of the expenditures are given in the table below.

YEAR	EXPENDITURE			RECOVERY
	SANITATION WORKERS	HEALTH DEPARTMENT WORKSHOP	HEALTH DEPARTMENT ESTABLISHMENT	
96-97	1,72,38,122	18,74,660	11,75,653	-
97-98	1,99,16,074	81,38,287	11,87,912	-
98-99	2,25,98,308	51,30,049	15,02,388	-
99-00 PROJ.	3,35,00,000	60,00,000	20,00,000	-

Table No 14 : Source Account Section of Nagar Palika

CHAPTER 6.0

ANALYSIS

6.1 Water Supply

6.1.1 TECHNICAL ASPECT

Inadequate resource exploration in the study area causing water shortage.

6.1.2 MANAGEMENT ASPECT

Inadequate water pressure and irregular water supply hours.

(A) SERVICES ASPECTS :

Because of irregular and winding street pattern (especially built-up area of Haridwar and Jwalapur) the water supply is not uniform. There were high head losses thus resulting in reduction of water pressure and this is further accentuated by non-uniform network distribution. There are other problems for losses in head due to variation of topography.

(B) LEGAL ASPECT :

Many HHs have private water meters, illegal water connections, etc. which are tapping water from water main thus the cumulative effect of this is tremendous reduction of water pressure during peak hours. Authority is well aware of this fact that illegal means are being used but due to absence of any strong legal action and user interests they are not able to stop pilferage of water.

(C) ORGANIZATION ASPECT

Because of inefficiency and vested interest in the staff the organization is not efficient enough to supply water at adequate pressure and for regular supply hours and stop pilferage of water.

6.1.3 PUBLIC PARTICIPATION ASPECTS

People participation in improving water supply condition is missing. Although most of the HHs, Hotels, Dharmshala & Ashram know and are aware of the fact that use of illegal means of water tapping is one of the reasons for water shortage but still they cannot stop using it because they are not sure of water supply. Another point is that due to irregular water supply hours and arrogance people kept their water taps open even during non supply hours thus reducing water pressure and often, causing leakage's. As there illegal water connections are very near to ground surface and to open surface drains so water sometimes get contaminated causing various water hazards.

6.2 SEWERAGE FACILITIES

Despite the meticulous planning and maintenance jobs done by the Nagar Palikas, HDA and Ganga Pollution Control Unit still around 10% of population doesn't enjoy the facility of sewer system. Also due to the organic development of the city it proves a very expensive job to lay and maintain the sewer lines in the interior parts of the city. The problem of sewage collection and treatment disposal become acute due to the sudden influx of floating populations during the Kumbh Mela or other festivals . Also during the rainy seasons, a huge amount of storm water is also include in the sewer system which may be as high as twenty times of the regular supplies there by causing the sewer system to overflow.

The sewage collected from the Jawalapur area goes untreated as there is no provision of treatment plant and is thus disposed off in the nearby agriculture fields which is turn may prove harmful for the inhabitants.

In case of failure or overloading of the sewage pumping station provisions have been made so as to overflow the sewer in the river Ganga.

6.2.1 TECHNICAL ASPECTS

- Due to the haphazard and organic layout of the city it has become a tough task to lay and maintain the proper working of the sewer system.
- Excess pressure due to the huge amount of floating populations, the working can't be optimized.
- Provision of pumping and treatment for the peak loads may not be economical for round the year jobs.

6.2.2 MANAGEMENT ASPECTS

- The layout of sewer lines, collection, treatment, disposal and proper operation and maintenance is been devised as a job under various agencies viz. H.D.A. G.P.C.U., Naga palika etc. thus it is difficult to coordinate properly and thus any planning scheme or policy, finds difficulty implementation.
- The collection of taxes and sewer charges should be imposed and it should be made compulsory for the public to take sewer connections for better sewerage collection sewer wherever sewer exists.

6.3 SOLID WASTE

6.3.1 TECHNICAL ASPECT:

As Haridwar is a pilgrim city as per the Hindu mythology a large bulk of floating population camps in the city occasionally all round the calendar causing tremendous changes in the quantity of refuse thus causing problems for the authority to maintain regular schedule for collection and disposal of the refuse.

6.3.2 MANAGEMENT ASPECTS

(I) DETACHED AND SCATTERED GROWTH OF HOUSES

The Haridwar has grown organically along the river Ganga in unplanned manner. The development is not in any defined system and is scattered in Haphazard manner.

(II) RIBBON DEVELOPMENT

The ribbon development along roads suggests decentralized positioning of dump yards which in turn does not seem to be a feasible solution as more nos. of dump yards increase the hazards on account of public health & sanitation.

(III) ENVIRONMENTAL PROBLEMS

As the solid waste collection and disposal system in Haridwar is lacking in the infrastructure requirements the huge piles of refuse provides a breeding ground for mosquito's flies etc. which further enhances the health problems. Also this situation becomes more gloomy during the peak tourist seasons as the quantity of refuse is bound to be higher. The presence of non-biodegradable substances viz. polythenes etc. also makes the situation gloomy as far as the public health is concerned.

(IV) LEGAL ASPECTS :

In the absence of certain rules and regulations and at peoples own will and lack of civic sense no body bothers about the use of dustbins etc and throw the refuse at any position, which suits them as per their convenience.

CHAPTER 7.0

PROJECTION OF POPULATION

PHYSICAL INFRASTRUCTURE DEVELOPMENT 83

6.1 PROJECTION OF POPULATION FOR DESIGN PERIOD (2015)

The projection of population, the various departments of Haridwar which are responsible for providing the infrastructure facilities like Jal Nigam (Water supply) and Ganga pollution Board (sewerage) and solid waste (Sanitary and health department). They divided Haridwar (taking into consideration the uneven topography of the area) into Five Zones, which have more or less complete infrastructure facilities themselves.

The total area of each zone has been distributed in the following activity:-

1. Dharmashalas, Bhawans, temples and other pilgrims place.
2. Market, hotels and other commercial centers.
3. Roads, railway, park, river, canals, colleges, play grounds and cinema halls etc.
4. Industries
5. Residential area.
6. Open area for future developments.

For distributing the area of the zone in different activities the existing conditions of the zone has also been considered. The conditions of the each zone has been described as follows:

ZONE 'A' BHOPATWALA

This zone comprises the area North of seasonal river Baghro upto Sapt Sarover having a common boundary with distt. Dehradun. The river Ganga and the

old supply channel form the eastern boundary of the zone and the hill forms the western boundary. This zone consists of big Ashrams, which occupy a major area of the zone. These Ashrams accommodated large floating population during Mela period round the year but does not attribute much towards the permanent population. The total area of the zone is 250 Hectares. The area distribution for different activities in the year 1991, 1998, 2015 have been shown in the table no. 16

ZONE 'B' (BHIMGODA)

This zone has Baghro River in North, zone 'C' in south, hill ranges in West and Ganga River in East as its boundary. Due to natural barriers this zone has limited scope for expansion. The total area of the zone is 56.63 Hectares. The area distribution for different activities in the year 1991, 1998and 2015 has been shown in table no. 16

ZONE 'C' (MAYAPUR ZONE)

The main town and the famous "Har ki Pauri" fall under this zone. This zone has very little open area for future expansion, besides this it in Bilkeshwar Nagar, Nirmala Akhara and Devpura area. Famous Rishikul medical college, Bhalla college, main market, govt. & private offices, big Dharmshalas & hotels, railway stations & roadways bus station exist in the zone. The total area of zone is 273.38 Hectares and area of different activities in the year 1991, 1998and 2015 has been shown in the table no. 16

ZONE 'D' (KANKHAL)

This zone comprises the area of Kankhal Township that lies in the SouthEast direction of the town, in between the left bank of the canal and the Right Bank of the river. This zone also contains large no. Of Dharmshalas, Ashrams and Akharas like zone 'A' which do not contribute much towards permanent population. The total area of the zone is 297.85 hectares and the areas of different activities in the year 1991, 1998, 2015 and has been shown in table no. 16

ZONE 'E' (JWALAPUR)

This zone is further divided into two sub-zones namely E1 & E2.

ZONE 'E1'

Zone E1 is the area lying between railway line in the West, Gangain the East. Floating population during Mela period round the year but do not attribute much towards the permanent population. The total area of the zone is 250 Hectares. The area distribution for different activities in the year 1991, 1998 and 2015 have been shown in the table no. 16

ZONE 'E2'

This zone comprises the area of Jawalapur township which lies in the southwest direction of the town in the between the Right Bank of the canal and the east north direction zone E1 lies. The total area of the zone is 274 Hectares. The area distribution for different activities in the year 1991, 1998 and 2015 have been shown in the table no. 16

PERMANENT POPULATION

Haridwar Urban Agglomeration was declared in 1951, in which areas of Haridwar Nagarpalika , Gurukul Kandri University and Jawalapur areas were covered under Haridwar Nagar Palika. In 1951, the rate of growth of population was 40.60 percent. This abnormally high increase could have been because of a large number of people settled in Haridwar after division of India in 1947 after independence. In 1961, there was very low increase in population of 4.57 percent only, which does not find any justification. From 1961 onwards there has been sharp increase in population in successive decades .the rate of growth of population from 1961 to 1991 has been depicted in the following table.

The population of Union in the Beginning 2001 and end of 2015 the design period has been worked out by various methods follows:

A ARITHMETICAL INCREASE METHOD:

Population of the town as per 1991 census = 147011

1. Population in the year 2001 = $147011 + (1.0 \times 14808.50)$

$$= 147011 + 14808.50$$

$$= 1,62,113.50$$

Say = 1,62,500.00

2. Population in the year 2015 = $147305 + (2.40 \times 14808.50)$

$$= 147305 + 35540.40$$

$$= 182845.40$$

Say = 183,000

ZONE WISE AREA DISTRIBUTION FOR DIFFERENT ACTIVITIES

ZONE	A			B			C			D			E1			E2		
	1991	2001	2015	1991	2001	2015	1991	2001	2015	1991	2001	2015	1991	2001	2015	1991	2001	2015
Dharmshala, Bhawans, Temple pilgrim places	20%	22%	26%	12%	13%	14%	15%	15%	15%	12%	13%	14%	9%	10%	10%	10%	5%	5%
Market, Hotel & other s commercial centers.	7%	8%	9%	10%	12%	14%	15%	9%	10%	10%	8%	9%	10%	8%	9%	10%	10%	10%
Roads, Railway, Park, River, Canals College, Play groud Picture Halls	16%	18%	19%	16%	17%	19%	16%	16%	17%	20%	20%	23%	32%	33%	34%	35%	20%	20%
Industrial etc.	-	-	-	-	-	-	15%	15%	15%	-	-	-	5%	5%	5%	3%	3%	3%
Residential area	27%	30%	33%	46%	47%	48%	40%	41%	42%	35%	36%	38%	30%	31%	33%	35%	62%	62%
Open area of further devel- -opment	30%	22%	13%	15%	11%	5%	5%	4%	1%	25%	22%	16%	17%	13%	9%	5%		

Table No. 16 Zone wise area distribution for different activities

Source : Zone wise distribution for different activity was anticipated for sewage works under Ganga Action Plan which is approved by Ganga Pollution Directorate - New Delhi, vide letter no. 12015/15 OPO dated 16-7-85

B. INCREMENTAL INCREASE METHOD

The population forecast by this method is given by the expression.

$$P_h = P_o + ns + 2n(n+1)$$

Where P_h = population after decades from the year P_o

P_o = Population at the base year to 1991

n = No. of decade

s = Average increase in population per decades.

Y = Average incremental increase in population per decades.

1. Population in the year 2001 = $147505 + (1.0 \times 14808.50 + \frac{1}{2} \times 0.7)$
 $(0.07 + 1) \times 4456.86$
 $= 147305 + 10365.95 + 2651.63$
 $= 1,60,322.78$ Say 1,61,400

2. Population in the year 2015 = $147505 + (2.20 \times 14000.50) + 2 \times 2.2$
 $(2.20 + 1) \times 4450.80$
 $= 147305 + 32578.70 + 15688.15$
 $= 1,95,571.85$ 1,95,571.85

C. GEOMETRICAL INCREASE METHOD

Population in the year 1991 = 147305

1. Population in the year 2001 = $147305 \times (1.235)$
 $= 140305 \times 1.235$
 $= 1,81,921.67$

$$\text{Say} = 1,82,000$$

$$\begin{aligned} 2: \quad \text{Population in the year 2015} &= 147305 \times (1.23)^{2.4} \\ &= 147305 \times 2.952 \\ &= 234360.70 \end{aligned}$$

$$\text{Say} = 2,34,400$$

D. WARD DENSITY METHOD

The population densities of each zone in different years have been assumed on following basis:

1. Scope of expansion of the zone.
2. Trend of expansion in past years.
3. The increase in the population densities from the year 1998 to 2015 has been taken as follows according to the departmental design-criteria:

Population density	Increase in population density at design year
At base year	
1- Upto 250 persons/Hectare	20 % or upto 250 P/H.
2- 250 - 500	15%

Zone wise areas of ward and zone population for the year 1991

Zone	Ward No.	Ward Area (Hect.)	Population	Population
			Density	1991
A.	1	250	32.47	8117.50
		27.13	32.47	880.91
B.	2.	29.50	230.06	6786.77

	Total	306.63		15785.81 Say 15785.00
C.	2.	6.76	230.06	1555
	3.	15.54	481.66	74.85
	4.	25.90	282.05	7305
	5.	30.04	250.03	7511
	6.	147.63	67.67	9990
	10.	37.51	53.60	2013
	11.	10.00	109.24	1092.40
	Total	273.38		36951.40 Say 36950
D.	7.	49.21	144.73	7122
	8.	38.85	193.56	7520
	9.	209.79	40.67	8533
	Total	297.85		23175
E1	10.	193	53.66	10357
	11.	41055	109.24	4539
	Total	234.55		14866 Say 14900
E2	11.	65.00	109.24	7100.60
	12.	18.13	479.26	8689
	13.	1843	206.07	3736
	14.	88.06	80.80	7115

	15.	33.67	355.27	11962
	16.	22.27	435.88	9707
	17.	28.49	287.40	8188
	Total	273.75		50197.60 Say 50195
Grand Total				147011

Table No 17: Zone Wise population According to census 1991

Source: Project report of Jal Nigam, Haridwar

CAMPING POPULATION

Besides the permanent population Haridwar has a camping population, mainly pilgrims, for 8 to 9 months. From the March to October about 4 to 5 lacks people camp for one or two days in almost every month.

FLOATING POPULATION:

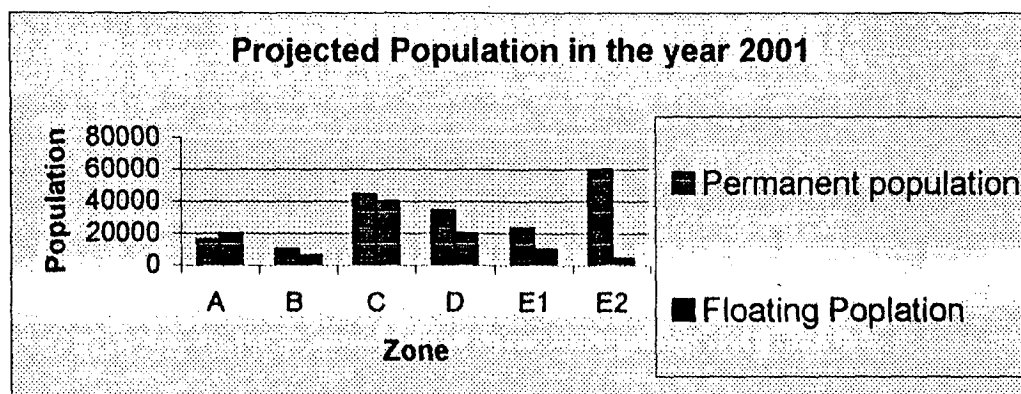
Besides permanent population, quite a large number of floating population come to Haridwar on Holy Hindu festive occasions such as Makar Sankranti, Ram Navmi, Guru Purumina, KanwarMela, Bansant Panchmi, Shivrati, Baisakhi Etc., in Arth Kumbh And purna Kumbh 5 to 10 million people visit Haridwar. According Sources of Nagar Palika , an average five lakh pilgrims visit in Haridwar. They have been adopted in the base year 2001.The increase in floating population in different years has been calculated in the same ratio as in permanent population in different years calculated by incremental increase method. Equivalent floating population has been taken as twenty percent of floating population.

The total projected permanent and floating population can be summarised in the table no.18

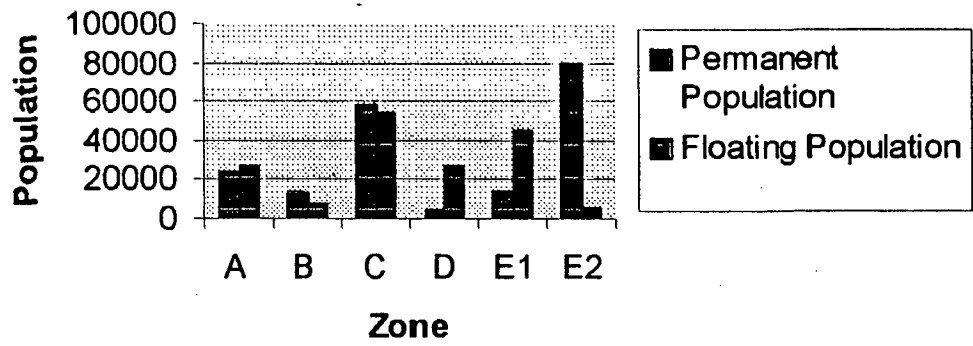
ZONE POPULATION

Zone	Population in the year 2001			Population in the Year 2015		
	Permanent	Equivalent Floating	Total	Permanent	Equivalent Floating	Total
A	16000	20000	36000	24000	27000	51000
B	10000	6000	13000	13000	8000	21000
C	44000	40000	84000	58000	54000	112000
D	34000	20000	54000	4600	27000	73000
E1	23000	10000	33000	14000	45000	41000
E2	60000	4000	64000	80000	5000	103000
Total	187000	100000	287000	252000	135000	387000

Table No: 18 Projected Zone Population Year 2001 and 2015



Projected Population in the year 2015



CHAPTER 8
PROPOSALS

8.1 WATER SUPPLY

8.1.1 TECHNICAL ASPECT:

Proposals for permanent population and floating population for design Period (2015):

Rate of water supply and expected water requirement in the year 2001 is worked out below. Managing director, U.P Jal Nigam, Lucknow vide his latest circular No. 427/J.N.Vishwa Bank M.D. Camp dated 06/04/94 has prescribed the rate of water supply for towns having population between one lacks to five lacks as 150 LPCD. Rate of water for camping and floating population was taken as 50 LPCD and 10 LPCD during 1998 –Kumbh Mela and Ardh Kumbh Mela 1992. The same is adopted for design period 2015 and Ardh Kumbh Mela (2004) and Puran Kumbh mela (2010).

A. Permanent population	1,83,000 x 150	= 27.45 MLD.
B. Camping Population	5,00,000 x 50	= 25.00 MLD.
C. Floating Population During peak periods	25,00,000 x 10	= 25.00 MLD
D. Extra water for sprinkle water		= 0.50 MLD
	Sub total	= 77.95 MLD
E. As per manual of water supply and treatment		
15% to 20 % losses are accounted for losses		
in distribution system. Therefore anticipating 15%		
losses in distribution system		= 11.69 MLD
	Grand total	= 89.64 MLD

Against above requirement of 89.64mld which is worked out keeping the forthcoming Ardh kumbh Mela 2004 and Kumbh Mela 2010, Permanent works for 89.64 mld water requirement only as detailed below have been proposed in phase I and Phase II and phase III of

Augment scheme. For remaining requirement temporary works shall be constructed as per practice of every Kumbh Mela. Since such requirement built up of every Kumbh Mela. Sector wise water requirement has been calculated listed in table No. 19

SOURCES PROPOSED:

The proposed sources have been provided in three phase, i.e Phase-I, phase –II, and phase III. The works under three phases are proposed to be executed before 2004, 2010 and 2015. The total deficit is 28.20 mld. So it is divided into three almost equal phases.

Under phase I, II and III following new sources have been proposed considering projected permanent population and floating population .

Sl .	Name of Source	Proposed discharge in lpm.	In MLD
1.	Tube Well	2250	2.16mld
2.	Tube well	2250	2.16mld
3.	I.W	2250	2.16mld
4.	I.W	2250	2.16 mld
5.	I.W	2250	2.16mld
	Total		10.8mld

Table No. 19 Proposed sources of water works in different phases.

8.1.2 ADMINISTRATIVE ASPECTS

Haridwar Nagar Palika creates distribution of responsibility between these two departments and consequently causes confusion in execution of works. i.e., though responsibility of maintenance of water supply system and rest all with Jal Nigam but Nagar

Sector Wise Water Requirement

Sl. No.	Items	Moti chur	Bhim goda	Bhoopa twala	Lalgi wala	Pant deep	Harki pauri	Hard war	Rori bel-wala	Bairagi camp.	Kank hal	Maya pur	Jawa lapur	Neel Dhara	Gauri Sha nkar	Total Mld.
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

17

Year 2015

1. Water Requirement (Mld)

a. Permanent @150 Lpcd	-	1.80	1.20	-	-	1.80	4.50	-	-	4.20	3.60	8.40	0.30	-	25.80
b. Camping@501lpcd	-	0.75	1.25	0.25	1.00	0.75	3.50	2.50	1.50	2.00	2.50	2.50	1.50	5.00	25.00
c. Floating@10 lpcd.	0.10	1.10	3.30	0.10	3.00	0.60	1.60	1.10	3.00	2.20	2.20	2.30	3.30	1.10	25.00
Total Water Requirement	0.10	3.65	5.75	0.35	4.00	3.15	9.60	4.50	8.40	8.40	8.30	13.20	5.10	6.10	75.80

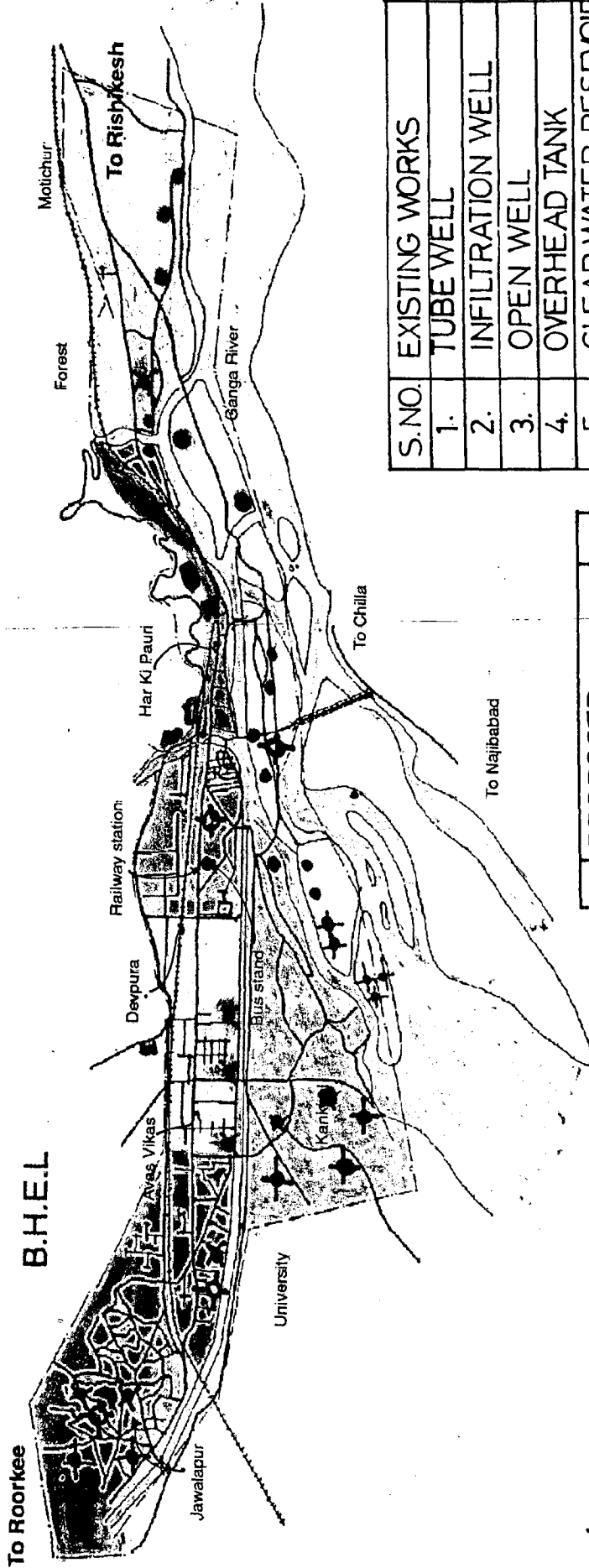
d. Water for sprinkling

and wastage in D/system	-	0.555	0.900	0.10	0.70	1.50	0.60	0.75	1.30	1.35	2.05	0.77	0.77	0.87	11.94
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Net water requirement

(C+D)	0.10	4.205	6.650	0.45	4.70	3.650	11.10	4.20	5.25	9.70	9.65	5.25	5.87	6.97	87.74
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Layout plan of Municipal Boundary Area






PROPOSED	
TUBE WELL	☉
INFILTRATION WELL	⊕

S.NO.	EXISTING WORKS	SYMBOL	NO.
1.	TUBE WELL	☉	17
2.	INFILTRATION WELL	⊕	16
3.	OPEN WELL	●	03
4.	OVERHEAD TANK	⊖	05
5.	CLEAR WATER RESEVOIR	☐	05
6.	TEMPORARY WELL	⊙	02
7.	SHALLOW WELL	○	01

PHYSICAL INFRASTRUCTURE DEVELOPMENT OF HARIDWAR CITY

PROPOSED WATER SUPPLY FACILITIES
SCALE
N.T.S

Legends/Notes
Based on the range prepared by town planning unit H.D.A Haridwar, errors in the map, if any may be due to computer rendition

River 
Roads 
Municipal Boundary 

Palika provides labour only. This anomaly can be eradicated by merging these two departments as far as Water Supply system in city is concerned.

8.1.3 FINANCIAL ASPECTS

Haridwar Nagar Palika undertakes to water supply department. There is ample scope for improving its financial strength and making it self sustainable. The water charges in Haridwar are levied as flat rate but in proposal this has been taken as 2.34 Rs/Kl.

To this effect, an exercise was carried out by the consultants to estimate the revenue surplus generation through adoption of various improvement measures. The recovery rate has been increased form 26% to 80% in a phase manner. Similarly the waste has brought down from 25% to 15% in a phased manner. The following table summarizes the revenue generation and expenditure for the horizon years.

S.I	Item	2000	2005	2010	2015
1.	Water Supply (mld)	61.44	71.55	81.55	91.00
2.	Recovery	26%	40%	60%	80%
3.	Average Rate (Rs./Kl)	2.34	2.34	2.34	2.34
4.	Wastage (%)	25	22	20	15
5.	Stand post and Public Services	03	03	03	03
6.	Income (Rs. Crores)	0.55	2.44	4.17	6.21
8.	Expenditure	1.28	2.00	3.50	4.50
9.	Net Revenue	(-) 0.73	(-)0.44	0.67	1.71

Table No.20: Revenue Generation of water supply for Design period (2015)

It can be observed from the table that by resorting to the indicating improvement measures, HNP would be generating net surplus after the year 2010 AD and this would get increased in the future years. The net surplus can be very well utilized by HNP to undertake development works for long term borrowing etc.

Apart from this, HNP has been carrying on construction work by resorting carrying to borrowings from State Government, World Bank etc. The present recovery rate is only 26% and it can be improved through resorting to strict measures or privatizing the billing/collection system. Added to this, is the high incidence (15%) of wastes in water supply, which can also be improved through proper maintenance of the water supply system.

8.2 PROPOSALS FOR SEWERAGE

8.2.1 TECHNICAL ASPECTS:

- i. Sewerage system must be provided where it doesn't exist.
- ii. Future growth of the city and floating populations shall be kept in mind.

Total water supply in design year (2015)	= 89.65mld.
Total sewerage generate in design year (2015)	=71.72 mld
Existing capacity of treatment plant	= 18.00 mld.
Required capacity of treatment plant	= 71.72 – 18.00 mld.
	=53.72.mld

According to existing infrastructure Jwalapur area is not having any type of treatment facilities. As per the topography of Haridwar, Jwalapur area has its own sewerage farm in which all sewerage is dumped (Near SHANI DEV MANDIR). A part of proposals for Jwalapur is provision of Oxidation pond, which will serve the requirement of design year (2015).

Total Supply of Water in Jwalapur area = 13.00 mld.
 (Zone E2) is required for 2015
 The capacity of Oxidation Pond = 0.80 x 13.00mld
 = 10.40 mld.
 Now The Capacity of treatment plant = 43.32mld.

The proposed capacity have been provided in three phase, i.e Phase-I, phase –II, and phase III. The works under three phases are proposed to be executed before 2004, 2010and 2015. The total deficit is 43.32 mld. So it divided into three almost equal phases.

Under phase I, II and III following new sources have been proposed considering Projecting permanent population and floating population. (TABLE 21)

Sl.	Year	Proposed	Nature of Treatment Facilities
1.	2004	18.0 mld	Extension of Treatment Plant(Phase I)
2.	2010	18.00mld	Extension of Treatment plant (phase II)
3.	2015	18.00mld	New Construction area .

During peak periods when Kumbh Mela Area is extensible used, sewerage disposal becomes major cause of concern for authorities. Keeping in mind the frequent used of Kumbh Mela areas, Laying of sewerage lines in these area is justified. Temporary Toilets are constructed in Kumbh Mela Areas during peak Periods can avail the provision of these sewerage lines. Thus problems sewerage disposal during mela time can be solved once for all.

8.2.2 ADMINISTRATIVE ASPECTS:

Maintenance of sewerage system is the combined responsibility of both Ganga Pollution Board and Haridwar Nagar Palika. This arrangement causes diffusion of responsibilities

between the two departments and consequently cause confusion in execution of works. There must be single administrative setup, which is to be made answerable regarding the laying and maintenance of sewerage system in the city. Though, the maintenance of sewer system is the responsibility of Ganga Pollution Board, yet the labour for the maintenance is being provided by the Haridwar Nagar Palika . This anomaly can also be seen in generation of finance. It is Ganga pollution Board, which is entitled to, received state aids on the name of laying and maintenance of sewerage system while in reality Haridwar Nagar Palika executes fieldwork for this. Ironically Nagar Palika is not being provided with avenues to generate finance on the name of maintenance of sewerage system in the city so Nagar Palika remains depended on Ganga pollution Board as far as revenue generation regarding sewerage system is concern.

8.2.3 FINANCIAL ASPECT:

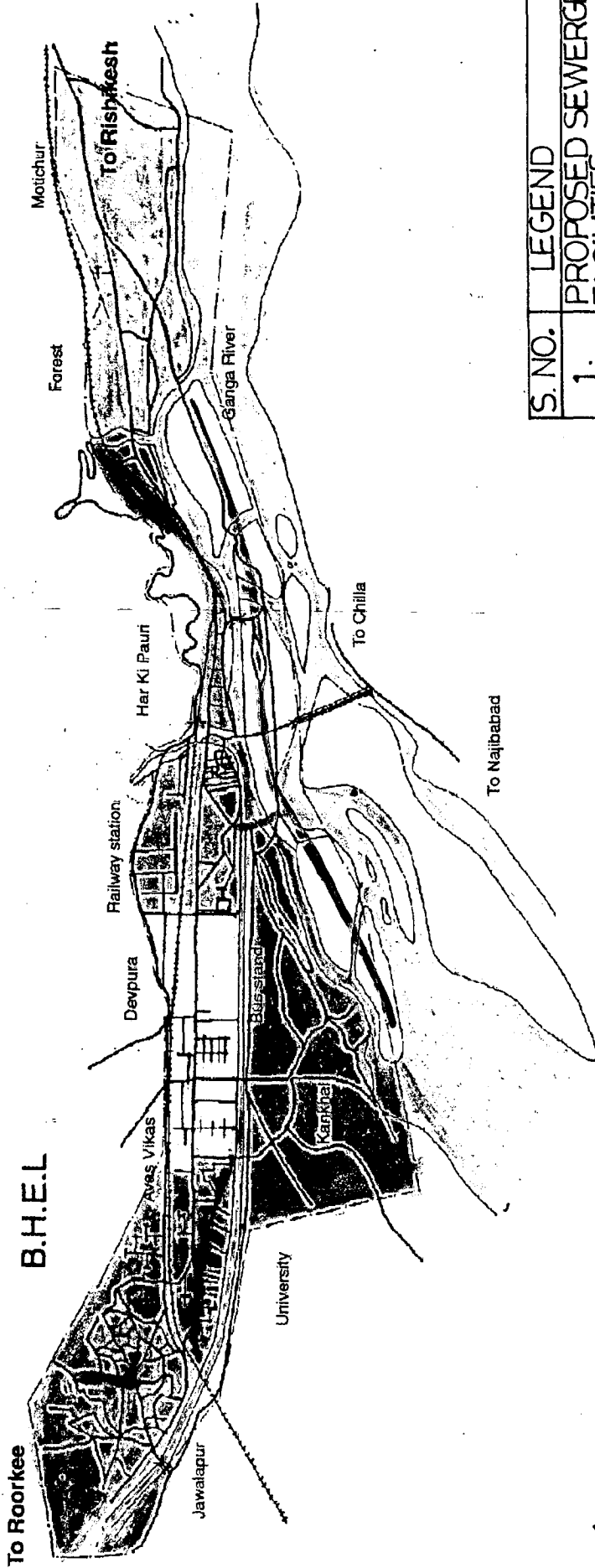
Haridwar Nagar Palika must be made self-sustaining as far as generating finance regarding maintenance of sewerage and layout of sewerage system is concern.

8.3 PROPOSALS FOR SOLID WASTE DISPOSAL

8.3.1 TECHNICAL ASPECT:

Prevailing method, which is being used to treat solid waste, is inappropriate as solid waste is dumped in open trenches without covering by sand or mud. Thus sanitary landfill method of solid waste treatment is not used properly in city. This causes environmental pollution and makes nearby areas disease prone as well as it increases the possibilities of contamination ground water. So this inappropriate method of solid waste treatment must be stopped and method of sanitary landfill should be adopted. Trucks or carts carry refuse from the township to the disposal site.

Layout plan of Municipal Boundary Area



S. NO.	LEGEND	SYMBOL
1.	PROPOSED SEWERGE FACILITIES	

PHYSICAL INFRASTRUCTURE DEVELOPMENT OF HARIDWAR CITY

**PROPOSED SEWERAGE
FACILITIES**
SCALE
N.T.S

Legends/Notes
Based on the range prepared by town planning unit H.D.A Haridwar, errors in the map, if any may be due to computer redtion

River
 Roads
 Municipal Boundary

- a. They are placed in trenches or low laying areas in layers.
- b. Each layer is placed maximum to depth of 1.5 meter.
- c. Each layer is covered by at least 20 cm of earth.
- d. Each layer shall be allowed sufficient time to settle before the next is added.
- e. While not filling depression ,the tip shall be battered to an angle of above 45°
- f. The maximum height of tip shall be 6 meters above the surrounding land surface.
- g. For preventing nuisance from rodents, flies, vermins etc., the tip shall be sprayed with 50 percent solution of creosote or paraffin.

This is an economical method of refuse disposal, as it does not require large initial expenditures for implementations.

II. PROPOSALS FOR 2015:

Keeping in the mind of future growth of city and floating population, proposals for solid waste disposal is the need of the hour.

* Total Solid Waste generates in 2015 = 3,87,000People

* Total Solid Waste generation in 2015 = 232 MT

The proposed infrastructure facilities are as given in the table below:(TABLE 22)

S.No.	Vehicle fleet	No.	capacity
1.	Carrier bus	(6 nos.)	4.5 cum (10 qtl).
2.	J CB	(02 no.)	-
3.	Loaders	(06 nos.)	
4.	Tipper trucks	(08 nos.)	30 qtl.
5.	Tractor trolley	(10)	20 qtl

8.3.2 ADMINISTRATIVE ASPECTS:

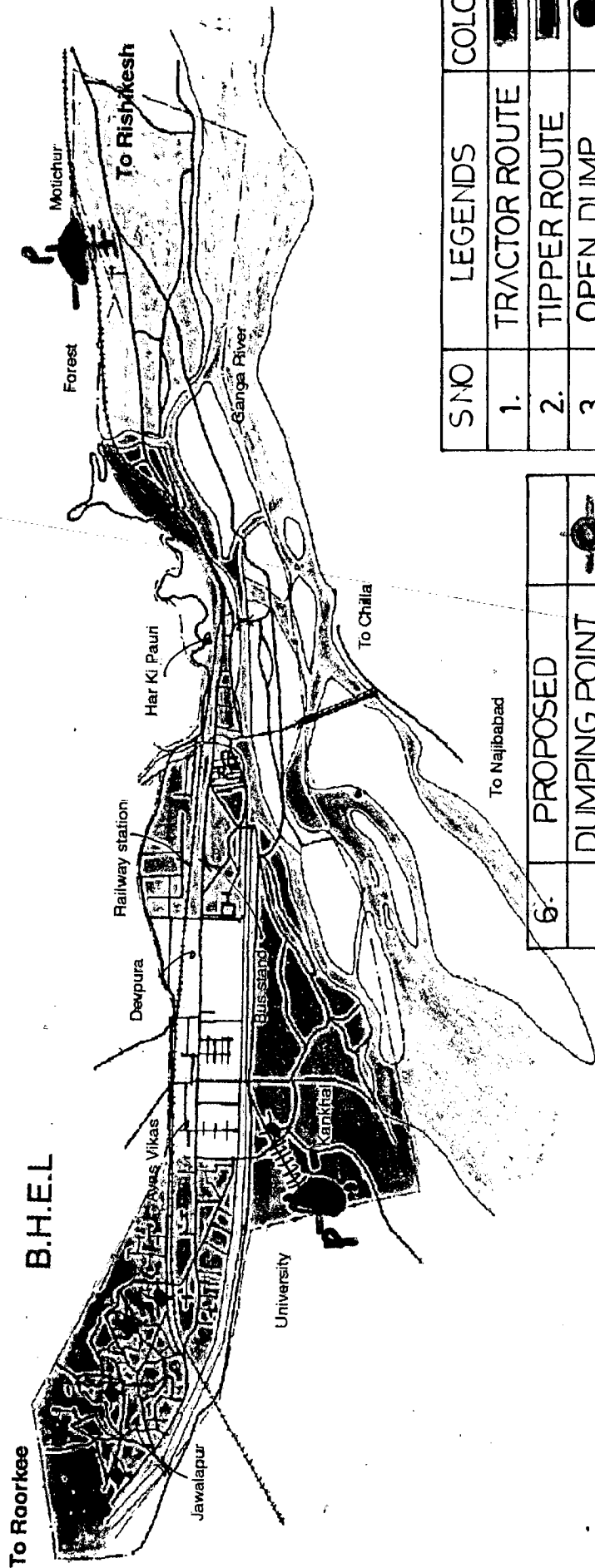
As Haridwar is subjected to sudden influx population during the festive seasons the amount of Solid Waste generated varies randomly from time to time .A universal scheme and plan of action on the administrative part is not applicable throughout the year .During Kumbh Mela ,special arrangements have to be implemented so as to maintain the healthy scenario .Also during rains a large amount of silt and pebbles gets accumulated at various places by virtue of the topography of the city which require immediate action by the authorities.

Administrative authorities need to keep a look over the ever –changing quantity and quality of the solid waste and thereby it is required to keep standby provision for the varying demands. Authorities must derive their polices so as to use the potentials of public participation's to the maximum.

8.3.3 FINANCIAL ASPECTS:

In present situation Nagar Palika bears the expenditure incurred on Safai Karamcharies, though house holds indirectly pay for it in the form of house taxes. As levied tax on solid waste disposal remain unspecified in house taxes thus people generally have scant awareness that they are paying tax for this services of Nagar Palika. Many times This causes irresponsible behavior of Safai Karamcharies as answerability towards House Holds remain absent due to the lack of public awareness. So tax levied for solid waste disposal must be clearly specified in House Tax so that people become aware of their civic rights of having the clean city.

Layout plan of Municipal Boundary Area



SNO	LEGENDS	COLOUR
1.	TRACTOR ROUTE	
2.	TIPPER ROUTE	
3.	OPEN DUMP	
4.	DUST BINS	
5.	DUMPING POINTS	

6.	PROPOSED	
	DUMPING POINT	
	DUST BINS	
	TIPPER ROUTE	
	TRACTOR ROUTE	

PHYSICAL INFRASTRUCTURE DEVELOPMENT OF HARIDWAR CITY

**PROPOSED SOLID
WASTE FACILITIES
SCALE
N.T.S**

Legends/Notes
Based on the range prepared by town planning
unit H.D.A Haridwar, errors in the map, if any
may be due to computer rendition

River

Roads

Municipal Boundary

CHAPTER 9.0

RECOMMENDATIONS

9.0 RECOMMENDATIONS

Although the infrastructure facilities in Haridwar seem to be working at the hardest levels so as to maintain the better living condition in term of healthy , clean and aesthetic aspects still there is a deficiency in almost all the sector. The available infrastructure is not adequate to cater the permanent population in the most satisfactory manners. On the other hand the situation becomes more acute with the advent of huge amount of floating population during the festive seasons. The authorities however, combat the floating influx with the help of temporary arrangements which in turn causes of financial burden due to the recurring costs. Haridwar enjoys on average of 1,00,000 people every day as immigrants around the entire calendar year.

The revenue generated by the authorities is not adequate to keep the entire infrastructure facilities in perfect order as well as the govt. aid does a little bit to manage the expenditures.

The following are the steps suggested to maintain the proper functioning of the resources:-

9.1 WATER SUPPLY

- Jal nigam & nagarpalika must be side by side as one origination .
- Assessment of charges as per the property valuation should be fair on accurate. The authorities must enjoy some well educated technical hand to attain fair valuation.
- Water supply shall be made available to every single house hold.
- Extra provision for floating population shall be maintained in view of the further requirements.

- Water supply lines should be inspected and maintained regularly so as to manage the line looser.
- Water treatment plant should be employed as on be ensure the safe drinking water to the inhabitants as the direct supply of water may contain certain impurities general due to percolation of water line.
- Illegal tapping of water lines shall be checked and the people found guilty shall be punished by law enforcing authorities.
- Public must be educated to use the water in the most efficient manners so as to avoid wastage of such a gift of nature.

9.2 SOLID WASTE

- Collection methods should be improved upon by the use of mechanical devices such as tipper truck etc, to maintain regular cleaning of the refuse from the point of collection to the disposal chambers.
- Nagar Palika or other working authorities may figure out certain taxes to generate funds to maintain the necessary infrastructure. A very normal amount from every household may be charged on annual basis.
- The disposal of the sewage shall be inspected carefully as the uncontrolled dumping may prove to be hazardous for public health.
- The solid waste shall, as a rule , be divided into the bio degradable and non-bio degradable substances before finally disposing off.

- Law enforcing authorities shall be given certain set of controlled powers so as to ensure the act of prohibition polyphone bags in Haridwar City.
- Public must be educated about the better ways to dispose off their refuse. viz. collecting the glass, polythene and other organic matter in separate containers and thus dispose off them separately.
- Household- maids/ servants should be trained / forced to throw the refuse at proper places settled by the Nagar Palika so as to make the collection easy and effective.
- The number of public dust bins should be increased so as to maintain easy accessibility from the households/ business establishments.
- Treatment plants like incinerate for could be employed for treating the refuse before disposing it off finally if funds permit.

9.3 SEWERAGE

- The capacity of the sewage treatment plant needs an immediate enlargement so as to leave no amount of untreated sewage. Also the requirement of the floating population must be kept in view for calculating the required capacity.
- All the authorities like Nagar palika, HDA, Ganga Pollution Control Unit shall work side by side as one organization for the effective implementation of the policies and efficient use of the available resources.

- Sewer lines must be made available to all the inhabitants in every area of the city.
- Proper maintenance of the sewer lines has to be ensured as any fault may lead to serious results.
- Sewer connection shall be made compulsory to all the households in the areas where sewer lines exists.
- The authorities must collect the charges on very fair grounds and no scope for any mischief shall be left.

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